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VETERINARY SURGERY

By Louis A. Merillat, V. S.

Volume III.

VETERINARY SURGICAL OPERATIONS

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VOLUME I

ANIMAL DENTISTRY AND DISEASES OF THE MOUTH

VOLUME II

PRINCIPLES OF VETERINARY SURGERY

VOLUME III

VETERINARY SURGICAL OPERATIONS

Veterinary Surgery

VOLUME III

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BY

LOUIS A. MERILLAT, V. S.

AUTHOR OF "ANIMAL DENTISTRY AND DISEASES OF THE MOUTH" AND "PRINCIPLES OF VETERINARY SURGERY"; COLLABORATOR AMERICAN VETERINARY REVIEW; PROFESSOR OF SURGERY IN THE CHICAGO VETERINARY COLLEGE; LATE PRESIDENT OF THE CHICAGO VETERINARY SOCIETY; LATE SECRETARY OF THE ASSOCIATION OF FACULTIES AND EXAMINING BOARDS OF NORTH AMERICA; VICE-PRESIDENT AMERICAN VETERINARY MEDICAL ASSOCIATION, ETC., ETC.. ETC.

CHICAGO

ALEXANDER EGER

1909

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To my Colleague

PROFESSOR JAMES M. WRIGHT, D. V. S.

with whom I have been continuously associated for twenty years,

This Volume

is respectfully dedicated, as a token of esteem, by

The Author.

PREFACE.

In writing this book the author has endeavored to explain in a plain manner all a student or practitioner desires to know about the veterinary surgical operations which have been tried and found useful. Untried procedures, passing surgical novelties and classical operations more picturesque then adaptable to our purpose, have been intentionally omitted. Attempt has been made to describe every phase of these useful operations in the minutest possible manner, sometimes at the risk of inviting criticism for apparently unnecessary repetitions. The fact that knowledge of minor details of surgical technique is indispensable to the successful practice of surgery was kept prominently in mind thoughout. The methods of performance are those used in our daily work; the conclusions as to the usefulness of the operations are the resumé of our own observations; and the accidents and untoward results are records of actual events.

If it had not been thought more confusing than instructive, and if space had permitted, the opinions and modern methods of others would have been described. The reader is invoked not to interpret this apparent display of conceit as entirely a matter of choice, since the capacity of the volume is already overtaxed.

The illustrations are from photographs taken specially and at random by my colleague, Dr. H. E. Torgeson, from original drawings and from copies obtained by Mr. Eger from the various sources mentioned in the descriptions.

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INTRODUCTION.

1. **THE SURGEON'S ATTRIBUTES.**—In diagnosis, in preparation of the patient, in performance of the operation and in the post-operative treatment, the careful, painstaking, methodical and studied execution of minute details is consecrated as an absolute law by the experienced surgeon. **Theoretical knowledge, inventive genius** and **practical adaptability** are resources par excellence, but of all these various attributes heralded as essential to success in surgery, **attention to detail** stands conspicuously first. The surgeon who has animals for his patients might also profitably possess the **health of an athlete,** the **strength of a giant,** the **manipulative dexterity of a magician** and **the skill of an artisan,** and as Moller once so aptly expressed it, "He should know how to deport himself in the pig-sty as well as in the parlor."

He will need, also, a keen, almost unerring judgment that will enable him to arrive at correct conclusions, or at least render sane decisions under all circumstances; and while his disposition, owing to the nature of his pursuit, should be bold, firm and even aggressive, he should display at all times an unaffected abhorrence against the infliction of unnecessary and avoidable pain. His mind must be clear, active, vigilant and resourceful; his temper cool and always under perfect control; and his ambitions for material gain should be constantly overshadowed by an unselfish desire to relieve the distress and alleviate the pain of his patients in the shortest possible time and at the least possible cost to his clients.

To qualify for a veterinary surgical practice a **competent knowledge of animals in general** is indispensable. Proficiency in **comparative anatomy, comparative physiology** and **comparative pathology** is not sufficient; a thorough understanding of the habits, the customs, the susceptibilities, the immunities, the endurance, and in fact all of the peculiarities of the different species and of the various breeds should be included in his budget of knowledge.

Personal cleanliness can not be ignored with impunity in the practice of veterinary surgery. The dirty nature of the pursuit is all the more a reason why the animal surgeon should be a habitually clean man, for is there not always

danger of conveying serious infections to self or patient with the unclean hands and contaminated fomites? Daintiness and fastidiousness are not insisted upon; in fact these attributes, in the eyes of the rural American, usually discredit the practitioner; but the effect of good, sensible efforts in this connection invites personal respect, promotes professional dignity and is manifestly influential in the prevention of wound infections. Clean hands, clean nails and clean clothing are needed in wound therapy, even if the personal appearance is deemed unimportant.

2. **THE SURGEON'S EQUIPMENT.**—It would require too much space to enumerate all of the instruments, tools, dressings, drugs and apparatuses needed in veterinary surgery. Let it be known, however, that **an inadequate equipment is a serious obstacle to a veterinary surgeon's progress.** In fact, no man of intelligence and integrity would assume the responsibilities of important operations without a good and sufficient means of performance. The possession of a well-equipped and well-kept hospital should be the first ambition of every practitioner, and the field and stable surgery should, as far as possible, be renounced for the more thorough nosocomial operations. Although at this day the rural veterinarian is generally required to bundle up his surgical appurtenances and proceed to the patient's habitat to perform his operations, much of this arduous and often unsatisfactory work could be avoided by constantly displaying the advantages of his well equipped operating room and hospital. Perfunctory, out-of-door, barn-yard or stable operations degrade animal surgery, while the operating-room procedures of high order, no matter how simple, promote the art by leaving lasting impressions of its importance and a higher appreciation of the results.

A small, compact and handy hospital is preferable to the large, roomy, barn-like affair whose ground value, cost of construction, and, especially maintenance, is out of proportion to the income of the average veterinary practice. The more prominent urban practitioners in the larger cities may profitably support large establishments with their retinue of expensive attendants, but the rank and file will find more profit and much more general satisfaction in a hospital of small dimensions. Whatever may be regarded as the proper general arrangement and space allotment for the accommodation of the different species of animals and for the different diseases (the discussion of which would be out of place in a surgical work) an area of no less than 25x25 feet should be

given up exclusively to the surgical "work-shop." An area of 30x30 feet or 25x35 feet would be still more desirable, as it would allow sufficient room for the construction of a stocks (which the reader will notice is wanting in Fig. 1) and more space could be allowed between the walls and two sides of the operating table; but an area of still larger dimension would contain superfluous space.

The floor material is of wood, planed and calked. Ce-

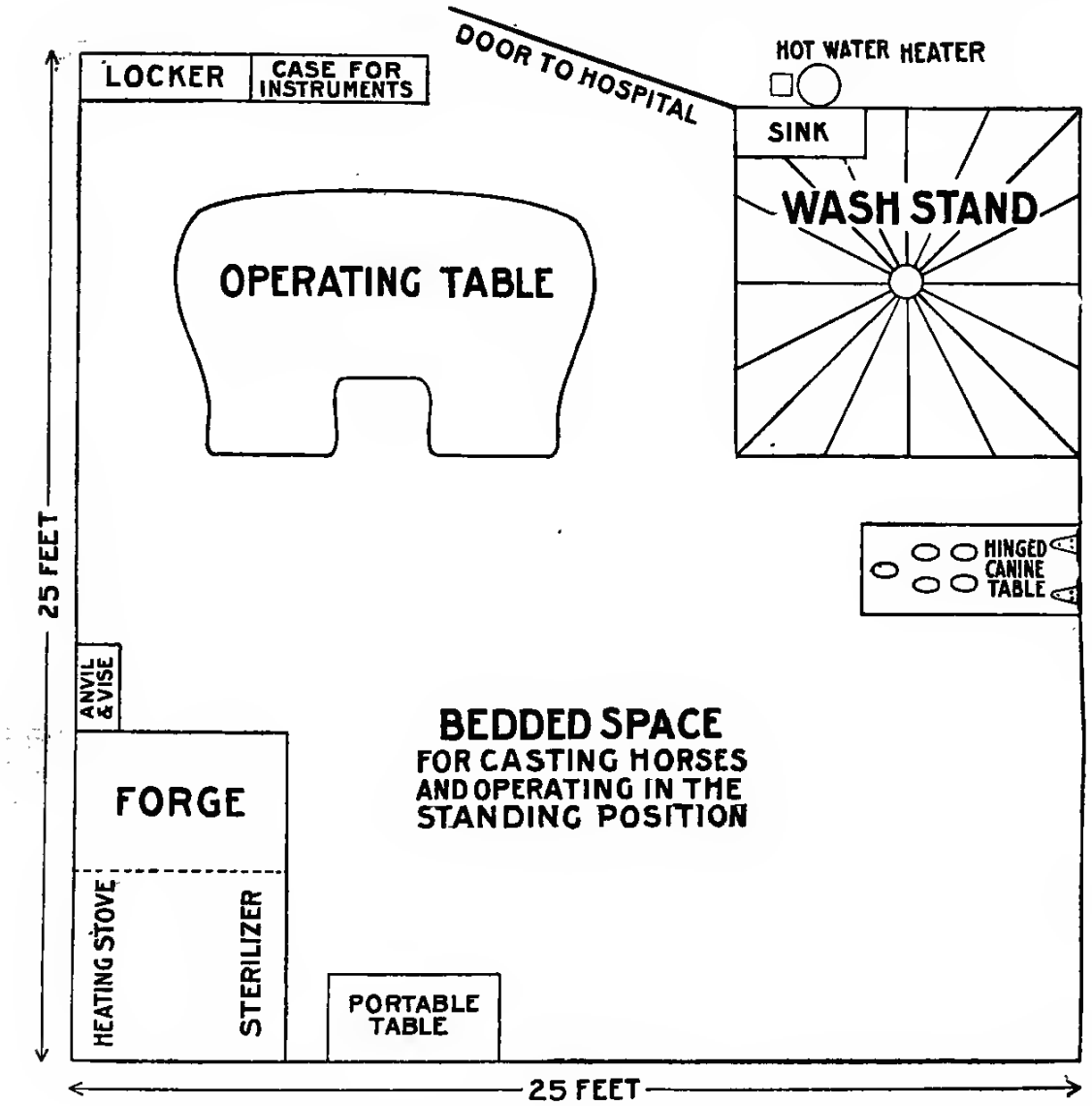


FIG. 1—Plan of Operating Room and Appurtenances.

ment, which is heralded as the sanitary floor par excellence, is positively hazardous in an operating room where decrepit horses, often hopping on three legs, must be handled. Its slipperiness and hardness condemn it as unsuited for the purpose, and besides it produces an uncomfortable state of humidity, chilliness, and coldness that can not be overcome except by constant artificial heat and excessive ventilation.

The wash stand at one corner, with its beveled floor lean-

ing toward a central sewer connection, and with its hot and cold water supply directly adjacent, is an important feature. The pre-operative preparation of the field, the post-operative cleansing of the blood-soaked surroundings of the surgical wound, and lastly the after-care of the wound during the patient's sojourn in the hospital, are carried out in this convenient space.

The horse operating table is indispensable, as it easily excels the other restraining apparatuses in all of the counts by which these are judged. Few assistants are required; the surgical field can be well controlled; the dangers from accidents to the horse and to the operator are reduced to the minimum; accidental contamination of the surgical wound is easily prevented; the operator's position is comfortable; and finally, the operation can be performed in a slow, deliberate, painstaking manner on account of absence of formidable opposition to the restraint.

This apparatus occupies one corner of the area, sufficient distance from the walls to afford freedom of movements. (Fig. 1.)

The open bedded space for casting large animals and for operating in the standing position is also indispensable. To monopolize this precious space by placing the horse operating table in the center of the room is soon recognized as a serious error, not only because it may often be needed as a casting space when harness restraint is thought preferable, but because it affords an excellent place for all the various standing operations; firing, standing neurotomies, lancings, paring of feet, etc. As seen in the accompanying plan, this is a large square space when the canine table is turned against the wall and the portable table is set aside. The bedding, which may be of shavings, sawdust, peat or tan bark, is spread over the entire floor excepting the wash stand and the space occupied by the forge, sterilizer and stove, and is kept moist by an occasional sprinkling of antiseptic water. Parts of this litter that become soiled with droppings, blood or pus are shoveled up and replaced with a new quota. This plan is preferable to that of leaving parts of the floor bare, because sweeping,—the most harmful practice in a veterinary operating room,—is obviated. In an operating room managed in this manner, a ray of sunlight through a window will always show a minimum amount of suspended dust.

The canine table is a smooth, varnished board 2x4 feet, hinged to the wall, where it is fastened with hook and eye when not in use. It has two hinged legs at the free end,

which drop into supporting position automatically as the table is turned downward into the horizontal position. (Fig. 1.)

Forge, sterilizer and heating stove occupy a space 2½x6 feet in the corner opposite the operating table. These are elevated one foot from the floor on a cement foundation with pressed brick facing, as a precaution against accidental ignition of the floor, and especially the surrounding bedding. The forge should be a good, substantial affair, fixed solidly into the cement; or it may even be constructed entirely of fire brick, with a sheet iron hood. The position occupied by it (shown in Fig. 1) is convenient to the operating table and floor space where the hot irons are needed, and it also serves

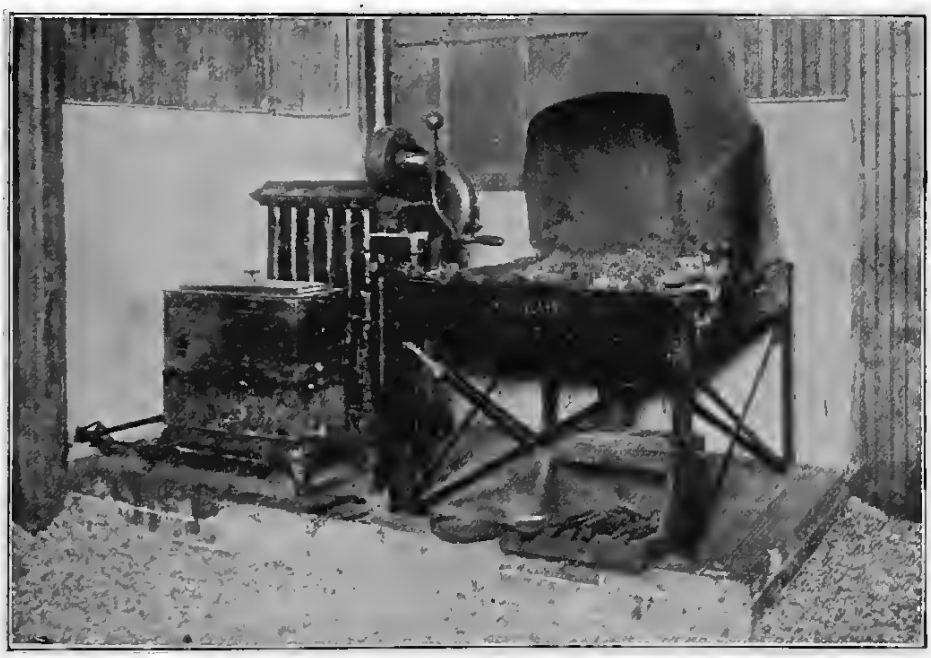


FIG. 2—Forge, Sterilizer and Heater for Operating Room.

as a protection to the sterilizer and stove. **The sterilizer** may be an ordinary metal boiler in lieu of a standard surgeon's apparatus, which contains a lower compartment for boiling instruments and an upper one for steaming the dressings and drying the instruments. Any vessel in which instruments can be submitted to a good boiling will answer, but in no case should this feature of the equipment be ignored. An operating room today without a sterilizer for instruments burlesques the outward display of polished instruments, and prostitutes the whole establishment in the eyes of the intelligent observer.

The heating stove occupies the space behind the sterilizer, in a position well protected against an accidental collision

with a refractory patient. The hot water heater and tank which are placed behind the washstand partition might occupy the space allotted to the stove and thus fill the double mission of supplying the hot water and the heat, but this arrangement is objected to because of the unbearable heat it produces in warm weather.

The portable table is needed as an elevated resting place for the instruments, dressings and antiseptic basins, and is carried within reach of the operator during the operation.

The locker is needed for clothing, ropes and other more or less unsightly objects needed from time to time. The **instrument case** is supplied with shelves enough to hold all of the instruments. The small instruments are classified and kept in separate places or in separate boxes properly labeled.

The anvil and vise are not absolutely necessary, but are nevertheless handy when a shoe must be fitted, when an instrument must be straightened, filed or curved to meet certain requirements, or to make emergent repairs of various apparatus.

A small grind stone, an oil stone, a hone and **a razor strop** are absolutely needed amongst the operating room appurtenances. These should be kept together in a convenient place specially assigned for them, and in view of the advantages of keen cutting knives they should be constantly utilized. The adage of the wheat cradlers of past epochs, "There is no time lost in whetting," applies here, and besides good "cradling" in the surgical field can hardly be done with dull instruments.

3. **GENERAL RECOMMENDATIONS:** (a) **Diagnosis.**—By artful attack of the symptoms, medical treatment can often be carried to a successful issue without an inkling of the nature or even the location of the causative lesion. Surgical treatment, never! **In surgery an accurate diagnosis must precede all interference.** The nature, the location and the extent of invasion must be known. The physician may sometimes cunningly cover up an error in diagnosis, but the surgeon can not, because he uncovers the disease in his work or else exposes his error in the untoward results.

The prospective practitioner is first of all warned against incautious, hasty decisions. The deliberate, cautious, scrutinizing examination must prevail in order to prevent the blundering diagnoses which lead to the performance of improper, unsuccessful and ofttimes harmful operations. No element that may in any way add to or distract from the probable results of operative intervention should be overlooked, and

no avenue must be left unexplored in the examination of a proposed surgical patient. The problems presented are often so puzzling, their presentation so deceptive and the circumstances surrounding their inception so misleading that the incautious diagnostician soon becomes fairly swamped in the consequences of his errors. He fires the spavined horse lame from a penetrant nail still hidden in the lateral lacuna of the frog; he performs neurotomy on the navicular case without having discovered the existence of a suppurating corn; he evacuates the antrum without sufficient examination of the teeth to exclude incipient decay of a molar; he leaves a foreign body in the depths of a punctured wound; he treats colic for three days only to discover when too late that the cause is a strangulated hernia; he hastily castrates an animal and learns to his dismay, by the appearance of the prolapsing intestines, that an inguinal hernia has been overlooked; in short, by his constant display of incaution he brings upon himself the everlasting censure of a disgusted clientele.

The wisdom of submitting the foot to a thorough examination before deciding upon the location of a lameness, always held out so conspicuously in every instruction on veterinary surgical diagnosis, is unimpeachable. But why stop with lameness? This good sound advice to **look elsewhere** applies to all categories of diseases, and it is adopted as an absolute law by the experienced practitioner.

And moreover, the examination must not end with the disease. The patient must be submitted to critical attention as regards age, sex, general health, pregnancy, conformation, deformities, diseases of the skeleton, organic diseases, temperament, occupation, habitat, et cetera. If these do not often alter the decision to operate they do very frequently call for an alteration of the modus operandi, and must therefore never be slighted in the pre-operative cogitation.

(b) **Pre-operative Preparation.**—Before performing an operation certain preparatory steps must be executed, and while their significance is decidedly varied in accordance with the character and importance of the proposed procedure there is always something to do in this connection.

These steps include (1) **preparation of the patient,** (2) **assembling the equipment and sterilization of the instruments and dressings,** and (3) **preparation of the surgical field.**

(1) **Preparation of the Patient.**—This step includes chiefly dieting, purging, and starving in order to forestall the complications which emanate from casting, anæsthetizing and operating upon animals whose abdomens are filled. In

abdominal invasions its object is to facilitate the manipulations; in hernia it facilitates reduction; while in the other major operations not connected with the splanchnic cavities it prevents colic, intestinal rupture and chloroform syncope. Sometimes the opposite course must be pursued. Instead of restricting the feed the patient, on account of an existing debility, may need a strengthening and stimulating preparation for the exhausting ordeal. Stomachics, ferruginous tonics, dentistry, laxative and nutritious feeds are sometimes excellent preparatory expedients.

But aside from these the feet and the shoeing of the proposed surgical patient often need attention. Even when neither the feet nor the legs are concerned in the operation it is always prudent to shape the feet or shoe them in such a manner as to make the patient's sojourn in the hospital or stable as comfortable as possible. A convalescent that must remain standing day after day is ill prepared for the ordeal if the feet are long, unkempt or badly shod. Excellent surgical operations are sometimes turned into failures through this neglect.

2. **Assembling the Equipment and Sterilizing the Instruments and Dressings.**—The patient having been pronounced ready for the ordeal the attention is now directed to the paraphernalia that will be required to perform the proposed operation: The restraining apparatus examined as to its completeness for the purpose, every instrument known to be required and others needed to meet suspected exigencies, the antiseptics decided upon as the best for the purpose, the sutures and needles and finally the dressings, are assembled and conveniently arranged. While this is being systematically and thoughtfully carried out the instruments are submitted to some form of effectual sterilization. In preparing for a major operation it is sometimes no small mental task to assemble without omission every little instrument that might be required before the operation is complete, and to avoid embarrassing delays, often at a crucial moment, it is always better to assemble too many than too few. To prevent losing instruments, if not also, as in human surgery, to prevent some of them being accidentally forgotten in the splanchnic cavities, counting is an excellent practice. The lost and forgotten instruments make no trivial item in a veterinary practice where carelessness prevails.

3. **Preparation of the Surgical Field** refers to the disinfection of the spot, space or region about to be submitted to a surgical operation. In animals this includes skin, hoof or

mucous membrane, but generally the former. The hairy skin of animals is an excellent harbor for microbes. It affords countless ruffles and recesses for the accumulation of dirt and is constantly contaminated by exposure to filth. Cultural experiments show that the surface, the recesses and the deepest parts of the follicles are fairly teeming with microbes, and that even the underlying layers may contain them; and clinical observations as well as the bacteriological investigations indicate clearly that no perfunctory effort is sufficient to entirely dispatch them. **The skin of animals, like the hands of the surgeon, is never aseptic** no matter how thoroughly it has been cleansed, but despite this apparently hopeless situation experience shows that by **thorough disinfection and proper handling** a safe state of cleanliness can be produced and maintained in the skin of animals even better than in that of human beings. In fact, if the skin of animals around a wound or around the seat of a proposed incision is properly managed, very few infections will be traced to this source. Skin disinfection must either be thorough or else omitted entirely, as perfunctory lavage tends more to provoke microbian activity than to destroy it. The following steps are recommended when it is desired to take advantage of all available precautions:

First Step—A Soap and Hot Water Lavage.—The part to be operated upon is well lathered with suds, rubbed briskly for some moments with the finger tips and then rinsed off with pure water. This not only cleanses the field of dirt but also softens the hair for shaving. Around this washed area the hairs are moistened to allay dust and prevent loose hairs from flying about as the patient struggles. The amount of surface to be thus moistened will depend upon the general cleanliness of the patient, the condition of the coat and the location of the wound. In the spring when the hairs are shedding fast, in dusty, ungroomed patients, and in operations located where dust and hairs will readily fall into the wound, this precaution is no trivial matter. For example, while operating upon a long-haired yearling colt for inguinal hernia during the shedding season a single struggle and a draft of air in the right direction often sends a veritable cloud of hairs over the exposed tissues. Such harmful incidents are guarded against in this preparatory cleansing of the field by moistening the surroundings.

Second Step—Clipping and Shaving.—The clipping, so far as the working of the clipper is concerned, is done more easily when the hairs are dry, but to prevent raising unneces-

sary dust and loose hairs it is postponed until the field has been washed. The clipping is necessary only to facilitate shaving when the hair is long, thick and difficult to attack with a razor. After the hair has thus been shortened with the clipper a large area, which might properly be called **the surgical field,** is shaved. The dimensions of this field should exceed those actually required for the incision and sutures sufficiently to prevent invasion of the hairy surroundings with any part of the work and to provide a clean resting place for the fingers while handling the instruments. After shaving the loose hairs are flushed off.

Third Step—Chemical Disinfection.—The first effort in this direction is to submit the shaved field to a good, brisk rubbing with a solution of mercuric chloride, 1-500. The solution is poured upon the field with one hand and rubbed well with the other. This washing should continue for two or three minutes and end by laying a layer of cotton soaked in the same solution over the field for four to five minutes longer. The cotton is then removed and the field dried by rubbing it briskly with pure alcohol.

Fourth Step—Post-operative Care.—The purity of the field is maintained by drying it thoroughly immediately after the operation is complete, and by maintaining a state of absolute dryness throughout the healing of the wound. When secretions are permitted to saturate the field, especially if covered by bandage and dressings, the microbes (which would have been innocuous in a dry environment) soon multiply and invade the wound. Bandages enclosing a skin soaked with secretions, constitute, with the warmth of the body, an excellent incubator for the microbes that might have otherwise remained harmless in the recesses of the skin.

In short, the success of obtaining and maintaining a safe surgical field in animal surgery depends upon: (1) **ridding the field of hairs by shaving**; (2) cleansing it with a strong antiseptic solution; and (3) preserving a state of dryness.

(c) **Performance.**—Although the successful performance of a surgical operation depends largely upon the proper execution of an aggregate of minute details, these are nevertheless subordinate to certain dominating rules whose disobedience may end in serious consequences or in total failure. In this connection **restraint** and **position** occupy the first rank. It is not the danger of personal injury nor the danger of injury to the patient, but the impossibility of effectual performance without adequate restraint that renders this feature of animal surgery so conspicuously important. The veterinarian

who is less than an expert in securing the different species of animals and assumes the responsibilities of surgery is seldom successful. He should be perfectly familiar with the minutest detail of the various methods by which animals are **handled, secured** and **attitudinized** with the greatest safety to self and patient and to the best advantage for the proposed intervention. When the patient has been perfectly tied, the proper anæsthetic administered and the field brought out into the most accessible position, the operation is already more than half done. On the contrary, when the patient is badly tied, kicks with every stroke of the knife, and the field is not well exposed by reason of an improper posture, the operator is seriously handicapped and unable, except in the crudest way, to carry the procedure to a satisfactory state of completeness. In fact, young practitioners often become seriously embarrassed or even give up in despair in the midst of an operation when the only hindrance to a successful end is inadequate restraint or disadvantageous posture. (For special instructions in this connection the reader is referred to the chapter on Restraint in Vol. II., and to the paragraph on restraint accompanying the description of each operation.)

Next to restraint comes **hæmostasis** as an important feature of operative technique. Blood must not be shed with impunity; every possible drop should be conserved to the patient. The loss of one to two quarts of blood to a vigorous horse (and a relative quantity in the smaller animals) is not a serious matter, but when the loss exceeds this quantity the operator must work with great caution. Blood loss plus the exhausting effect of a major operation is serious enough to the most vigorous subject, and it is positively disastrous to the debilitated. Sudden loss is much more dangerous than the gradual loss of the same quantity during the progress of a long operation, because in the case of sudden loss depreciation of the blood volume embarrasses the heart, favors syncope from the anæsthetic and is prone to end in post-operative shock. Bloodless surgery is the surgery of the day; sanguineous procedures are discredited. But it is not only from this standpoint that blood hampers the surgical operation. Invasion of the body with a knife is always followed immediately by a more or less stubborn bleeding that impedes progress by keeping the wound constantly masked. In this connection blood produces an annoying impediment that must be met effectively from the beginning to the end of the operation. Otherwise the operator is only groping in the dark throughout the entire procedure, and the quantity lost is un-

accustomed to an active life that are suddenly submitted to absolute rest frequently suffer from digestive troubles unless maintained on a restricted diet. When the standing position is ordered for some days the feet and shoeing will require attention. In the summer time flies prove exceedingly harmful in more ways than one, and should be eliminated as far as possible. Good ventilation, an even temperature, appropriate clothing and above all, a clean habitat must be insisted upon for the surgical convalescent.

CHAPTER I.

SURGICAL PROCESSES—ELEMENTARY OPERATIONS.

Surgical operations consist of the execution of one or more fundamental **processes** or **methods** which, either alone or combined, constitute a completed surgical procedure. A knowledge of them is a knowledge of the art of surgery. They are to the art of surgery what pathology is to the science. They are fundamental; basic.

The common surgical processes,—the so-called elementary operations,—are:—**Incision, dissection, ablation, resection, amputation, ecrasement, aspiration, ligation, cauterization, phlebotomy, lancing, setoning, suturing, and firing.**

INCISION.

DEFINITION.—Incision is the simple division of tissues with a sharp instrument. It is the loss of continuity with minimum injury and without loss of substance.

INDICATIONS.—Incision is the preliminary step of most all surgical operations, and when not constituting a complete operation in itself, it is invariably necessary to **uncover and render accessible** the underlying structures which require surgical interference. It is invariably the preliminary step of **ablations, dissections, and resections. Growths, organs,** or **parts of organs** to be ablated or resected must be first exposed by incisions through the skin and other integuments which cover them. Surgical operations in which incision is the principal feature are usually designated with the suffix "otomy" after the name of the structure incised:—thus, incision of the skin is **dermatotomy,** of a tendon, **tenotomy,** of a muscle, **myotomy,** of a nerve, **neurotomy,** of the scrotum, **oscheotomy,** of a bowel, **enterotomy,** of the abdominal cavity, **celiotomy,** of the flank, **laparotomy,** etc., etc. The great number of this type of surgical operations indicates at once the importance of incision as a surgical process; it enters into every procedure in which a knife is used.

INSTRUMENTS.—Incisions are made with various cutting instruments according to the character of the structure to be incised. The scalpel, with a convex edge (Fig. 3)

is, however, the most common one. It is of service and generally indispensable in almost all cutting operations. Its size and length should vary according to the character and position of the structure to be incised. The medium sized one is the most serviceable for the various operations on animals. Here and there a very small one may be handy, and occasionally a large, strong one is required to divide tough, thick tissues. Handles of exceptional length are sometimes

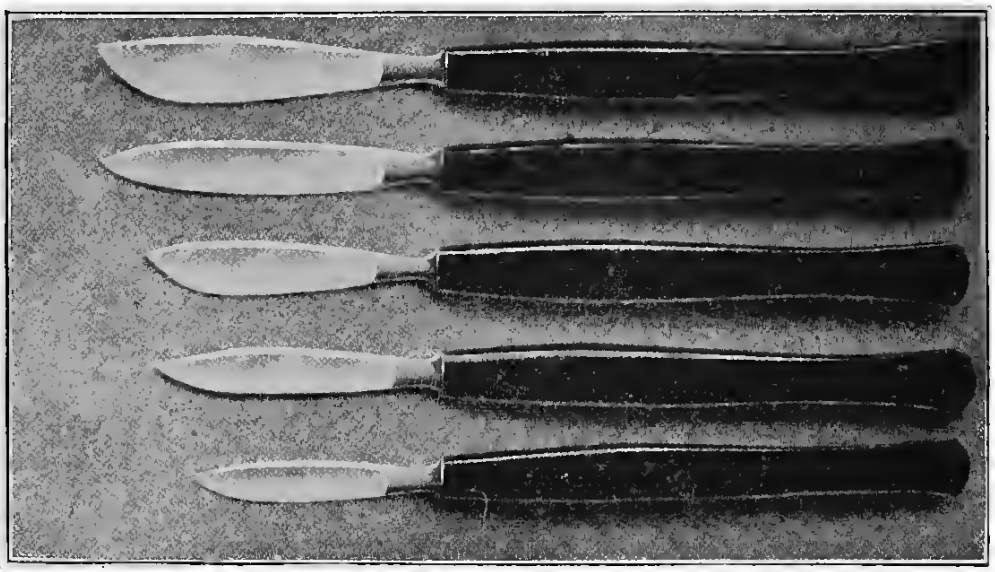


FIG. 3—Scalpels.

required to reach tissues in deep locations, as for example, operations within the larynx. The **probe-pointed, curved bistoury** comes next in importance as an incising instrument. It is used chiefly to cut outward. Its point can be passed safely and easily beneath a structure. This knife should vary in size from a thin, slender blade, cutting to the very end, to a large, strong blade with a prominent probe point, and with



FIG. 4—Special Probe-Pointed Tenetome.

handles of proper proportions, if every demand is to be satisfied. The **tenetome** is of service in dividing muscles and tendons. It is a fine, slender blade, of very slight convexity, so constructed as to make but a small point of entrance. It is used chiefly to make subcutaneous incisions, as in caudal myotomy, and the various tenotomies. The **probe-pointed, slightly curved tenetome,** (see Fig. 4) is of great service in many subcutaneous incisions, owing to the protection it af-

fords surrounding structures which are not to be cut. The **sharp-pointed curved bistoury,** as an incising instrument is less serviceable than the preceding knives. It is somewhat dangerous in many cases. It finds its greatest utility in lanc-

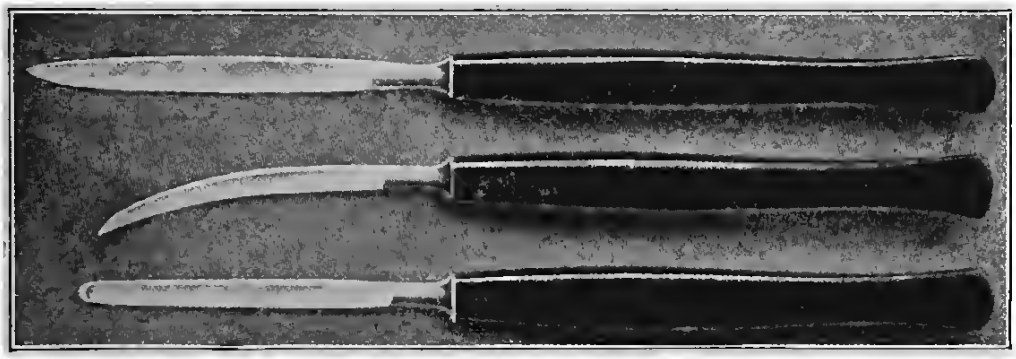


FIG. 5—Probe-pointed Curved and Straight Bistouries, and Sharp-pointed Tenetome.

ing large abscesses located in safe positions. In the ordinary surgical operations requiring careful dissection, it is little used. It is more of a lance than a bistoury. The **scissors,** both sharp and blunt pointed, but always curved, are espec-



FIG. 7—Backhand Position with Blade Downward.

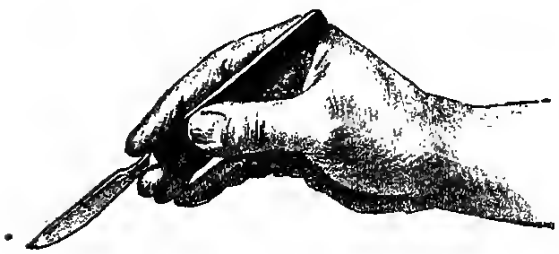


FIG. 6—Penholder Position.

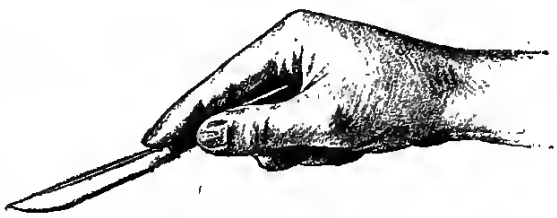


FIG. 8—Palmar Position.

ially useful in making certain incisions and dissections. The **bistoury-cache,** being provided with a protected cutting edge that can be unsheathed at will, is indispensable in vaginotomy.

TECHNIQUE.—Incisions with the Scalpel.—The scalpel

is held in four different positions:—(1) The **pen-holder position** with the blade downward (Fig. 6) to make incisions toward the operator. (2) The **back-hand position** with the blade downward, (Fig. 7) to make incisions from the operator. (3) The **palmar position** with the index finger upon the back of the blade (Fig. 8) to make incisions where strong downward pressure is required. (4) The **palmar position with the cutting edge upward** (Fig. 9) to make incisions from within outwards. The first three positions meet every requirement of almost every surgical operation on domestic

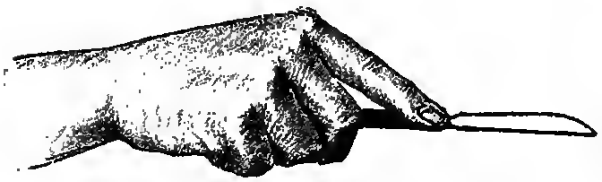


FIG. 9—Palmar Position.

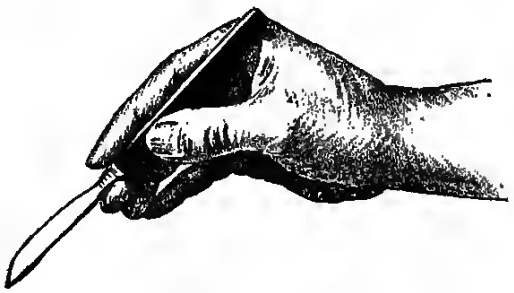


FIG. 10—Penholder Position, Blade Up.



FIG. 11.

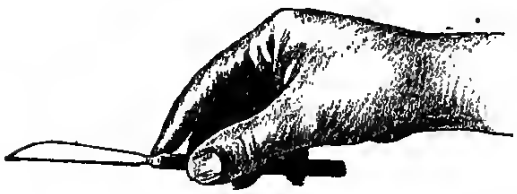


FIG. 12.



FIG. 13.

FIGS. 11, 12, 13—Other Positions for Holding the Scalpel, not Described in the List.

animals. Other special positions are only modifications of these, acquired by simply bending the wrist or fingers into different angles.

It is important always to hold a scalpel in such a position of safety as to provide against a sudden movement of the field. There are certain positions described in works on human surgery that the veterinary surgeon must regard as positively hazardous. A sudden movement against a scalpel pointing straight at an articulation, synovial sac, etc., for example, ofttimes ends disastrously by plunging the knife into such forbidden structures.

The part to be incised is submitted to as much tension as

possible in order to facilitate the cutting process. A loose tissue is difficult to cut even with a keen edge, whilst a tense one is cut with facility even when the edge is quite dull. This desired tension is usually obtained in simple cutaneous incisions by **stretching the skin between the thumb and index finger** (Fig. 14). Areolar tissue is tensed by picking it up with the tissue forcep; the parts to be incised in ablating a tumor are tensed by grappling the tumor and surrounding tissues with strong toothed forceps or tenacula; the tendon is

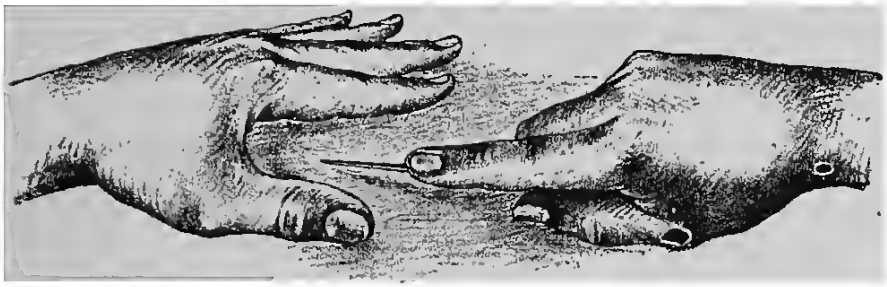


FIG. 14—Incision by Tensing Skin with Thumb and Index Finger.

tensed by extending the articulations over which it passes; etc., etc. This feature of surgical technics is of exceptional importance, both in regards to speed and exactness. Each stroke of the knife is more deliberate and accomplishes more than if the tissues lie lax. It also temporarily arrests bleeding at the seat of dissection, by bringing tension on the divided blood vessels.



FIG. 15—Skin Tensed by Left Hand.

When the skin is once opened by incision, further progress is impossible without the aid of an assistant, who divides his time between bailing out the blood and assisting in maintaining the desired tension here and there as directed, and in accordance with the particular work at hand. The bailing of blood must be continuous; every particle must be soaked up with the sponge or cotton pledget as fast as it masks the anatomical structures to be subsequently incised. Other-

wise the surgeon will be "groping in the dark," with little chance of accomplishing a neat isolation of the structure sought.

Incisions with the Probe-pointed Bistoury.—Incisions made with the probe-pointed bistoury are often nothing more than bold outward slashes. Little care needs to be exercised in thus making incisions, because the knife has previously been safely placed under tissue intended to be incised. In the use of this instrument the placing of the instrument is the important part of the process. Placed right, the process may be completed with one reckless stroke in the outward direction, that lays bare the whole hot-bed without further ceremony. Occasionally the probe-pointed bistoury is used more cautiously, as for example in effecting the division of ligaments and tendons.

Incisions with the Tenetome.—The tenetome is usually used to effect the subcutaneous division of tendons or muscles. The knife is passed flatwise under the structure turned against it, and then pressed outward until total division is effected. Such incisions require the assistance of tension of the structure to be divided. A lax tendon is cut with the greatest difficulty; tensed, it is snipped off promptly.

Incisions with the Scissors.—Scissors are useful in snipping cordiform structures, such as nerves, vessels, small tendons, or shreds of lacerated tissues, after these have been perfectly isolated. While not absolutely indispensable in the ordinary surgical operation on the surface of the body, they become very useful in incising parts in remote positions. Guided into a hidden recess with the index finger of the left hand, structures of this nature can often be very conveniently incised with the scissors. Sharp incising scissors should be included in the veterinary surgeon's outfit.

DISSECTION.

DEFINITION.—The word "dissection" in surgery is reserved to designate the separation of healthy or diseased structures from their surroundings by cutting or tearing the connecting tissues. Dissection in surgery is the process of isolating a structure to be ablated or otherwise submitted to treatment. It is the sum of a number of consecutive incisions.

INDICATIONS.—The separation of structures from each other, one from another, or their complete isolation, has two objects:—(1) the opening of a path to underlying structures and (2) ablation or resection. When diseased

tissues, organs or structures are deep-seated it is often necessary to dissect through the superficial tissues to reach them, but the principal indications for dissection are healthy or normal structures to be removed from the body. Thus, a tumor is first dissected from its attachments and then removed (ablated); or a part of a nerve is first dissected from its areolar connections, and then resected.

Dissection is an important surgical process, constituting the major part of many complicated operations. It is generally the most intricate and delicate portion of the technique. When a structure is once well isolated by dissection its subsequent management is a trifling matter. A nerve tumor, necrotic tissue, or organ, well isolated by a painstaking dissection in which the flow of blood is well controlled, is easily removed with neatness and dispatch, whilst one that is poorly dissected and is masked with blood, is always annoying. Partially hidden amongst its relations the desideratum may be difficult or impossible to execute, and thus leave a cause for an unsuccessful termination.

In fine, dissection is a conspicuous, salient, prominent,

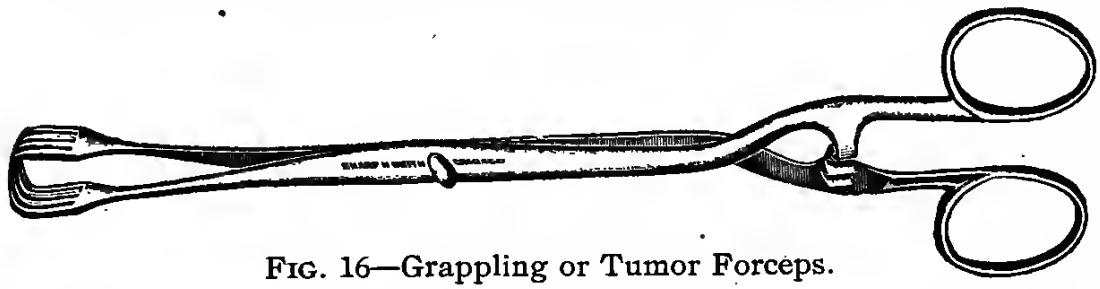


FIG. 16—Grappling or Tumor Forceps.

indispensable surgical process in almost every operation. Often it is carelessly or hurriedly done, in the haste to reach the desired end, with unfortunate results. **To dissect well is to operate well.**

INSTRUMENTS.—As dissection is so often but a succession of incisions, the same instruments suffice. The **scalpel, bistouries, and scissors,** to which may be added the **tissue or dissecting forceps, grappling forceps, tenacula** and **retractors,** are the instruments required to execute the various dissections. Sometimes the hands, the finger tips, knife handles, or other blunt objects can be conveniently and advantageously used.

TECHNIQUE.—The scalpel in the right hand, held as a pen-holder, the tissue forceps in the left hand, picking up the tissues to be cut, and the assistant energetically bailing out the blood, is the proper manner in which ordinary dissections are executed. If a vessel spurts it is ligated or twisted. If a structure is large, as a tumor, the grappling forceps or

tenaculum is used to pull it out or turn it to advantage, and at the same time bring about the desired tension on the parts to be separated. The resection of areolar tissue is very important in dissection. This tissue surrounds and connects everything. Bloodless it is white, and only acts as a transparent screen to underlying structures, but when soaked with blood it effectually masks prominent objects immediately under it, often to the dismay of the unsuspecting sur-



FIG. 17—Thumb, Tissue or Dissecting Forceps.

geon. In searching for structures to be isolated by dissection the necessity of first picking up and resecting all masking areolar tissue, can not be too frequently mentioned nor too strongly emphasized. By so doing prominent anatomical structures, previously effectually hidden, are promptly brought into the foreground and thus made to serve as landmarks for further progress. Often a structure sought diligently in every direction is right before one's eyes, masked

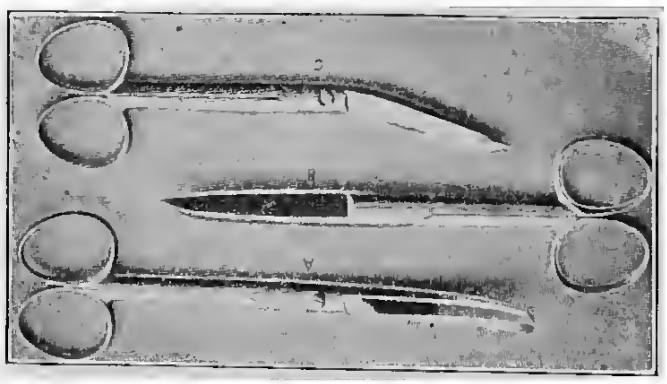


FIG. 18—Three Styles of Dissecting Scissors.

with nothing more than a mere mesh of blood-soaked areolar tissue.

In making extensive dissections it is advisable to search out vessels before cutting them, in order that they may be ligated and thus limit the loss of blood as much as possible. In the course of long dissections the loss of blood may be enormous, and therefore a matter of some consequence. When a large number of small oozing and spurting vessels are cut and threaten the loss of too much blood, besides in-

terfering with the progress of the dissection, the flow may be effectually limited by touching each bleeding spot with the thermo-cautery in the hands of the third assistant. The value of the thermo-cautery in this connection is immense. Often an exceptionally extensive dissection can thus be completed with an incredibly small loss of blood.

In making dissections, the surgeon must always "know his ground," in order to avoid transgression upon forbidden structures. The division of a large vessel, motor nerve trunk, or important tendon, or the incision of a synovial sac, or one of the splanchnic cavities, are among the many possible accidents of a careless dissection.

RESECTION, ABLATION, AMPUTATION.

DEFINITIONS.—In the literal sense these three words are synonymous, meaning the removal of a part of the body.



FIG. 19—The Scalpel and Forceps in Dissection.

In surgery, however, each one is reserved to designate a special process. **Resection** is the removal of a part of a structure or organ, such as a part of a nerve, tendon, muscle or any tissue. **Ablation** at once suggests the removal of an entire structure or organ, such as a tumor, a scirrhous cord, the testicles, the thyroid body, etc. **Amputation** refers only to the removal of all or part of a projecting anatomical member of the body, such as the tail, an extremity, the tongue, the ears, etc. A nerve is **resected,** a tumor is **ablated,** and an extremity is **amputated.**

INDICATIONS.—In surgical operations the process called **resection** is indicated both on normal and diseased structures. A resection of **normal tissues** may be necessary **to make a path to remote structures** which are the real objects of attack; **to establish drainage orifices or other artificial communications; to effectually destroy the continuity**

of nerves, tendons, or muscles; and finally to accomplish a number of objects too miscellaneous to classify. The resection of abnormal structures has for its object the **elimination of harmful elements from the body.** Examples of the former are found in trephining for the repulsion of teeth, the removal of a part of one or two tracheal rings for tracheal intubation, and the various neurotomies. An example of the latter is found in the resection of the ligamentum nuchae for the cure of poll evil.

In veterinary operations, **ablations,** like resections, are often directed alike toward normal and abnormal structures; in fact, the most important ablations of veterinary surgery,—**castration** and **spaying,**—are performed with rare exceptions, upon strictly normal organs. **Growths,** of inflammatory as well as non-inflammatory origin, **(true tumors)** however, furnish the most indications for this surgical process. These defects incapacitate the work-horse when located at points touched with the harness, and when compatible with health and utility in any of the domestic species they often constitute damaging blemishes; sometimes they are extirpated, because of a justifiable suspicion of malignancy, before they have generalized or have become locally inoperable. The **thyroid body** is ablated in goiter, and the **eye ball** in cancer. **Actinomycotic and botryomycotic growths** also furnish innumerable indications.

Amputations are relatively less important in veterinary surgery. The saving of life by amputating a diseased or seriously injured limb is not a mission of veterinary surgery, except here and there, in a dog or cat whose leg has been crushed, and occasionally in a pregnant mare or cow carrying a precious fœtus as an object of salvage. The large animals, however, seldom ever survive the loss of a limb, and furthermore they are useless without all four, while the small pet animals, being looked upon as objects of pity when a leg is lost, are usually painlessly killed. Hence the small importance of limb amputations in domestic animals.

The tail of the horse, ox or dog is occasionally amputated on account of disease or serious injury. The tail of the horse, sometimes accidentally strangulated by tying its hairs too tightly around the stump, especially when tied up too long in shipping, when fired, blistered, etc., may then require amputation above the necrotic line.

The tail of the ox, from treads of neighboring animals, contusions from switching at flies or from wounds sustained in various ways, sometimes becomes the seat of a gangrene

that progresses in both directions from the initial injury. Frost bites in cold climates and preventive inoculations of black-leg vaccines have been known to cause formidable gangrenes of the tails of oxen. In these events, amputations are indicated.

The tail of the dog is sometimes accidentally crushed beyond repair from treads of large animals, and sometimes a load of buck-shot accidentally or intentionally fired may terminate in an extensive necrosis, requiring amputation.

Again, it is a prevailing custom in many countries to amputate the tails of coach horses, hackneys, hunters, draft stallions, and even draft show-horses, for no other reason than that of satisfying a well founded caprice over which the veterinarian has little control.

The tails of dogs of certain breeds, notably fox-terriers, Ayersdale terriers, bull-dogs, and some spaniels, are likewise sacrificed by fanciers to satisfy an unexplainable whim that does not originate in the veterinary profession.

The tails of the sheep are invariably amputated in nearly every sheep-raising community. But in this species it is justified by the fact that it prevents the accumulation of feces and burrs on the wool of the tail, and that the tail of sheep is of no possible service.

The tongue of the horse is occasionally amputated when its extremity is gangrenous from bit pressure, from laceration, from the accidental or malicious application of a rubber band over its end, or from frost-bites sustained by the tongue-loller. Amputation of the tongue is also recommended as a last resort in the treatment of incurable habitual tongue-lolling.

Actinomycosis of the tongue of the ox (wooden tongue) although seldom ever recognized until too late, and although often located in an impossible position near the base, sometimes furnishes an operable case.

The penis of the horse, ox and dog, afflicted with malignant growths, frost-bites, paraphymosis and stricture of the urethra, gives the veterinarian innumerable occasions to amputate this organ. The horse is most frequently afflicted with these conditions.

The concha of dogs of certain breeds is customarily amputated on the demand of fanciers. Bull terriers, Boston terriers, Great Danes and bull dogs are the ones usually selected for this torture.

EQUIPMENT AND TECHNIQUE.—Resections, ablations and amputations all constitute such special operations

that no general recommendation for their performance will answer. The reader is referred to the general index, for reference to the detailed description of each operation included within the scope of these surgical processes.

ECRASEMENT.

DEFINITION.—Ecrasement is the process of crushing the nutrient vessels of an organ or growth by means of the ecraseur or other instrument, for the purpose of preventing hæmorrhage from them. It is one of the methods of ablation, adopted for many veterinary operations, because of its practicability over other more tedious methods of controlling the flow of blood.

INDICATIONS.—Ecrasement is now the almost universal method of managing the blood vessels in the **castration** of the larger domestic animals. The testicles are exposed by a single slash of the scalpel, the ecraseur chain or emasculator is slipped over the spermatic cord, and then with a few turns or a single squeeze the organ falls off and the cord retracts into the inguinal canal. The operation is done; no further attention is given to the large blood vessels that have been divided. Without this valuable process complicated, annoying methods are required to prevent an inevitable, copious bleeding. Ligation, cauterization, torsion, and clamping are among its numerous predecessors. All of these require tedious manipulations which, in the case of castration, favor the development of complications. In the **castration of the large domestic animals** ecrasement meets with the greatest favor, but it is also frequently adopted in the **castration of small animals** and always in the **ablation of the ovaries.** In **vaginal ovariectomy** of the mare and cow, and in **laparo-ovariectomy** of any of the domestic animals, ecrasement is the universal method of preventing the hæmorrhage.

In the **ablation of tumors** ecrasement can often be used to very good advantage. After the tumor has been dissected down to the peduncle through which the chief nutrient vessels enter, its ablation can be neatly completed with a few turns of the ecraseur without danger of serious hæmorrhage.

In the **ablation of scirrhous cord** no other good method of managing the bleeding is available, especially when the cord at the seat of ablation is so large and so hard as to render ligation ineffectual.

INSTRUMENTS.—The common crushing instruments used in veterinary operations are the **ecraseur** and the **emas-**

culator. The former is made in several different types, each to suit its particular purpose. The vaginal-ovariectomy ecraseur is long, so as to reach the ovaries through this long path; the one for male castration is short and somewhat slender, as no great length nor special strength is required; while the one for the ablation of tumors is exceptionally heavy and equipped with a strong chain because of the great strain to which it is usually submitted.

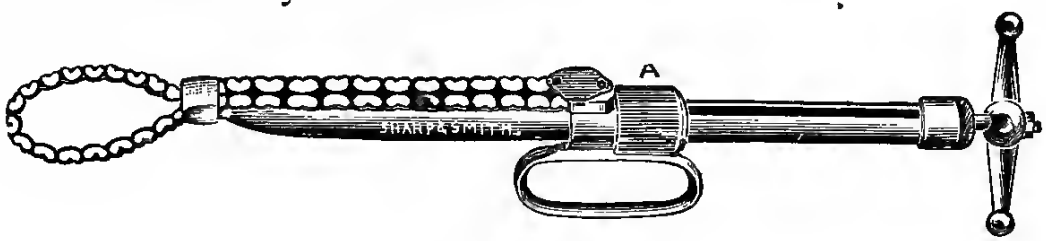


FIG. 20—Ecraseur.

Emasculators are also made in different styles for different purposes. The male emasculator is short and stout, while that for the female is long and slender.

Aside from these two special instruments ecrasement is sometimes effected with artery forcep or even by the thumb nails.

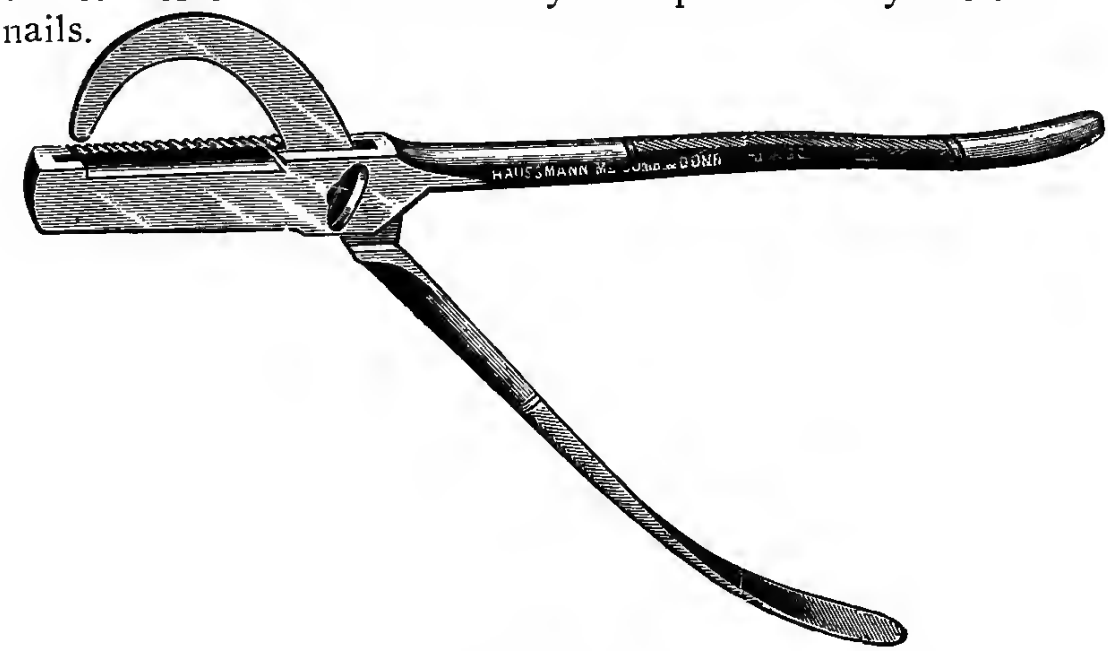


FIG. 21—Emasculator.

TECHNIQUE.—The technique of ecrasement is comparatively simple. The organ or part is first exposed, and then the crushing instrument is made to crush it off at the desired point. The bruising to which the vessels and the tissues supporting them are submitted will generally prevent bleeding, and thus obviate ligation, cauterization, compression or any of the other expedients necessary to prevent the inevitable hæmorrhage that follows the division of blood vessels by other methods.

Sometimes it is thought advisable to crush the vessels at two points some little distance apart. The crushing instrument is first made to crush the structure without entirely dividing it, at a point one inch or less above the point of ablation, and then dropped lower down to effect a complete division. This method assures more perfect hæmostasis, in vessels deprived of their normal hæmostatic propensities from disease of their walls or the tissues conveying them.

ASPIRATION.

DEFINITION.—Aspiration is the surgical abstraction of fluids or gases from natural cavities, wounds or organs, by means of a canula. The force required to cause the evacuation may be internal pressure, tension, siphonage or artificial suction.

INDICATIONS.—The indications for aspiration in veterinary surgery are legion. It is indeed frequent that fluids and gases accumulate in this or that part of the organism to the detriment of the health or soundness of the individual. Sometimes the large **splanchnic cavities** become flooded with transudates or exudates in sufficient quantities to render prudent their abstraction, as in the case of **hydrothorax or ascites.** At other times the **synovial sacs** supporting the synovial membranes engaged in the secretion of the synovia necessary to lubricate the great tendon sheaths, the various bursæ, or certain diarthroses, become so over-filled as to produce undesirable if not harmful blemishes, which may be modified and often entirely cured by timely aspiration of their contents. **Cysts, serous sacs, sanguineous sacs,** and even **abscesses** under certain conditions, may be thus evacuated, in the effort to prevent the inevitable complications that always follow free incision. Aspiration is also very valuable as a diagnostic expedient. **Exploratory aspirations** are always justified when other diagnostic methods fail to reveal the exact nature of abnormal fluid accumulations. Hydrothorax is thus differentiated from chronic solidification of the lung; ascites from abdominal tumors, cysts from aneurisms; and purulent from non-purulent accumulations. Whilst the usual physical examination and the history are usually sufficient to make such differentiations, certain confusing features may sometimes present themselves and thus necessitate an exploratory puncture to disclose their precise characteristics. **Intestinal gases** accumulated in sufficient quantities to threaten life and which can not be otherwise evacuated, are

readily aspirated with the canula and trocar passed through the abdominal wall. The rumen, the folded colon and the cæcum are the organs which may be thus evacuated.

The aspirations include a number of special operations which require description in detail. These are:

1. **Enterocentesis**—puncturing the intestines to evacuate gases.
2. **Celiocentesis**—puncturing the peritoneal cavity to evacuate the fluid of ascites.
3. **Thoracocentesis**—puncturing the thorax to evacuate the fluid of hydrothorax.
4. **Thecocentesis**—puncturing synovial sheaths or bursæ, to evacuate excessive synovial accumulations.
5. **Gastrocentesis**—puncturing the stomach or rumen to evacuate gases.
6. **Cystocentesis**—puncturing the urinary bladder to evacuate excessive accumulations of urine during temporary strictures.
7. **Keratocentesis**—puncturing the eye-ball, to evacuate the aqueous humor in purulent inflammations of the chambers of the eye.

ENTEROCENTESIS.

SYNONYMS.—Paracentesis abdominalis; tapping; radical operation for flatulent colic.

DEFINITION.—Enterocentesis signifies puncturing the bowels. In veterinary surgery it is an appropriate designation for the evacuation of intestinal gases by means of the trocar and canula. The name "paracentesis abdominalis" is very frequently applied to this special operation, without a qualifying word to indicate that the viscera and not only the abdominal walls are punctured. This name being a general one should be abandoned for the more special term "enterocentesis," which immediately identifies the object of the procedure.

INDICATIONS.—Enterocentesis is performed for the single purpose of evacuating gases which accumulate in the large bowels during the course of various forms of colics in the horse, and sometimes in the large ruminants. The operation is especially indicated **when the bloating is extreme and threatening,** but is sometimes justified when the intra-abdominal tension is less formidable. When the tension is great, the bowels stretched, the lungs pressed forward, the aorta and vena cava compressed and the cæcum forced into the pelvis, evacuation of the gases through the natural channel

is out of the question. The condition must then be met with prompt artificial evacuation by means of the trocar and canula plunged into the bloated bowels through the right flank. Other less formidable degrees of bloating also sometimes justify the operation. Gas in nominal amounts pent up in different sections of the folded colon or cæcum, although not sufficient to cause immediate harm, perpetuate the pain, exhaust the peristaltic force, depress the vital forces by becoming absorbed, and thus often prolong a colic into a critical state of inflammation or impaction which might have been prevented by an early artificial evacuation. Ordinarily these minor bloatings can be dispatched by such simple remedies as eserine, carminatives, enemas, exercise, intestinal massage through the rectum, etc., but when these fail to effect an early relief enterocentesis must not be too long postponed. In old horses especially, slight flatulence often does irremediable harm if not promptly expelled or abstracted. General intestinal atony or local intestinal dilations of aged animals predispose to total suspension of all peristaltic movements, when these lesions are submitted to further injury by the irritation and pressure of confined gases. Furthermore, the pressure of a bloated section against another very frequently effectually blocks all movements of the intestinal contents. The bloated colon may squeeze the ileum and thus practically arrest all intestinal movements. If the tension is diminished the peristalsis returns and normal evacuation of the remaining gas and gas-forming ingesta soon brings about the desired relief.

These and other critical situations into which the complex intestinal mechanism may be placed by bloating clearly exemplify the necessity of frequently resorting to enterocentesis in the treatment of colics, and especially the importance of not delaying the operation until an incurable damage has been done. In short, the operation must be promptly performed in all cases of extreme tension and in all cases of minor bloatings that can not be promptly relieved by the usual palliative remedies.

EQUIPMENT.—The **intestinal trocar and canula,** preferably Fash's instrument, (Fig. 22) a scissors to clip the hairs, an antiseptic solution to wash the field, and a bit of vaseline to lubricate the canula, are the only requirements.

RESTRAINT.—Ordinarily no form of restraint, except a firm hold of the halter by the attendant, is necessary. A restive animal may be twitched; usually however the intense internal pain renders the subject perfectly tractable. The

second or third operation, may, however, occasionally provoke a resenting kick as the trocar is plunged into the flank. While this incident is somewhat rare, the careful surgeon will never so far forget the liability of its occurrence as to expose himself to injury in any case. We once observed a horse, that after having been submitted to the operation a number of times during different attacks of colic, fought viciously at the sight of the trocar and canula and could only be controlled with the twitch and sideline. But such cases are exceptional. By standing at a safe distance in front of the reach of the hind leg no restraint will be found necessary except in these rare cases.

TECHNIQUE.—First step.—Locating the Seat of Operation.—The seat of operation is the right flank at a point equally distant from the anterior angle of the ilium, the transverse processes of the lumbar vertebræ, and the posterior border of the last rib. But this rule must not be followed "to the letter" in every instance; some respect must be given to the **most prominent point** of the distention, irrespective of this classical measurement. The operation may sometimes



FIG. 22—Intestinal Trocar and Canula (Encased).

be performed at the **left flank** when, in threatening cases, it was found impossible to afford sufficient relief from the right side. The relations of the bowels, when bloated, are often changed, and thus leave little assurance that the colon or cæcum will always be punctured by penetrating the right flank. A third seat of operation is **the rectum.** After futile efforts to relieve the tension through either flank the cæcum, whose base pushes into the pelvic cavity when distended with gas, may be punctured **through the rectum** with very satisfactory results in many instances.

Second Step.—Disinfecting the Field and the Instrument.—Except in instances where the life of the patient is in immediate danger, or when the patient on account of violent pain is too uneasy, great care should be taken to cleanse the field and disinfect the instrument. In the urgent case,a bit of lard, oil, vaseline or any unctuous substance at hand that is reasonable clean is smeared over the seat of operation so that the hairs at the point of penetration can be parted and thus leave a denuded spot for the point of entrance. The instrument in a few moments can be safely sterilized by passing it

through the flame of a match, a convenient gas jet, or a lamp. Thus, in a moment a reasonably safe condition can be created, which in view of the urgency of the situation must answer the purpose. But when the situation is less urgent much more pains should be given to this step of the operation. The hairs should be clipped with the scissors, the skin washed with mercuric chloride solution 1-500 and the instrument well sterilized as above directed. A bit of vaseline rubbed over the canula will facilitate its abstraction after the gas has been evacuated, but only clean vaseline should be tolerated. If the ointment is not considered safe it might better be omitted. The thrusting of an unclean instrument



FIG. 23—Enterocentesis. Position of Surgeon and Instrument.

into the peritoneal cavity through a dirty, hairy field is to be avoided under all circumstances. Even when the situation is an urgent one, some effort in the direction of surgical cleanliness must be made in order to prevent serious infections of the bowels, peritoneum and abdominal paries.

Third Step.—Inserting the Canula.—The operator takes a position well forward (Fig. 23) to avoid a possible side-sweeping kick, holds the instrument between the thumb and index finger of the left hand, at a right angle with the level of the region, and then strikes it with the palm of the right hand, hard enough to send it to its hilt at one stroke. A good, sharp, keen cut is desirable and this can not be obtained by pushing the instrument slowly, and besides the

sudden thrust of the instrument reduces the pain to nil; its entrance is scarcely felt.

Fourth Step.—Evacuating the Gas.—The evacuation is usually effected by simply pulling out the trocar from the canula and allowing the gas to escape, without following any special directions. In **severe bloats, and especially in severe bloats of several hours' duration,** some effort should be made, however, to prevent the gas from escaping too rapidly. The too sudden relief of severe abdominal tension may cause **fatal shock.** To cope with this situation the outward gush is regulated with the finger at the end of the canula. The flow may be momentarily arrested from time to time as the tension diminishes, so as to bring a gradual instead of a sudden resumption of the intestinal circulation.

Sometimes, after a sudden gush of gas, the flow stops as suddenly as it began, before there has been any perceptible diminution of the distention. The arrest is due to several causes. The canula may slip from the bowel on account of a wide and forcible peristaltic sweep, it may become choked with ingesta, or it may only have penetrated a small intestine; or, worse than all, there may be no free gas to evacuate. The distention very often arises not from gas alone, but from an enormous fermenting mass of semi-liquid ingesta that only bubbles through the canula without affording any relief, to the great dismay of the operator. These deviations from the usual situations are met by first reinserting the trocar into the canula to clear its lumen of a possible choke, and if this is not fruitful it is pulled out about two inches and then plunged in in another direction. If results are still negative this may be repeated two or three times; that is, the trocar is driven into the bowel at different directions in the hope of placing it where gas will flow freely. These punctures must, of course, not be too often repeated, because each one leaves a hole the size of the canula in the bowel, through which bubbling, fermenting ingesta in considerable quantities may find its way into the peritoneal cavity. As the puncturing of a distended bowel without relieving the tension leaves an open hole, it is important, once the operation is begun, to diminish the distention at all hazards. Here, the situation being critical, the left side is attacked in the same manner, and if results are still negative, the rectal route offers the only possible chance to prevent the threatened asphyxiation.

Fifth Step.—Withdrawing the Canula.—The instrument is withdrawn with the fingers of the right hand as the first and second fingers of the left one press down upon the

skin around it. It is advisable always to first insert the trocar into the canula to prevent the distribution of ingesta along its tract through the abdominal muscles.

Sixth Step.—Protecting the Wound.—When the relief is complete and permanent no special protection of the cutaneous wound is necessary because the elasticity of the skin leaves but a very small, almost imperceptible, breach, but when the relief is only partial and the stretched condition of the skin keeps the orifice open, it is well to apply a coating of vaseline over the surface to protect against contamination with the litter during the subsequent colicky pranks of the still uneasy patient.

ITERATION.—In the course of any given attack of colic the operation may have to be repeated two, three, four or even five or more times before the gas formation ceases. The duty of the surgeon here is that of simply resorting to it as often as it is found necessary to rid the intestinal canal of the accumulating gases. In no case should there be any hesitancy of repeating the operation on account of previous performances, if the degree of the recurrent distention warrants.

In iterant operations a different point of entrance is selected for each. It is advisable to operate as far as possible from preceding points,—one inch or more,—in order to prevent abscess formation, which would be favored by riddling a small area with a number of punctures.

ACCIDENTS AND SEQUELÆ.—(1) **Hæmorrhage** may occur from two sources; from blood vessels in the abdominal walls or from blood vessels in the intestines. Branches of the **lumbar arteries,** the **circumflex ilii,** their collateral veins, or the colic arteries or veins may be breached as the instrument is plunged into the bowels. This accident is unavoidable and usually not serious. When large vessels of the intestines are breached, blood in considerable quantities may be forced or splashed out of the canula when the trocar is withdrawn from the canula; it having first flowed into the intestinal lumen and then having been forced out by the outward gush of the gas. It sometimes happens that considerable blood flows imperceptibly into the colon and is only noticed on the second or third day when evacuated with the feces, or that it flows into the peritoneal cavity outside of the intestines, where it is often found post-mortem, or is suspected because of the local peritonitis that often follows the operation. These intestinal hæmorrhages, although sometimes very profuse, are generally harmless. They are una-

voidable and beyond the reach of any effectual treatment. Their arrest must be spontaneous.

Bleeding from the abdominal wall by breaching one of its vessels is likewise unavoidable, and whilst not as serious as a hæmorrhage in the bowels, the blood sometimes dissects its way between the abdominal muscles and accumulates in quantities at certain points, to the decided benefit of any pyogenic microbes that might accidentally enter this favorable environment. Blood from this source may also flow into the peritoneal cavity and provoke or at least augment a local peritonitis. This accident is managed by allowing the blood to flow freely outward on the surface of the body, instead of arresting it by digital pressure. If exceptionally profuse it is even advisable to enlarge the cutaneous orifice and await its spontaneous arrest, in order to prevent its onward dissemination or accumulation between the layers of the ventral wall.

(2) **Shock** sometimes supervenes enterocentesis by the sudden resumption of the splanchnic circulation after the tension, which dammed the blood into other parts of the body, is eliminated. The sequel is favored by general exhaustion of the vital forces that accompanied colic of long duration. A nominal distention of long duration is much more dangerous from this standpoint than an extreme distention of short duration. The capacity of the intestinal vessels is enormous and they are very elastic. If the intestinal blood is forced into other parts of the body for hours while the ravages of the disease undermine the general vitality and embarrass the heart at the same time, the splanchnic vessels which have been stretched, weakened, paralyzed, by the distention, are in no condition to cope with the sudden rush of blood into them. They over-fill at the expense of the periphery and to the decided detriment of the already embarrassed heart. The totality of this disturbed equilibrium is shock with all of its typical manifestations,—coldness of the surface, cold perspiration, accelerated respirations, pallor or cyanosis of the visible mucous membranes, emptiness of the peripheral arteries, imperceptible or thready pulse, tremors, cessation of the colicky pains, and finally an early death. This accident of enterocentesis is seen often in aged horses, and generally in colics that have dominated for some hours. It is rare in the acute colic of the vigorous subject.

Whilst not always avoidable shock may sometimes be prevented by evacuating the gas very slowly, by applying an

active counter-irritant over the whole abdomen and chest and by the prompt administration of stimulants. Mustard well rubbed into the skin, warm blankets held closely to the body by two or three surcingles, a drench of two ounces of aromatic spirits of ammonia in a pint of hot water and finally a good hot enema, is a combination of expedients that should not be omitted in the treatment of neglected bloats in aged horses.

Shock is particularly an unfortunate sequel because the operation may justly be blamed for having caused it. Erstwhile, the case may have been considered favorable, now it is known to be hopeless, a situation that reflects seriously on the operation.

(3) **Circumscribed peritonitis,** is a very common sequel of enterocentesis. It begins about four days after the operation and is manifested by a nominal pyrexia of 102° to 104° Fahr., tucking of the flanks, more or less anorexia, disinclination to move about, and marked manifestations of pain when the right side of the abdomen is palpated. The cause may be pyogenic infection, frequent repetition of the operation, hæmorrhage or the flow of ingesta into the peritoneal cavity. It runs a course of about eight to ten days and generally terminates favorably. Laxatives, laxative diet and absolute rest in a roomy box is the only necessary treatment. Antiphlogistics internally and externally fomentations in the form of hot wraps are indicated if not absolutely essential.

(4) **Abscesses in the Ventral Walls.**—The tract of the instrument through the abdominal muscles may become infected with pyogenic microbes and become the seat of a more or less serious phlegmon, varying from a small subcutaneous pus sac to a large, deep-seated abscess with a capacity of several pints. During their evolution these abscesses may cause threatening general symptoms as well as intense local pain, simulating peritonitis. Soon, however, the nature of the trouble manifests itself by the appearance of a hot, extremely painful, and hard tumefaction of the flank at the seat of operation, that later points and discharges its contents over the surface of the region. The real abscess may be preceded by a nominal discharge from the cutaneous orifice made by the canula.

These abscesses are usually caused by driving infectious matter, (hairs, skin dirt, dirt upon the canula, etc.) into the tract, by not having taken proper preventive measures. The accident is excusable when, in urgent cases, there was not time to spare for the important preliminary disinfection of

the skin and instruments. In the less urgent cases, and especially when the operation was only performed once, this sequel should seldom ever be permitted to occur. It savors of uncleanly surgery.

Sometimes, however, the infectious matter is brought into the tract from the intestinal contents as the canula is withdrawn. When the contents of the colon is a churning, fermenting mass, and the distention was not relieved from the operation, there is always much danger that some of the ingesta will follow the canula into its tract as it is withdrawn. It even happens that froth and food particles will bubble from the cutaneous orifice after withdrawal of the instrument. In these incidents prevention is impossible, beyond the precaution of replacing the trocar into the canula before withdrawing it.

The abscess from intestinal infection is differentiated from the one from external infection by its greater size, its slow evolution, its great depth, its fetid contents, the necrotic shreds in its contents, and by the frequent presence of the bacillus pyogenes fœtidus (colon bacillus). This pus-producing microbe, ever present in the intestines of horses, finds a favorable environment for growth in the track of a canula, and it is indeed frequent that it finds its way into the tract.

The course of these abscesses is varied. After pointing, or after their contents have been artificially evacuated by lancing, they may cicatrize promptly and cause no further trouble. Sometimes, however, they may develop into chronic fistulæ that discharge for months, or that defy every effort to locate their exact direction or perpetuating cause. If the original orifice closes they may point as low as the groin near the mammæ or sheath.

The abscess supervening enterocentesis should be treated by early evacuation of its contents. Whatever may be the proper course to pursue in regard to lancing abscesses in general, this one should be ripped open at once as soon as it is seen. This early treatment prevents dissemination, and precludes the formation of fistulæ. A good, liberal incision is made into the forming sac, which is then treated with frequent injections of hydrogen peroxide. Forcible irrigations which would tend to spread out the infectious matter are avoided.

CELIOCENTESIS.

SYNONYMS.—Paracentesis abdominis, punctio abdominalis.

DEFINITION.—Celiocentesis is the surgical penetration of the abdominal cavity with a canula. The word is specially adopted as an appropriate designation for the aspiration of fluid from the peritoneal cavity.

INDICATIONS.—**Ascites** of non-inflammatory origin is the chief, in fact only, indication for celiocentesis in veterinary surgery. It occurs chiefly in **aged dogs.** It seldom occurs in young dogs and rarely ever in the other domestic animals as a special clinical entity. Abdominal dropsies in herbivora are very rare, except trivial accumulations which co-exist with general anasarca. The accumulation of sufficient fluid to perceptibly distend the abdomen may sometimes occur in an old cow or old horse, but the occurrence is noted chiefly for its rarity. Dropsies are found post-mortem, but are seldom recognized ante-mortem in the large animals. The one exception is the dog, which animal alone seems susceptible to the particular lesions upon which such accumulations depend. Ascites is a secondary condition, a phase, a reflection of some serious abnormality of the splanchnic circulation. It is a transudation of blood serum into the peritoneal cavity, dependent upon a passive hyperæmia which in turn is caused by an **obstruction to the portal circulation.** The obstruction may be in the portal vein, in the liver, in the vena cava and even in the right heart. Any influence that will prevent the free outward flow of the blood that is constantly carried into the bowels by the arteries, will, on account of the great extent of the peritoneum and its natural tendency to secrete fluid, cause more or less fluid to accumulate that the peritoneum is not capable of absorbing. Chronic renal afflictions, but more rarely in dogs than in human beings, sometimes precurse or co-exist with the disease.

Ascites of dogs is chronic; its course is slow; the abdomen gradually becomes larger and larger, it fluctuates, and the subject emaciates slowly but with certainty. The condition needs to be differentiated only from pregnancy and tumors and sometimes from enormous distentions of the urinary bladder caused by strictures of the urethra. Palpation, succussion, the history of the disease, and the age of the patient offer ample opportunity to make a correct diagnosis, but

when there is any doubt the operation itself is a diagnostic expedient.

EQUIPMENT.—

1. Razor.
2. A basin of soap and water.
3. A basin of antiseptic solution.
4. A small trocar and canula.
5. A tape muzzle.
6. Two assistants to hold the patient.

RESTRAINT.—The dog is muzzled and held in the lateral recumbent position. The canine operating table is of no special advantage, as the operation is not pain-

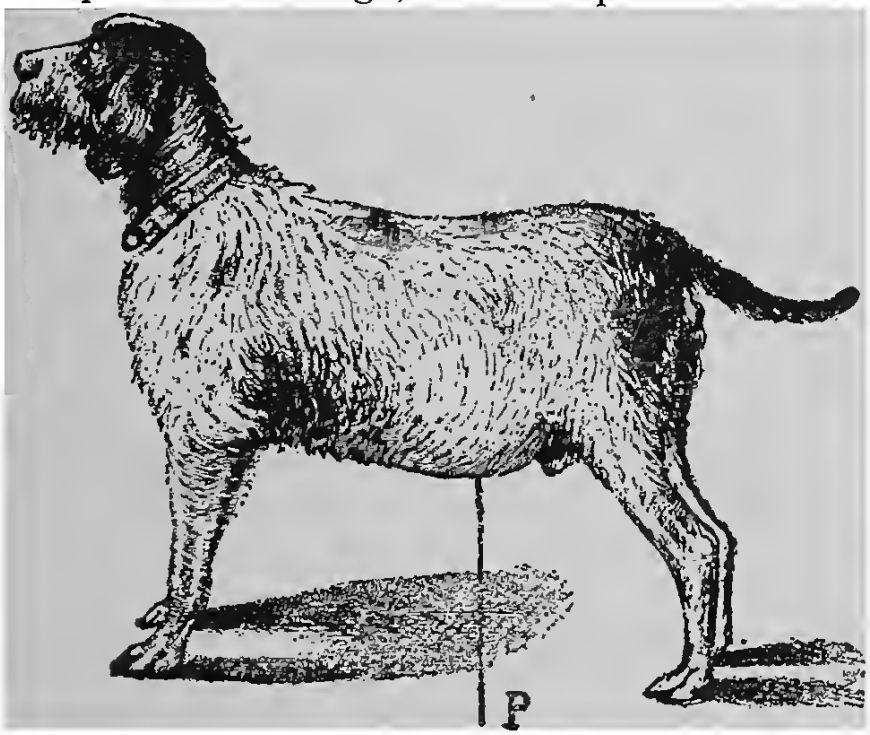


FIG. 24—Dog with Ascites in Standing Position for Evacuation of Fluid. Line "P" Shows Seat of Operation and Direction of Canula.

ful and the patient should be placed upright after the canula is inserted.

TECHNIQUE.—The belly around the umbilicus is shaved and bathed with the antiseptic. The trocar and canula, previously sterilized, is plunged slowly through the abdominal wall just in front of the umbilical cicatrix and a little to one side of linea alba. After the trocar is withdrawn from the canula the fluid is allowed to flow until the stream becomes feeble, then the patient is placed on its feet until all has been aspirated. The abdomen may be manipulated with the hands and the direction of the canula changed from time to time when the flow ceases.

SEQUELÆ.—Celiocentesis is not a successful operation.

It seldom ever permanently benefits the patient, because it only influences an effect without benefiting the cause. The original lesion, the primary abnormality, being still active, a re-filling of the cavity is certain to occur sooner or later. Often it refils rapidly and manifestly enfeebles a patient whose general health previous to the operation was fairly good. As a general rule it is more harmful than beneficial, although occasionally it does prolong the days of an old, favorite pet.

THORACOCENTESIS.

SYNONYM.—Paracentesis thoracis.

DEFINITION.—Thoracocentesis is the aspiration of fluids from the thoracic cavity with the trocar and canula.

INDICATIONS.—The operation is indicated in any accumulation of liquids in the thorax, whose quantity is sufficient to manifestly interfere with respiration. The exudate of **serous, seropurulent or hæmorrhagic pleuritis** (inflammatory hydrothorax) or of dropsy of the thorax (true hydrothorax) are the two conditions encountered in domestic animals which call for an evacuation of the thoracic cavity. The former is very frequent in solipeds, complicating almost every case of pleurisy that does not promptly terminate in resolution. It is especially common in broncho-pneumonia complicated with diffused pleurisy, but exists also as a close sequel of plain, uncomplicated inflammations of the pleura.

Often in acute pleuro-pulmonary affections two, three or four gallons of fluid will accumulate in a few days, and on the eighth to the tenth days of the fatal cases the lungs are found flooded. As these cases are usually fatal from the extensive inflammation of the lungs, pleura and pericardium, the operation is of little service. The mere aspiration of the fluid accumulated around the lungs has no perceptible effect on any of the symptoms presented. The course of the disease goes on unchecked and the cavity rapidly refils in spite of everything if the patient survives long enough. In this condition the practitioner is, however, justified in resorting to the operation, if for no other purpose than that of demonstrating the accuracy of his diagnosis.

Inflammatory hydrothorax following in the wake of the acute stage of pleuro-pulmonary inflammations which pass into sub-acute and finally chronic stages, is the real indication for thoracocentesis in veterinary surgery.

All of the domestic animals suffer from this complication

of pleurisy, but it is in the soliped that the condition is most frequently recognized early enough to render surgical treatment effectual. The condition calling for aspiration becomes apparent at the end of the usual course of pleurisy, when the patient, instead of convalescing, remains mysteriously indisposed. The fever continues; the appetite is variable; the strength wanes slowly; the respirations, already slightly accelerated, become more and more labored day by day; the general condition becomes more emaciated; frequently a marked œdema develops between the fore legs; the eyes become glassy, staring and anxious; and auscultation reveals an absence of vesicular murmur up to a level that is equal on both sides of the chest. These symptoms develop rapidly or slowly in obedience to the activity of the inflammatory process. The filling process may run a course of one week, two weeks, three weeks or even five weeks, before the symptoms reach the maximum intensity. In rare cases three months of mysterious ill-health following acute pulmonary inflammations is finally accounted for by the appearance of symptoms which point to hydrothorax.

The prognosis depends upon the rapidity of the filling process. As already mentioned, the rapid filling up of the pleural sacs during the acute stage of broncho-pleuro-pneumonia or simple uncomplicated diffused pleurisy, is an unfavorable condition. It is generally fatal. But when the accumulation is less rapid the condition is often amenable to treatment. The sub-acute and the chronic cases very frequently recover under energetic surgical and medical interference, and are therefore the favorable indications for the operation. The character of the exudate has also an important bearing upon the prognosis. If composed of pure serous fluid, especially if the accumulation has been slow, a favorable result may be expected; but when purulent or hæmorrhagic and especially if the accumulation was more or less rapid, there will be but little chance for recovery.

EQUIPMENT.—1. Trocar and canula.
2. Scissors.
3. Razor.
4. A yard of small rubber tubing.
5. A small quantity of antiseptic solution.
6. An empty pail.

Restraint.—The operation is performed in the standing position, under no other restraint than that of holding the patient along the side of the stall to prevent moving about

while the fluid is being aspirated. As the fluid, for reasons hereafter mentioned, is caught in a pail it is important that the patient be kept in one position during the entire operation. The twitch may be applied to the nose while the puncture is made, in the exceptionally restive subject, but since the pain amounts to nothing more than one sharp pang as the trocar penetrates the skin, even this precaution is not often necessary. Furthermore, the patient is usually too ill to offer formidable resistance.



FIG. 25—Seat of Operation and Method of Preventing Aspiration of Air into the Thorax in Thoracocentesis.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The seat of operation is the flat part of the costal surface behind and above the olecranon, on the right side of the body. The puncture is usually made between the sixth and seventh ribs and as near their distal terminations as possible. It is not necessary to count the intercostal spaces, in fact this can not be done except when the patient is in exceptionally poor flesh. (Fig. 25.) It is sufficient to trace an intercostal space in the region as far down as its cartilage (if possible) and then select a spot at the anterior border of the rib bounding it posteriorly. When the animal is fleshy this may not

be possible, as the outlines of the ribs can not be accurately traced in that part of the thorax, except in emaciated animals. In this event, the spot is determined by tracing a rib as far as possible and then making a mental calculation of its course beneath the flesh.

Second Step.—Disinfecting the Field and Instrument.—The point selected is clipped and shaved and then well washed with mercuric chloride solution 1-500. The canula is passed frough the flame of a candle, match or gas-jet.

Third Step.—Inserting the Trocar and Canula.—The operator stands behind the field, holds the instrument in the right hand (Fig. 27) and then slowly and deliberately pushes it into the thorax, in an oblique direction, inward, forward and upward. This oblique direction of the canula, is one of the salient features of the operation, in that it prevents striking a rib. Ribs are so arranged as to almost over-lap one another roof-like, from before backward. If attacked from behind an object easily finds the space between them, but if attacked from in front the space could hardly be entered at all.

Fourth Step.—Aspirating the Contents.—When the instrument has penetrated safely through the wall, the trocar is removed from the canula and the fluid allowed to flow into a pail previously provided for the purpose. The canula is immobilized with the fingers; otherwise it will move about with the respiratory movements. As long as the stream is free and keeps the canula full, it is allowed to flow without further ceremony. Later, however, the flow will spurt only during the inspiration, and between the spurts, **air will be aspirated into the thorax** to the decided detriment of the patient. To prevent this occurrence a rubber tube is attached to the end of the canula and dropped into the pail which now contains a quantity of the liquid. With one end of the rubber tubing attached to the canula and the other buried under the fluid in the pail, the admission of air into the thorax is effectually blocked and the aspiration will continue until all of the contents has flowed out. The author sometimes uses a bottle which is hung by its neck to the surcingle, the tube is dropped into it and the aspiration allowed to go on unattended for hours. (Fig. 25.)

Fifth Step.—Protecting the Wound.—Although the abrasion is a small one, and the chance of infection **ab extra** is slight, it is nevertheless sensible to clothe the breach with an impervious dressing, such as collodion, tar, vaseline, etc.

SEQUELÆ AND ACCIDENTS.—Pneumothorax is by far the most serious accident of thoracocentesis. It is caused by permitting the suction of air into the cavity through the canula, after the major part of the fluid has been abstracted. During the inspiration, as the lungs inflate with air, the fluid around them is forced up to the level of the canula and a limited quantity will flow out, but as the thorax contracts for the exhalation a certain amount of air will be drawn in, unless preventive measures are taken. (See fourth step.) Although but little air enters at each respiratory act, a sufficient amount will find its way into the pleural sacs during the entire last part of the aspiration to cause a pronounced distress of the breathing. Normally the pleural sacs should each be a vacuum; in the horse they constitute a single vacuum, being connected to each other through a fenestrated membrane in the posterior mediastinum. When air is admitted into this vacant space an important part of the mechanism of respiration is destroyed and a distressing dyspnœa immediately supervenes and continues for some hours. This dyspnœa, added to an already serious embarrassment of respiratory function, at once deprives the operation of any curative value. In fact, the patient, which now needs vigor more than ever, is stricken with a demoralizing distress that leaves little chance for recovery. The operation was, then, more harmful than beneficial. On the other hand if no air has been permitted to enter, the operation is followed by an immediate improvement of the labored breathing. The deep, heavy, pumping respirations become calm and almost normal as the fluid gradually flows out.

Treatment.—Pneumothorax is easily prevented by attaching a rubber tube to the canula as prescribed above, but is incurable except through nature's own forces, i.e., by resorption of the air by the pleura.

Shock.—Old cases of hydrothorax, where the thorax is full, where the respirations have gradually become more and more labored, without having made a corresponding impression on the general health, are very prone to succumb to shock after the fluid is removed. The acute cases and the sub-acute cases are less susceptible to this sequel. It is the chronic one that is actually dangerous from this standpoint. Dropsy, in the absence of any existing or pre-existing inflammation of the pleura, is the more dangerous. The danger of shock is also augmented by rapid aspiration. If the thorax were lanced and all of the contents suddenly evacuated, shock would be the inevitable result in almost every case. A large

canula will give a larger percentage of shock cases than one of smaller caliber.

Treatment.—Shock is prevented by a slow, gradual evacuation of the fluid. The evacuation should be so gradual as to leave no impression that would tend to disturb the equilibrium of the general circulation. In a pronounced case, internal treatment is of little service. Warm clothing, ammoniacal stimulants, intravenous and subcutaneous salt solutions, are among the expedients to be tried.

Refilling of the Thorax.—Thoracocentesis is not often effectual because it attacks only an effect. The cause is often still active. If the disease is due to inflammation of the pleura, as is generally the case, the inflammation, not being benefited by the operation, will again proceed to refil the pleural sacs. This refilling will occur rapidly in acute cases and slowly in the chronic ones. In the latter when the inflammatory process is on the verge of resolution and fails to fill the cavity with exudates faster than the pleura absorbs them, convalescence will follow soon after the operation. But if the exudation exceeds the absorption, a refilling, one two, three or even five weeks later will occur, according to the activity of the process.

In **true hydrothorax,** that is non-inflammatory hydrothorax, the refilling will follow in strict obedience to the nature of the primary lesion.

Treatment.—The task of preventing refilling of the thorax is that of curing the caustive disease—the pleuritis. The success of the operation in permanently restoring the health, depends upon the possibility of restoring the pleura to its normal condition. This must be done largely through treatment that will restore the lost vitality. Good supporting food, abundance of fresh air, invigorating, out-door exercise, sun-baths, cheerful surroundings and a medication of strychnia, quinine and bitter tonics, is a combination of treatments that must not be omitted. Ferruginous tonics in the form of small doses of tincture chloride of iron well diluted are also helpful. The emunctories must not be neglected. Frequent doses of oil of linseed to keep the bowels in a state of activity, digitalis to promote diuresis and warm clothing to maintain a normal activity of the skin are appropriate lines of treatment in this connection.

Pleural Adhesion.—The cessation of the inflammation of the pleura sometimes occurs only after more or less extensive fibrous adhesions have formed between its parietal and visceral portions. These may be limited or they may be dif-

fused over a large area. Sometimes the two pleuras are held in firm juxtaposition; at other times the union is a loose connection with fibrous bands. The seriousness of this sequel depends upon the extent, the location, and the firmness of the adhesions. Located in the mediastinum they are somewhat more serious than on the costal walls. Animals so affected are "short-winded," pant on exertion, grunt when turned sharply, are very often hopeless roarers, and generally maintain a certain degree of ill health for months and even years.

Treatment.—Pleural adhesions are exceptionally refractory conditions. Once formed they will persist for all time, and the symptoms by which they are manifested can scarcely be palliated. A long run at pasture, healthful exercise or an easy occupation with first-class food and general care may tend to promote a state of fair health with which these formidable abnormalities may remain compatible.

THECOCENTESIS.

DEFINITION.—Thecocentesis is the aspiration of synovia from distended sheaths and bursæ, for the purpose of diminishing their size.

INDICATIONS.—Lesions requiring this operation exist only in the horse. They are **wind-puffs** of the fetlocks, **thoroughpin** of the hock, **thoroughpin of the knee,** distention of the theca of the extensor pedis tendon in front of the fetlock, and distentions of other bursæ and sheaths provided with more or less extensive sacs which sometimes become distended and produce annoying blemishes. Wherever they are met they constitute appropriate indications for the operation under consideration. Although far from a prompt, radical cure, it has a certain definite value if patiently repeated, and if the after-treatment is carefully managed.

"Wind-puffs or wind-galls" are the two vulgar appellations for distentions with synovia of the superior cul-de-sac of the sesamoidean sheath. It is a stretching out of the sac from strain, or constant concussion, accompanied with an over secretion of enough synovia to fill up the dilatation. The enlargement evolves through the combined influence of the internal pressure of the secretion and the continual insult inflicted to the sac. Laterally, the sac is not supported by any adequate structures; only the thin skin covers it, to the decided benefit of the process. These enlargements are found more or less developed on nearly all horses submitted

to hard work, fast work or constant work, appearing often soon after the young animal is first submitted to exertion. They generally advance gradually, but in rare instances supervene a sudden injury. They usually enlarge with work and diminish with rest, but sometimes maintain a definite size without change in character or dimensions.

Pathologically, a wind-puff is a slight inflammation of the synovial membrane of the entire sesamoidean sheath, together with a dilatation of its uppermost cul-de-sac. If the inflammation is more intense it may cause lameness during the acute stage, but since the great majority of cases evolve slowly without any initial period of acuteness, lameness is scarcely ever observed. They vary in size from small, almost imperceptible, fluctuant elevations to large elongated enlargements that greatly disfigure the leg. They are always harder and somewhat larger while the leg is supporting weight.

In an examination for soundness wind-puffs should be regarded as an unsoundness, in spite of the fact that they seldom ever depreciate the utility of the patient. Their tendency to enlarge, although small at the time of examination, and their location on a conspicuous part of the leg, stamps them as redoubtable blemishes.

Thoroughpin is a distention of the tarsal sheath which over-laps the posterior surface of the hock about six inches superiorly, and as far as the middle third of the metatarsus inferiorly. Inferiorly it is bounded by unyielding structures that prevent any extensive distention, but superiorly the space between the tendo-Achilles and the flexor pedis perforans, which is enclosed laterally only by the elastic skin, facilitates the development of an almost unrestricted dilatation.

Like the wind-puff, thoroughpin generally evolves under the influence of a slight, chronic inflammation of the synovial membrane. The resulting excessive secretion and the constant strain to which the part is subjected, gradually enlarge the sac until it becomes a visible, fluctuant enlargement, which can be pressed from side to side beneath the tendo-Achilles. At first it appears only as a slight, flattened, very soft enlargement externally, and then later shows itself also on the internal aspect of the region. Rare cases, especially those resulting from a single, sudden strain, may appear first on the internal side. In either case the finality is the development of a large, tuberous, fluctuating distention that is much larger internally than externally. The enlargement may as-

sume enormous proportions and become exceedingly hard, especially while the leg is supporting weight, or else it may remain small and markedly fluctuant. In some instances thoroughpin produces an exceedingly obstinate lameness, that yields to firing, blistering and prolonged rest, but recurs



FIG. 26—Thoroughpin of the Tarsus.



FIG. 27—Method of Holding Trocar and Canula.

again after a brief period of hard work. In these cases, the distention can be traced through the hock downward to the inferior extremity of the sheath at the upper third of the metatarsus, where a pronounced dilatation announces the diffusion and the seriousness of the inflammation.

Thoroughpin often co-exists with bog-spavin, but the two

are never directly connected with each other. Each one is a distention of a separate synovial sac, having no communication with the other.

Thoroughpin of the Knee or carpal thoroughpin, quite frequently encountered in the hard-worked draft horse, is to the carpal sheath what thoroughpin proper is to the tarsal sheath. It is, however, much less common, and seems only to occur where there is ample provocation in the form of exceptionally heavy work. A case is met here and there in the high-stepping coach horse, but with this exception, horses other than those subjected to heavy pulling are seldom ever affected. This condition, which is very often accompanied



FIG. 28—Thoroughpin of the Knees.

with an obstinate—if not incurable—lameness, is manifested by the appearance of a fluctuating enlargement of the carpal sheath just above the radio-carpal articulation. The dilated cul-de-sac occupies the space between the flexor muscles and the posterior surface of the radius, bulging rather indistinctly on both sides of the leg. Below the carpus a similar but smaller distention is felt along the upper third of the metacarpus.

Other Synovial Distentions occur in the legs of horses, but they are less serious from every standpoint than the ones previously described. The synovials of the flexors, being concerned in supporting weight and being submitted to the great strain of locomotion, are more frequently affected with

such abnormalities than those of the extensors. Bursal enlargements along the extensor tendons, besides being less common, are also less serious. They never produce a chronic lameness and will yield to treatment to which the others are refractory. The more common ones are: (1) Distention of the sheath of the extensor metacarpi obliquis at the lower third of the radius; (2) Distention of the sheath of the extensor pedis at the fetlock; (3) Distention of the sheath of the peroneus tendon at the antero-external part of the metatarsus.

(Dropsies affecting diarthroses, although similar in character to bursal distentions generally are not considered appropriate indications for thecocentesis.)

The operation of thecocentesis, as before mentioned, is not a radical cure for these chronic, blemishing abnormalities which, in fact, are generally classified among the incurable conditions. It is, however, often very helpful as a preliminary step of a course of treatment aiming to banish them. The distentions of the extensors may be lanced, then irrigated and drained for some days until the discharge stops without any danger of complications, but those of the flexors can not be managed with this same impunity. To set up a painful inflammation, infective or non-infective, in the great flexor sheaths by lancing or by injections of irritants, is too hazardous to recommend as a sensible treatment for a condition that previously is regarded as trivial. Although such radical measures are often eventually successful in reducing the enlargement by entirely destroying the secreting membrane, there is always a long and exceptionally painful period of convalescence which many patients do not survive.

Lancing the thoroughpin or the wind-puff is an operation that the practitioner will seldom ever repeat. The escape of the patient from death, especially in the case of thoroughpin, is too narrow to take the chance often. Firing is ineffectual and never satisfactory because it adds to the blemish without permanently reducing its size. Blistering, cooling lotions, compresses, special shoeing and rest do but little permanent good. The resection of a part or of all of the sac would always prove effectual if absolute operative and post-operative asepsis never mis-carried, but the great liability of infecting the surgical trauma, especially during the convalescence, makes this recourse analogous to the lancing operation, and hence unwarranted in view of its relative unimportance.

This leaves the veterinarian with no other expedient than thecocentesis. The operation should be performed early; be-

fore the distended sac has entirely lost its elasticity. The old, confirmed thoroughpin or wind-puff will not yield; the aspiration of the fluid, the rest and the external irritants (blisters) will not shrink up a sac that has maintained a certain definite contour for years. In the more recent case, the aspiration of the fluid every two weeks followed by the immediate application of a cantharides blister over the entire region, will usually effect a permanent cure if persisted in for a period of from three to six months. The aspiration should be repeated regularly as long as any synovia can be abstracted, but the blisters should be omitted when the condition of the blistered skin demands. The first three or even four treatments may be discouraging, but thereafter, if the plan is persistently carried out, the enlargement will gradually disappear. In the work-horse, where scarring is not objectionable, a good line firing may be substituted for the first blister. Rest, or at least easy work, is essential to the success of the treatment.

EQUIPMENT.—

1. Aspirating needle or small trocar and canula.
2. Scissors and razor.
3. A basin of antiseptic solution.

The aspirating syringe often used for drawing out synovia is not absolutely necessary, as synovia will flow out freely enough without it until the sac is quite empty.

RESTRAINT.—For the thoroughpin and wind-puff operations the standing position is the preferable one. The opposite limb is held from the ground with the side line and the twitch is applied to the nose By throwing all of the weight upon the affected leg the distended sac is made tense and prominent, and this facilitates both the penetration of the needle and the flow of the fluid. Local anæsthesia is not necessary, because the pain is limited to a single pricking sensation, and this will pass unnoticed if the twitch is given an extra turn as the needle penetrates the skin.

TECHNIQUE.—First Step.—Disinfecting the Field.— The hair is clipped and shaved from a small spot about one inch in diameter over the most prominent part of the enlargement. The denuded point is then submitted to a washing with the antiseptic solution that will assure a clean skin. A mercuric chloride solution, 1-500, applied with sharp friction, and then a rinsing with alcohol for a few moments is the least that should be done in this direction.

Second Step.—Inserting the Needle.—Before inserting the needle it should have been sterilized by boiling or by a

long immersion in a 95% solution of carbolic acid, and then just before inserting it the canula should be passed over the flame of a match. The latter precaution alone is insufficient because the stilletto or trocar within the lumen may not be sufficiently disinfected. The lumen of a canula must be free from needle rust and desiccated particles from previous operations, which may be pushed into the sac during the operation. Once safely cleaned the needle or canula is passed into the sac by one sudden thrust, as the assistant at the head

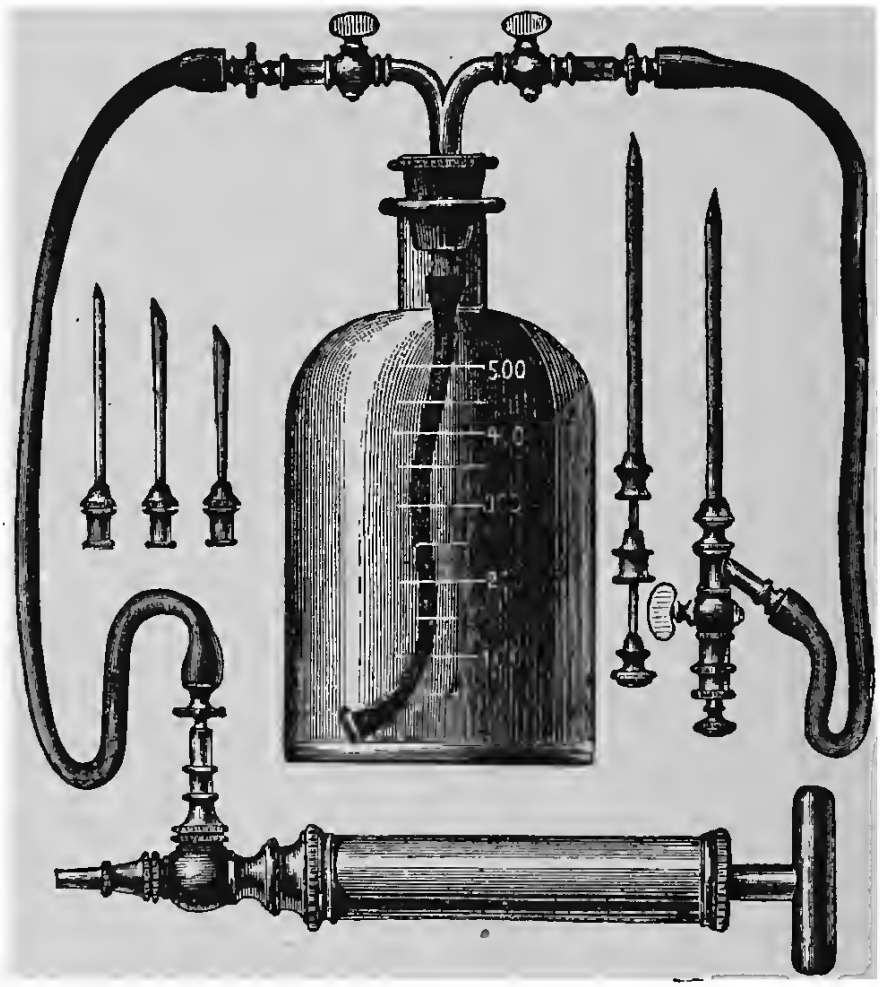


FIG. 29—Special Apparatus for Aspirating Synovial Fluid.

gives the twitch an extra turn to distract the patient's attention from the seat of operation.

Third Step.—Abstracting the Fluid.—As a rule the fluid will immediately begin to evacuate freely, but if it fails to flow the stilletto is passed through the lumen to rid it of a possible choke. Failing in this the needle is changed at different angles within the sac until success is attained. As the tension relaxes from the evacuation the sac is manipulated with the fingers of both hands so as to bring the remaining fluid under pressure at the entrance point of the needle. This manipula-

tion should be continued until all of the fluid has been abstracted.

The abstraction may also be effected by means of a special aspirating apparatus (Fig. 29) which withdraws the fluid by suction, but this method possesses no advantage over the more simple method of siphonage with a needle or canula.

AFTER CARE.—The treatment should be followed by the application of a cantharides blister over the entire sheath. In the case of thoroughpin the blistering is carried upward as far as the enlargement extends, and downward as far as the insertion of the check ligament in the metatarsal region. For wind-puffs the entire fetlock is blistered. The aspiration is repeated every two weeks or even oftener and the blistering as often as the skin recovers its normal state.

The subject is rested, turned in the paddock or pasture or else submitted only to easy work that will not seriously tax the affected parts.

SEQUEL.—Thecal Abscess.—The development of a severe infective inflammation of the whole sheath, which terminates in the formation of an exceptionally painful sero-purulent abscess, is always a possible result of such operations. The danger is, however, not great if ordinary cleanliness is observed throughout, and if no irritants are injected into the sac. The injection of irritants into synovial sacs following aspiration is an exceptionally dangerous procedure, in spite of cleanliness. The inflammatory exudates which fill up the sac after such injections often become infected in some unexplainable manner, and provoke a chain of serious local and general symptoms which sometimes prove fatal.

The appearance of a thecal abscess of the flexor sheaths following thecocentesis is announced by swelling of the whole region, inability to support weight on the affected leg, extreme local tenderness around the seat of operation, fever, anorexia, injected membranes, accelerated respirations and finally the pointing of abscesses at different parts of the infected sheath, which discharge a sero-purulent liquid in abundance without relieving the local symptoms. These abscesses are indeed serious; the process is of long duration; the patient emaciates; the muscles of the affected side atrophy; and the region is left in a state of permanent tumefaction.

Treatment.—The patient affected with thecal abscess must be placed in a large, roomy stall and nursed well. The region is bathed with hot water or wrapped in hot wet cloths until the abscesses begin to form, after which time attention must be directed to the suppurating process. The abscesses

should be lanced as soon as fluctuation appears and then irrigated moderately with hydrogen peroxide three or four times daily until their formation ceases, which is often as long as five to six weeks. If the patient lies down too much of the time special care must be taken to prevent decubitus, by abundant litter and by the use of slings.

This complication is mostly serious in the tarsal sheath and in the sesamoidean sheath of the hind leg. In the foreleg and in the bursæ of the extensor tendons it is much less serious.

GASTROCENTESIS.

DEFINITION.—Gastrocentesis signifies puncturing the stomach. It is applied here to designate the aspiration of gases either from the stomach or the rumen, by means of the trocar and canula or other instrument.

INDICATIONS.—Gastrocentesis is practiced chiefly on ruminants, and is always indicated when the rumen is distended with gases in sufficient quantities to cause pronounced distress. The disease, which is known as acute **tympanites, blown, hoven,** etc., and which is the condition that calls for this operative intervention, is a fermentation of rapidly ingested feeds. Green fodders or grasses eaten ravenously in considerable quantities, indigestible slops or, in fact, any of the ordinary feeds taken in too large quantities, are among the many causes which may provoke such attacks. The disease is in reality an overloading of the rumen with feeds which in turn still further distend the organ by elaborating gases of fermentation. But the rumen is generally found full of a semi-liquid, bubbling, churning mass of ingesta, through which the gases are permeated so completely as to prevent their immediate evacuation. That is to say, in acute hoven the gases are intermixed with the mass, and cannot be abstracted through a canula alone in sufficient quantities to afford any immediate relief. The intra-abdominal pressure in such cases can only be reduced by giving a free exit to the ingesta and gas combined through an opening sufficiently large to permit their passage. Gastrocentesis, in the ordinary sense of the term, is, therefore, not always an effectual operation in the relief of distended rumens. Rumenotomy may be necessary in those acute cases where the gases have not separated from the mass of ingesta. When the rumen is not completely filled with food and the upper part contains gas elaborated from the food below, the relief from the operation is prompt; otherwise it is always very unsatisfactory be-

cause only a limited amount of the fermenting mass will bubble through the canula. If the relief is inadequate,—that is, if the threatening state continues, rumenotomy must be at once substituted. In the extremely urgent case it is even allowable to plunge the blade of a large knife directly into the rumen without ceremony, in lieu of a careful, painstaken laparo-rumenotomy.

These operations for the relief of intra-abdominal tension in ruminants, must not be delayed too long. Their success depends largely upon their performance before fatal damage has been wrought by the extreme pressure upon the viscera of both of the large splanchnic cavities. Like enterocentesis in the soliped, gastrocentesis in ruminants is not a harmful operation, but is often discredited by performing it after the reactive powers of the organs have been destroyed by prolonged and extreme pressure.

In the soliped, gastrocentesis is never effectual. Although the stomach can with some difficulty be reached with a trocar and canula, the constitution of the contents is never of such

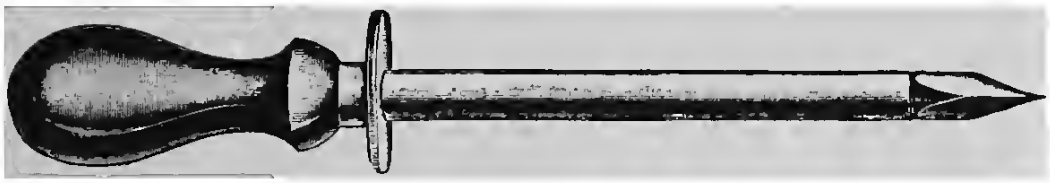


FIG. 30—Cattle Trocar and Canula.

a character as to admit of its passage through the canula in sufficient quantity to afford any relief. In short, tapping the stomach of the horse is not a sensible undertaking. It is uncertain, ineffectual, difficult, absurd. Aspiration by means of the stomach tube is the rational substitute.

In the carnivora, the overloaded stomach takes care of itself by emesis.

EQUIPMENT.—1. Scalpel.
2. Scissors.
3. Trocar and canula of large dimensions. (Fig. 30.)
4. Basin of antiseptic solution.

RESTRAINT.—The operation is always performed in the standing position, unless the patient has already fallen and is threatened with asphyxiation. In the latter event a plunge of the instrument into the exposed flank while the animal is recumbent is justifiable. In the usual case, fixing the head to a pillar, fence or stanchion is the only restraint required. It is advisable to have both sides accessible because in the smaller and medium sized animals the operation

is performed by leaning over the body from right to left, in order to avoid a side-sweeping kick.

TECHNIQUE. First Step.—Locating the Seat of Operation.—The operation is performed in **the left flank,** except in rare instances when the animal is down with the right side uppermost and is in danger of death before it could be made to rise. The rumen occupies the left hypochondrium, and is therefore best reached from the left side. The exact location of the penetration is immaterial. The most prominent part of the distended abdomen anywhere between the anterior angle of the ilium and the last false rib, and as near as possible to the transverse processes of the lumbar vertebræ, is the proper position.

Second Step.—Disinfection of the Field and of the Instrument.—Except in the urgent case the hair is clipped with the scissors from the selected spot, and then the region is washed with the antiseptic solution. The instrument, unless previously sterilized, is passed through the flame of a match, candle or gas-jet, or immersed in a strong chemical antiseptic. Although this precaution is less important than in the horse, too much dependence must not be placed upon the traditional immunity of ruminants to serious infections from such sources. A sensible disinfection of everything connected with the procedure is always expected of a careful surgeon, by a critical judge.



FIG. 31—Gastrocentesis in the Ox. Position of Surgeon and Instrument.

Third Step.—Inserting the Canula.—A short incision is made in the skin with the scalpel, in order to facilitate the entrance of the instrument, which is then driven into the

rumen with one sharp blow of the palm. The operator should stand at the right flank, performing these manipulations by leaning over the body (Fig. 31) unless they are found incompatible with the small stature of the surgeon or the large stature of the patient. In this latter event the operator stands on the left side, but well forward and at arm's length, or else takes the precaution against injury by securing the left leg with a rope held or tied backward.

Fourth Step.—Evacuating the Gas.—The evacuation is then effected by removing the trocar from the canula and then occasionally replacing it to prevent choking of its lumen with ingesta, which sometimes flows out in considerable quantities. Before the operation is abandoned, the intra-abdominal pressure should be reduced at all hazards, to prevent large quantities of ingesta from flowing into the peritoneal cavity after the canula has been withdrawn. If the rumen remains stretched after it has been perforated, the opening likewise remains stretched wide open, and gives free exit to the contents. The warning already heralded in the description of enterocentesis in solipeds, to make frantic efforts to diminish the intra-abdominal pressure once the evacuation has been attempted by tapping, can not be too frequently repeated. If evacuation is found impossible through the canula, a rapid rumenotomy must be immediately performed. In the urgent case a probe-pointed bistoury is passed into the abdominal cavity along the canula, and an incision two inches long made in the abdominal wall in the downward direction. The rumen, which will then bulge into and even through the incision, is then incised with a smaller incision. After the first gush of ingesta, the edges of the incision in the rumen are grasped with forceps, and held through the opening in the abdominal wall until the flow ceases. Dependent upon the cause, manual abstraction of the contents after enlarging the opening of the rumen may or may not be necessary.

Fifth Step.—Protecting the Wound.—The incision in the skin made at the point of entrance should be protected by the application of an antiseptic powder,—boric acid, iodoform, tannin, etc. When larger incisions are made the rumen must be closed with two or more Czerny stitches, and the abdominal wall with interrupted sutures.

AFTER-CARE.—After ordinary tapping of the rumen an antacid drench consisting of aromatic spirits of ammonia two ounces in a quart of water and a saline purgative of magnesia sulphate, are always indicated, but when the rumen has been incised it is preferable that that organ be left dormant long

enough to allow the incision to partially unite. A limited liquid diet for several days is advisable.

SEQUELÆ.—(1) **Peritonitis** in various degrees of severity often supervenes such operations. The inflammation is more or less diffused, confined to the region surrounding the operation, but affects both the parietal and the visceral portions, often terminating in extensive adhesions of the rumen to the abdominal walls. It is caused by pyogenic infection, by the flow of ingesta into the peritoneal cavity through the perforation, by hæmorrhage, or by a combination of such causes. Although not serious in the vigorous subject, it may prove fatal to the patient enfeebled by the disease or by previous causes.

(2) **Shock,** pure and simple, sometimes complicates rapid evacuations of the distended rumen. It is prone to supervene the sudden evacuation of a rumen that has been bloated for some hours, especially in aged or emaciated subjects.

(3) **Chronic perforation of the rumen.** (See rumenotomy.)

CYSTOCENTESIS.

DEFINITION.—Cystocentesis signifies tapping the urinary bladder with the trocar and canula, for the purpose of evacuating its contents.

INDICATIONS.—This operation, while rather rarely ever required, is nevertheless important under certain circumstances. It is used chiefly as a preliminary step in the surgical treatment of urethral strictures of horses and oxen, which by producing total obstruction of the urine, cause the bladder to become so enormously distended as to expose it to rupture while the patient is submitted to the restraint necessary to perform the operation upon the urethra. For example, a horse or ox suffering from a stricture of the urethra following an improper amputation of the penis, or from a calculus, is found with an enormously distended bladder. The patient must be moved some distance to the hospital, or possibly for some reason can not be operated upon until the following day, and when operated upon he must be secured and anæsthetized. By aspirating the bladder the suffering is temporarily relieved until the obstruction can be permanently removed at a later and more convenient moment. The urgency of the situation being met, the surgeon may then operate at his convenience. Again, when such a subject is cast and anæsthetized for the operation it is essential that the

bladder be not so enormously distended as to expose it to rupture.

Veterinarians practicing where urinary calculi are common in cattle frequently find it necessary to resort to the operation under some of these circumstances. Amongst horses these indications are not uncommon.

The bladder, in complete urethral obstruction, by distending under pressure of the constant entrance of urine, becomes stretched out of all ordinary proportions. Its capacity may increase to a point that is almost beyond comprehension. It may extend anteriorly as far as the liver, downward as far as the floor of the abdomen and posteriorly it may obstruct the pelvic lumen before the walls give way to the pressure, but usually in the horse and the ox a rupture of the urethra will occur at a point near to the obstruction long before the organ assumes such enormous proportions. In the dog a distended bladder, by enlarging the dimensions of the abdomen, may produce symptoms analogous to ascites. The two conditions are not easily differentiated. Even in making an exploratory puncture the nature of the fluid may escape attention.

The symptoms of complete urethral obstructions at first consist of repeated unsuccessful attempts to micturate; later the straining becomes forcible and continuous, but finally after several days it discontinues and no further attempt is made to evacuate the over-distended organ which now being paralyzed is no longer capable of conveying the necessary impulse. The symptoms henceforth are general, consisting of an accentuating emaciation, poor appetite, anxious eyes, slight fever and a more or less labored breathing. The straining, if any, is an occasional attempt to defecate rather than to urinate; the distended and paralyzed bladder compresses the rectum, which then conveys the wrong impulse.

The diagnosis in the larger animals is never difficult. The straining during the first few days, or a history that such straining to urinate has existed, followed by an investigating rectal examination, at once reveals the nature of the abnormality.

EQUIPMENT.—The only instrument required to perform the operation is an ordinary intestinal trocar and canula and a piece of soft rubber tubing that will fit easily over the canula after the trocar is withdrawn. The tubing is not absolutely necessary, as the urine will flow into and then out of the rectum without such an attachment. It is, however, ad-

visable to prevent straining from the irritation of the rectal mucous membrane, caused by the urine.

TECHNIQUE.—The operation is exceedingly simple. The hand, previously lubricated with vaseline, holding the trocar and canula guarded in the palm, is passed into the rectum about twelve inches at which point the bladder is found conspicuously bulged and extremely tensed. The point of the instrument is then advanced in front of the finger tips, and then pushed into the bladder in a slightly downward direction, by a sudden forward thrust. The trocar is withdrawn by manipulating it between the thumb and index finger. It is essential that the trocar be well lubricated and loosely fitted into the canula; otherwise its withdrawal with one hand alone would be impossible.

The rubber tube is then worked into the rectum with the opposite hand and then fitted over the hilt of the canula, thus completing a perfect siphon which will evacuate almost the entire contents.

SEQUELÆ.—Cystitis may follow several repetitions of the operation, but no noteworthy inflammation supervenes a single puncture. Jones performed the operation more than ten times on a yearling steer suffering from a urethral calculus, and found on post-mortem examination some months later that the bladder had undergone a severe acute inflammation that became chronic and caused thickening and induration of the whole organ, with a pronounced reduction of its capacity.

Shock.—Fatal shock may supervene the operation within a few hours, especially if the case be one of long standing. An old gelding suffered from a complete stricture of the urethra supervening a neglected frost bite of the penis, sustained by sleeping upon a cold, bare floor on a very cold night. A part of the organ sloughed off and the exposed urethra gradually constricted until only a few drops of urine were voided from the attempts to micturate. The obstruction was, in fact, complete, as the rectal examination revealed an enormously distended bladder. Preparatory to the removal of the patient to the hospital for operation the bladder was evacuated through the rectum, by means of an intestinal trocar and canula; but instead of giving the expected relief an alarming state of collapse almost immediately supervened. Tremors appeared at the shoulders, perspiration broke out about the head, the respirations quickened, the pulse became feeble and the whole body grew cold. These symptoms gradually accentuated and ended in death about three hours

later. The examination post-mortem revealed no lesions to which the untimely death could be attributed.

KERATOCENTESIS.

DEFINITION.—Keratocentesis is the name we apply to the operation of puncturing the anterior chamber of the eyeball for the purpose of evacuating the aqueous humor or abstracting harmful elements it may contain.

INDICATIONS.—The operation is performed chiefly for **periodic ophthalmia,** in which disease it is indicated either to prevent recurrence of the attacks or to evacuate unsightly and harmful purulent products resulting therefrom. For the former purpose it is performed after the inflammation has subsided and the eyeball has regained its normal appearance. The object is to evacuate the dormant microbes which have now precipitated to the floor of the chamber, and which sooner or later will provoke another inflammatory attack. In this connection the operation is fairly, although not universally effectual. Attacks sometimes recur despite its performance. Notwithstanding these failures, however, it is a justifiable procedure. In the author's opinion, based upon observations, the attacks are made less acute, the intervals between them are lengthened and some cases are entirely cured. The best results are obtained after the first attack, and before serious structural changes have developed upon the iris and the lens. It is contra-indicated during the sojourn of the acute inflammation.

In addition to this indication, keratocentesis is sometimes needed to abstract floating or partially attached flocculent bodies from the aqueous humor, which appear during the declining stage of the inflammatory process. In rare cases, one of which has come under the author's observation, one or more whitish-blue, vermiform, bodies continue to inhabit the anterior chamber, after the disappearance of all other evidences of the attack. This condition has been mistaken for helminthiasis, which is much more rare, but which does occasionally supply an operable case.

RESTRAINT.—Recumbent restraint with the table is the most satisfactory form of confinement.

Local anæsthesia induced by dropping 10% cocaine solution into the conjunctival sac will answer for simple evacuation of the aqueous humor, but when the operation includes any intra-ocular manipulation it is much better to use a general anæsthetic. The powerful movements of the eyeball,

which can only be curtailed by destroying all reflexes, prevent accurate execution, and must, therefore, be controlled by profound anæsthesia.

INSTRUMENTS.—1. Cataract knife.
2. Blunt hook.
3. Needle and silk suture, or an eye speculum.

A common, sharp-pointed curved bistoury may be substituted for the cataract knife, and the hook may be impro-

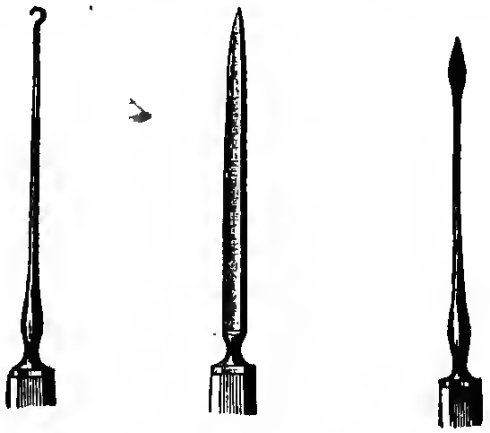


FIG. 32—Knives and Hook for Keratocentesis.

vised from any kind of bendable wire, the only special requirements being a smooth surface and a rounded, non-penetrant point. The needle and sutures are used as par excellence the best substitute for an eye speculum. (See step 1.)

TECHNIQUE.—First Step.—Adjusting the Speculum.—The eye speculum, a spring-wire affair, is placed beneath the lids, which it separates by its tension. When the anæsthesia is a profound one and the patient as a consequence thereof is perfectly still, the speculum will remain in place well

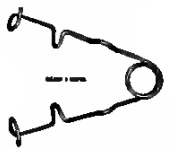


FIG. 33—Eye Speculum.

enough, but when only local anæsthesia is depended upon the movements of the head, the attempts to wink and the rolling of the eye-ball will usually dislodge it from its position and thus prove exceedingly annoying. In this event the author keeps the eye open by passing silk threads each about a foot long, through the center of each lid, and then detailing an assistant to draw the lids apart with them. In this manner the eye is widely opened and the seat of puncture is kept perfectly accessible without hindrance.

Second Step.—Puncturing the Globe.—The bistoury or

cataract knife is then thrust carefully through the cornea near the inferior part of the corneo-sclerotic margin. The incision is made perpendicularly, that is to say, at a right angle to the margin and not parallel to it. The corneal vessels which radiate toward the center at right angles from the corneo-sclerotic margin, and which, owing to inflammation, are often perceptible, are thus avoided. Horizontal incision along the corneo-sclerotic margin, in eyes affected with inflammatory conditions, provokes bleeding into the chamber that defeats the purposes of the operation by obscuring the object to be removed.

The incision, which need not exceed one-sixteenth of an

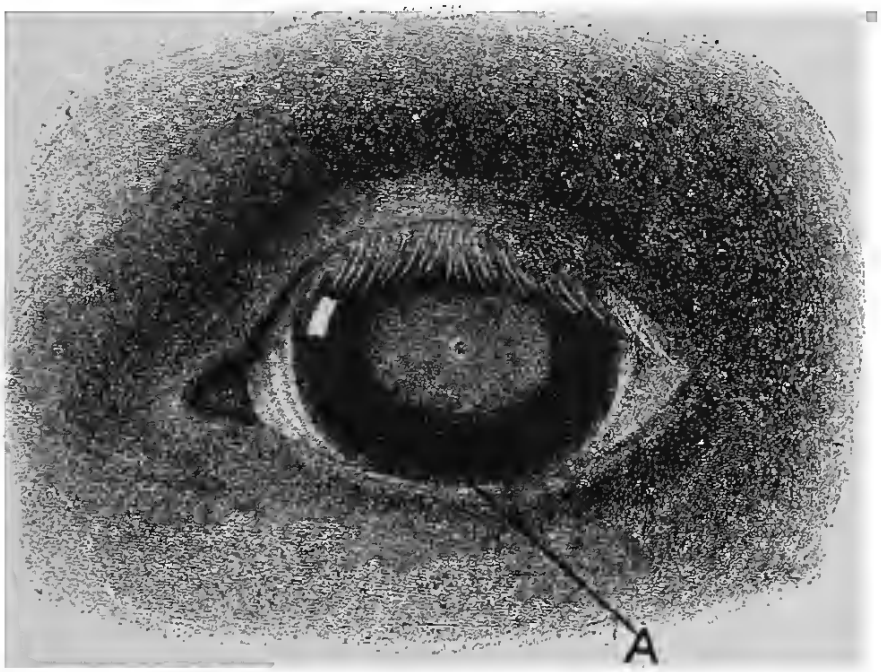


FIG. 34—Position of Incision in Keratocentesis for Periodic Ophthalmia.

inch in length, is made **inferiorly,** because it is here that the morbid products to be removed have precipitated. Incisions made superiorly may answer well enough for the abstraction of helminths or floating particles, but for the treatment of periodic ophthalmia whose aim is the evacuation of precipitated septic products, the puncture must be made inferiorly.

The reader may be profitably warned that the cornea is an exceedingly tough integument, the incising of which requires a keen cutting knife.

Third Step.—Evacuating the Aqueous Humor.—Abstraction of Coagula, Helminths, etc.—In the treatment of simple cases of periodic ophthalmia the aqueous humor is rapidly evacuated by pressure upon the globe while the point of the wire hook keeps the incision open. If pieces of coagulated humor block the incision, they are hooked out and the evacu-

ation by pressure resumed. Attempt is made to entirely empty the chamber. Fixed coagula lying along the floor of the chamber or upon the posterior face of the cornea are teased loose with the hook if the fixation is not too firm, but when firmly attached the attempt will be futile and will provoke bleeding.

Free bodies are withdrawn by passing the hook around them regardless of the position they occupy in the chamber. The hook may be passed into the pupillary opening or to any part of the chamber which chances to harbor harmful elements.

AFTER-CARE.—The eye is treated daily to a rinsing of boric acid solution and then anointed over the entire globe and conjunctival sac with an ointment consisting of yellow oxide of mercury, ten per cent, and vaseline, 90 per cent.

SEQUELÆ and ACCIDENTS.—If performed with sterilized instruments no untoward results occur, but if septic

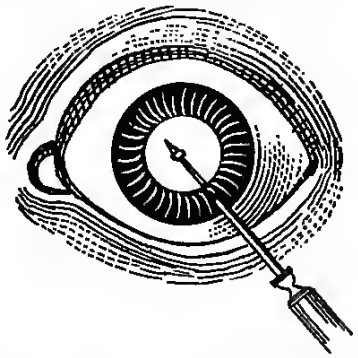


FIG. 35—An Intra-Ocular Invasion with the Cataract Knife.

products are deposited in the chamber, a possible inflammatory condition may follow. It is, however, remarkable how seldom serious inflammation supervenes.

The most common accident of the operation is bleeding into the anterior chamber. The cornea in periodic ophthalmia, even after all evidence of inflammation seems to have subsided, bleeds readily from its internal layer and as a few drops of blood dissolved in the aqueous humor immediately transforms the eye into a "blood-shot" condition, there is little possibility of proceeding effectually with the operation. In fact as soon as the blood has disseminated over the whole chamber the proceedings should cease.

PHLEBOTOMY.

SYNONYMS.—Bleeding; blood-letting; venesection; blood abstraction.

DEFINITION.—Etymologically, phlebotomy is the surgical incision of a vein, but its meaning in surgery has been

broadened so as to also include the abstraction of blood from the incision. The word "phlebotomy" is therefore synonymous in veterinary surgery with "blood-letting" from the jugular vein. The word is never used to designate the intentional incision of a vein during a surgical operation.

HISTORY.—Phlebotomy deserves to be described as the oldest surgical operation. It was a therapeutical expedient of the most ancient healer. The oldest description of efforts to cure the ills of man and animals mention the operation, and elaborate upon its efficacy. It was performed alike on the rich, the poor, the young, the old, the thin, the obese, the man, the beast, for every deviation from health, whether a trivial indisposition or a grave malady, and its popularity as a curative measure did not wane until recent years. About the middle of the nineteenth century it began gradually to sink into disfavor. During the last half of the nineteenth century it ceased to be so generally practiced; now its practice is as rare as it was once universal. The better knowledge of pathology claimed by the present generation, the better understanding of the relations between physiological and pathological states, and probably, also, mere caprice, have relegated the operation to oblivion. The new physician, surgeon and veterinarian know nothing of blood-letting, and care less. The operation today is condemned, stigmatized, ignored, ridiculed everywhere. It has no adherents, except a few straggling remnants of the so-called old school,—passing entities.

INDICATIONS.—Let us see whether this manifest prejudice of the modern therapist against phlebotomy is justified, or whether it is only a mere prevailing fancy or fashion.

It is now pretty generally conceded that during the many centuries that blood-letting was universally practiced, many patients, afflicted with debilitating fevers and asthenic organic inflammations, were bled to death by their physicians. That Washington fell a victim to this practice will become an American tradition. Among veterinarians it is known that animals likewise frequently were victims of this procedure, but in spite of these presents, the operation has had its victories, otherwise an established popularity, lasting centuries, would have been impossible. The persistency of its popularity was due partly to the fact that it was frequently very beneficial, that it seldom ever produced any perceptible harm, and that better antiphlogistic measures were not known. Depressing antiphlogistic drugs supplanted it, and although these still find some defenders, they too, are surely

passing into oblivion as did phlebotomy. We are now living in the day of stimulants, tonics, nourishment, hygiene, opsonins and antitoxins. What will be next? While passing adverse judgment on phlebotomy as it was practiced in past and almost forgotten epochs, the operation deserves to be credited with its victories, which were legion. The evil was found in its wholesale application, in its application to enfeebled patients, and the prevailing practice of frequent repetitions as the strength waned. To have discarded it entirely was also an evil, for, in veterinary subjects at least, it is often highly and promptly potent in dispatching certain conditions of a sthenic character.

It is well known that the abstraction of a limited amount of blood, or even a very large amount, has no harmful effects upon a healthy animal. Instead it improves the general health by exciting the vital forces to renewed activity to replenish the loss. In disease, it has various missions, but is especially active in equalizing or regulating the general blood-pressure. When blood flows toward the side of the veins at the expense of the arterial volume and to the embarrassment of the right side of the heart, the abstraction of a limited amount of blood will often set matters right more promptly than any known drug. If the arteries are too full and the pressure high, venesection acts as a prompt corrective. This especially is the case in the first stage of the acute organic inflammations, **pleurisy, laminitis, croupous pneumonia, hepatitis, enteritis,** etc. It is probably a pity that bloodletting has been discarded entirely from the treatment of these diseases, because they often present features in their first stages that certainly call for an action that venesection alone can supply. In **congestions and apoplexies,** the abstraction of a liberal quantity of blood will always decrease the impending damage and limit the subsequent changes in the affected tissues. **Acute cerebral hyperæmia, acute pulmonary hyperæmia, acute hepatic hyperæmia, intestinal apoplexy and similar conditions,** lack a modern treatment as manifestly effectual.

Recently phlebotomy has been recommended in the **last stages of pneumonia** when death from a failing heart becomes imminent. Here its action in part, is that of reducing the heart's labors by diminishing the volume of blood. The operation is defended on the hypothesis that the capacity of the lungs being greatly reduced by the hepatization, only a limited quantity of blood can be oxidized, and hence the heart handles much blood unnecessarily. Besides, the heart being

burdened with the fruitless task of driving an excessive volume through the impervious, hepatized areas, becomes exhausted and embarrassed. By limited blood-letting at this critical moment, the heart's labors are said to be reduced. The heart is given a momentary rest. Its burden is diminished. Its embarrassment is temporarily removed. The hypothesis upon which this treatment is based also includes the benefit derived by the dilatation of the aortas which always follows blood-letting. If the aortas relax, as they always do after venesection, heart's action is facilitated. There

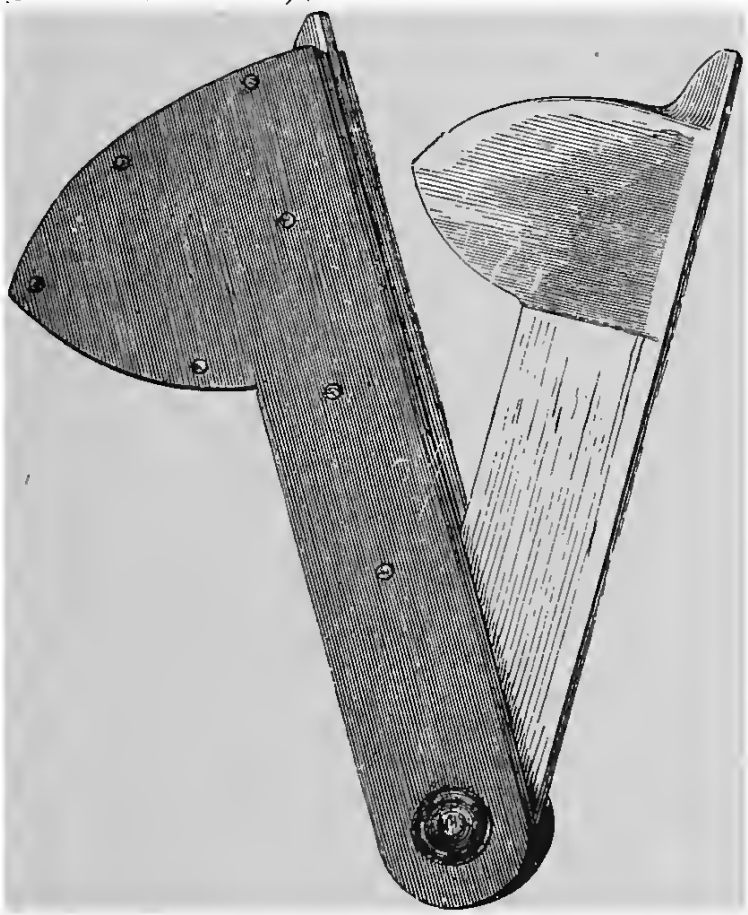


FIG. 36—Fleam.

is less counter-acting aortic pressure. In their aggregate, these different actions are frequently followed by an immediate improvement in the dying patient's condition. Although the effect is not lasting a critical period of the sickness is thus sometimes bridged over into the stage of resolution.

The treatment of the sinking pneumonia patient by blood-letting has not been sufficiently tested in veterinary surgery to establish its worth, but, although its theories can not be accepted as absolute laws, its logic is sound. The general prejudice against bleeding, even among laymen, and the fact that it no longer harmonizes with modern therapeutic ideals, prevents its adoption even as an experimental treatment.

Phlebotomy is also indicated when blood in any considerable quantity is desired for **experimental purposes.** It is also the method used in abstracting blood from the antitoxin-producing animals.

EQUIPMENT.—Phlebotomy is performed with the old fashioned **fleam** (Fig. 36) or a **sharp scalpel.** If the former is used a special **mallet** (Fig. 37) or a **heavy stick** is required to drive the blade into the vein, and as surgical cleanliness is essential, a **curved scissors** to clip the hair and **antiseptics** to wash the seat of operation, must be included in the equipment. A **long pin** and a **long tuft of tail-hairs** to close the incision after the blood has been abstracted, answers every purpose.

RESTRAINT.—Phlebotomy is performed in the **standing position.** The necessary restraint is accomplished with the **twitch** and the **hood-wink.** The twitch may sometimes be dispensed with, in fact it sometimes causes the horse to curve the neck or "set" the cervical muscles so as to obliterate the jugular groove, in which instance it is more of a detriment than a benefit. The hood-wink is, however, essential to prevent dodging as the fleam is struck with the mallet. A thick handkerchief, or even the hand placed over the eye, may be sufficient. The operation is best performed with the neck in the normal position, that is, held leisurely in a slightly upward direction. A high position, a low hanging position, or any strained, cramped position of the neck, renders impossible the necessary palpation of the jugular groove to locate and "raise" the vein.

TECHNIQUE.—First Step.—Locating the Seat of Incision.—The left jugular furrow in the middle of the cervical region, is the most advantageous position for the bleeding. Here the vein is less incumbered with muscles, and the location is in every way more accessible than either the upper or the lower thirds of the region.

Second Step.—Disinfecting the Field.—The hair is clipped from the groove at the point determined, with the curved scissors and then the field is well rinsed with mercuric chloride 1-500. If the abstracted blood is intended for experimental purposes, or the manufacture of antitoxic serums a much better disinfection of the field is advisable owing to the importance of obtaining only strictly non-contaminated blood. In therapeutic phlebotomy, nominal disinfection suffices, but it must not be omitted. To thrust the fleam through a hairy, unclean field may result in a serious infective phlebitis which, in the ante-antiseptic days was one of the formidable sequelæ of the operation.

Third Step.—Incising the Vein.—The surgeon standing at the shoulder, facing forward, takes the fleam in the left hand and the mallet in the right. The finger tips of the left hand (holding the fleam) are pressed firmly into the depths of the jugular furrow and as the vein fills up above them the point of the blade is adjusted to its most conspicuous part, the point touching the skin. Now after a glance forward to determine to a certainty that the blindfolding is effectual, the blade is given one quick, bold stroke with the mallet, forcible enough to send it, full depth, into the vein. A timid blow will result in a failure to reach the vein with the blade and will excite the horse, to the detriment of the next attempt.

Fourth Step.—Abstracting the Blood.—The vessel into which the blood is to be drained (a bucket or basin) is then

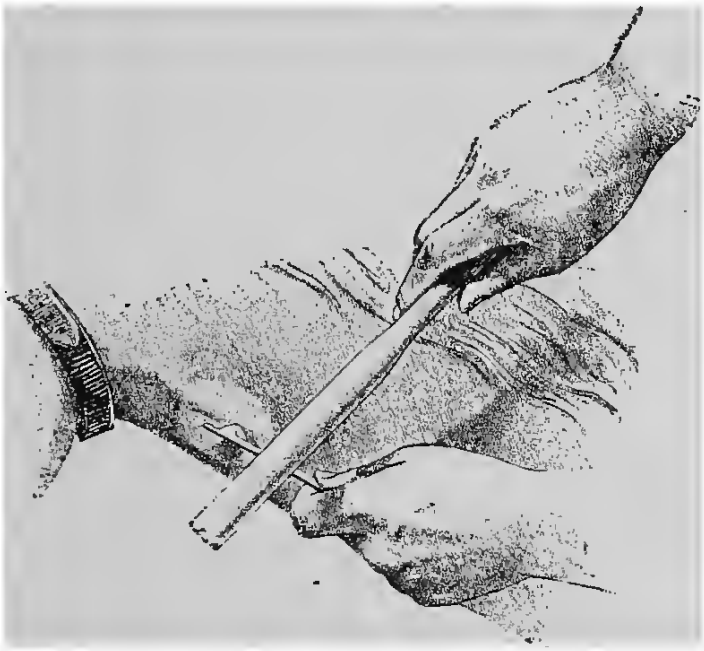


FIG. 37—Phlebotomy. Incising the Vein with Fleam and Mallet.

pressed against the jugular two inches below the incision. It thus serves the double purpose of catching the blood and of bringing the necessary distal pressure to force it out of the incision. One, one and a half, or even two gallons may be abstracted, according to the effects on the circulation. Sometimes the flow will even cease before the desired amount is obtained, but more often it can be maintained as long as the vein is submitted to pressure below the incision.

Fifth Step.—Closing the Incision.—The pin is passed through each edge of the small incision and then wrapped in the form of a figure 8 with the hairs previously obtained from the tail or mane.

AFTER-CARE.—The only after-care necessary is the re-

moval of the pin some four or five days later. The wound generally behaves well and requires no attention whatever.

ACCIDENTS AND SEQUELÆ.—A fleam blade in the neck of a small, thin horse might reach the **carotid artery,** if some judgment is not used in selecting an appropriate size, or in striking the blow. The danger here, however, need not be emphasized, as it is not very likely to occur. It is an impossible accident in a horse of ordinary flesh. Sometimes, after the pin suture is adjusted, the **blood will continue to flow subcutaneously** until a large sanguineous tumor develops around the seat of operation. Occasionally it assumes large proportions, extending as high as the larynx, as low as the thorax and outward three to five inches. In this event, if the flow is promptly discovered, a firm, continuous pressure above the incision will limit the flow and sometimes promptly arrest it. The patient must be kept quiet above all. If excitable, it is preferable to leave the patient quiet and await the spontaneous arrest of the bleeding. Under no circumstances must the incision be reopened with the intention of effecting direct pressure to the vein, on account of the inevitable danger of infecting the blood clot and thus provoking a serious abscess and possibly a serious phlebitis. Generally, the flow being rather trivial, non-interference is preferable.

The most formidable sequelæ of phlebotomy is septic phlebitis. This sequel occurs in the form of a serious, threatening inflammatory condition extending along the entire vein, from its confluent to the throat and even into its cephalic and facial branches. The acute inflammation terminates in the formation of multiple abscesses extending toward the periphery but exerting their greatest effects about the parotid region. The course of the disease is chronic, and not infrequently the prognosis is grave.

MODIFICATIONS.—Blood-letting from other veins besides the jugular is no longer regarded as a "modern veterinary method." The saphenic and radial veins were once bled for local diseases of the feet and legs, and pedal arteriotomy (bleeding at the toe) was once given some attention in the treatment of laminitis; but these expedients have fallen into obscurity on account of their uselessness.

In lieu of fleams the scalpel may be used to perform jugular phlebotomy, and although it is a less satisfactory instrument, the operation need not be abandoned simply because a fleam is not available. In performing the operation with the scalpel, the skin is carefully shaved, disinfected and

then anæsthetized subcutaneously to prevent annoying jerks of the head. The vein is "raised" by pressure below the field and an incision one inch long is made along its course through the skin and subjacent muscle until the rounded bluish vein appears in its depth. The incision into the vein is then made by a quick stab with the point of the scalpel. In closing this long incision two pins or two interrupted sutures are required.

In blood-letting for **experimental purposes** or **in the manufacture of antitoxins,** a special apparatus is required to pre-

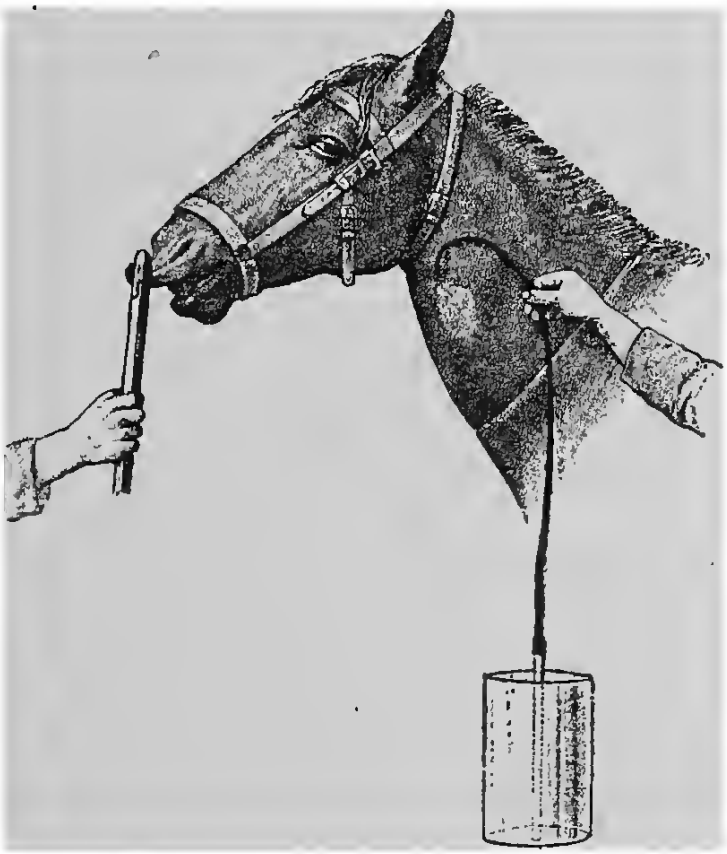


FIG. 38—Laboratory Method of Abstracting Blood from the Jugular Vein.

vent the abstracted blood from becoming contaminated with bacteria from without. The apparatus, appropriate enough for most any occasion, consists of a sterilized salt-mouth flask, a small rubber tube and two canulæ. The mouth of the flask is covered with a sheet of rubber stretched over it and secured around the neck. A canula is fastened at each end of the tube. In abstracting the blood one canula is plunged into the jugular after every thing is well disinfected, and the other one is plunged into the rubber covered flask. In this manner the blood is not exposed to outside influences. (Fig. 38.)

LIGATION.

DEFINITION.—Ligation is the application of a ligature, or, in other words, the operation of tying either normal or abnormal structures with a cord that encircles them.

INDICATIONS.—Ligation in surgery has two distinct objects:—(1) The arrest of hæmorrhage when applied to blood vessels; and (2) The strangulation of neoplasms.

The arrest of hæmorrhage by ligation is an important surgical process, made necessary by the profuseness of bleeding that occurs when large vessels are divided, and when such vessels can not be safely occluded by the more simple methods. In the course of surgical operations, or in the treatment of a bleeding accidental wound, the demands for ligation must be cautiously judged. Large vessels, especially arteries, require ligation to prevent fatal bleeding, serious anæmia, and shock, as well as to overcome the masking effect of blood. Large vessels, although apparently safely twisted with the hæmostatic forceps, may yield a secondary hæmorrhage, whenever the cut vessel is large enough to endanger life by loss of blood, or to discharge enough blood into the traumatic cavity to disturb the opposition of the mended breach. It is contra-indicated when the vessels are small, easily managed by twisting and unlikely to yield a secondary bleeding; or, when buried in a trauma, the ligature might act as a foreign body to the detriment of neat healing.

The strangulation of neoplasms by ligating the base or peduncle, is indicated as a method of ablation when the growth is small, has a more or less constricted base and where for various reasons surgical ablation is deemed inadvisable. **Warts** and other growths on animals that run at large, or that are too wild to submit to daily treatment of their wounds, may be disposed of at one stroke by simply strangulating them with a ligature and then leaving them to slough off without any further attention. The operation has the advantage of not exposing the underlying tissues to infection, as occurs when a growth is dissected out and the wound is sutured. Sutured wounds require a certain amount of after-care that may be difficult or even impossible to execute under some circumstances. **Hygroma of the elbow (Shoeboil)**, located at a movable part that often heals badly when wounded, is sometimes submitted to this form of treatment. In fact many practitioners, owing to the bad behavior of the surgical wound, have a decided aversion against total abla-

tion of these common lesions by dissection, and prefer to strangulate even the larger specimens. The practice in this case is, however, not a perfectly harmless one, nor is it universally curative, for frequently the denuded abrasion left on the elbow after the sloughing is complete, may heal slowly and even develop into another growth as formidable as the first. And besides, the strangulation of so great a structure may cause threatening reaction of no small proportions in the surrounding area, which in some instances ends disastrously. The operation should be reserved for small growths.

The radical treatment of superficial **aneurism** and **varicose veins** consists of a ligation of the affected vessels at each end of the dilatation (ligation of continuity), but these abnormalities are relatively rare in domestic animals and hence are of little importance to the veterinarian.



FIG. 39—An Elastic Ligature Adjusted.

In the treatment of **hernias** ligation is often selected as the best method of destroying the hernial sac. **Umbilical hernia** in particular is best managed by this method, (See Derr's operation page 357) but scrotal hernia (See Vanlaw's operation page 360) and even traumatic ventral hernia, can sometimes be effectually cured by special methods of ligation. Ligation in veterinary kelology is preferable to radical herniotomy on account of the greater danger of infecting the peritoneum and viscera in the latter procedure.

CLASSIFICATION.—Ligation is classified into **simple, sectional** and **elastic.** In **simple ligation** the base or peduncle of the growth is merely encircled with the ligature, while in sectional or multiple ligation they are divided into two or more sections by the passage of the ligature through them. Elastic ligation is the name given to the application of a rubber band around the peduncle of a growth, which

gradually cuts its way through by pressure upon the incarcerated tissues. (Fig. 39.)

EQUIPMENT.—1. Full curved special needles, aneurism needles, and straight needles are sometimes needed to effectually carry ligatures into desired positions. (Figs. 40-41.)

2. Cords of silk or linen thread, the size of which must vary according to the requirement, are the best ligature material. Exceptionally large strands are needed in ligating large growths, and in every case they must be strong enough to withstand the severe traction necessary to tighten them enough to strangulate the growth. For ligating vessels the ligatures must vary according to the size of the vessels, not on account of strength but because small threads applied to large vessels will cut them off too rapidly—before the coagulum has effectually occluded the lumen of the stump.



FIG. 40.



FIG. 41.

FIGS. 40 AND 41—Aneurism Hook and Needle used in Ligation.

3. Common rubber bands of various sizes are utilized for elastic ligatures.

TECHNIQUE.—The Ligation of Blood Vessels.—A blood vessel to be effectually ligated must be isolated and drawn out of the tissues with a forcep, so that the ligature when tied will not slip from the stump. When surrounding tissues are caught in a ligature it is very liable to slip off as soon as the parts are disturbed by movements or manipulations, but this accident can be prevented when the vessel can not be isolated and drawn out, by encircling the spot with a tobacco-pouch stitch, which, when drawn taut, will retain its position against any ordinary disturbance. The insertion of such stitches is facilitated by a double special needle arranged in the form of a forcep. (Fig. 42.) The needles are pushed through the tissues on either side of the bleeding spot, threaded, drawn back, and then unthreaded, thus leaving the vessel surrounded with a ligature ready to be tied.

In the course of surgical operations it is, however, advisable, when possible, to ligate vessels before they have been cut. Whenever it is known that a certain large artery or vein must be sacrificed in the execution of the steps of an operation its isolation and its ligation, proximally and distally, should be effected at all hazards before destroying its continuity. Superficial vessels, especially subcutaneous veins, which cross the line of incision, should be dissected out and ligated at each edge of the cutaneous incision before being cut, in order to intercept the vexing hæmorrhage. Veins which stand out prominently will collapse and retract into the tissues after their continuity is severed, and will be much more difficult to manage than before they were divided.

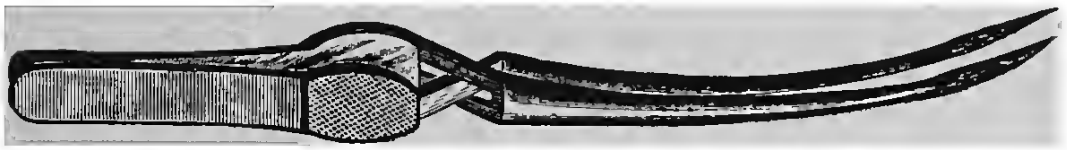


FIG. 42.

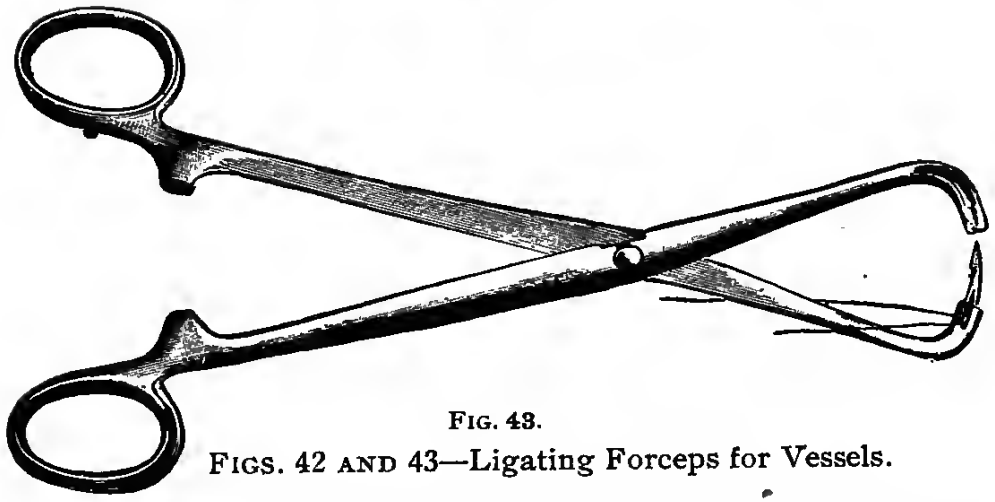


FIG. 43.

FIGS. 42 AND 43—Ligating Forceps for Vessels.

When a ligated vessel is in close proximity to the cutaneous incision the thread should be cut long so that its ends may protrude to the surface between the edges of the incision, thus facilitating removal by traction as soon as the stump has sloughed through. Buried ligatures which can not again be reached on account of healing of the surface wound should be cut short so as to leave only a small amount of irritant substance in the trauma. Absorbable ligatures,—fine silk or catgut,—only are admissible for this latter purpose.

The Ligation of Growths.—A small pedunculated growth, or any one with a narrow base, is strangulated by simply passing a cord around it as close to the surface of the body as possible and then drawing it taught enough to effect a total strangulation of the circulation. The cord should be of good

texture so as to withstand the traction. The "double-half-hitch" which can be drawn tighter and tighter without slipping loose is preferable for the first knot, but when tightened to the desired point it must be fortified against loosening by the addition of two simple knots. **Sectional ligatures** are applied by passing a thread through the base of the growth with a needle. If it is desired to divide a growth in but two parts a double thread is passed through the center of the base, the needle is cut off, and then each half is tied separately. To apply a quadruple ligature the growth is thus transfixed in two directions so that the threads cross each other at the center of the base. Although by this method each quarter is not encircled by a single thread the result, after the threads are tied, is equivalent to that of real quadruple ligation. By passing threads through part after part as shown in figure 44 a growth of any size may be ligated into as many sections as is thought desirable to effect a per-

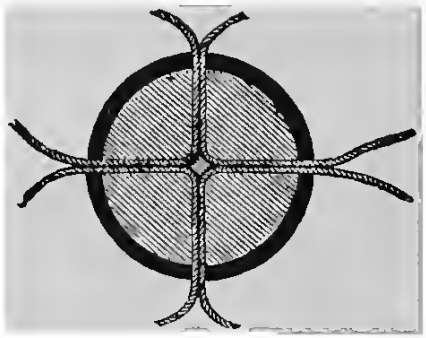


FIG. 44—Quadrisectional Ligation.

fect strangulation of the integral mass. In order to still further assure total obliteration of all nutrition a second series may be inserted in the opposite direction either above or below the first series.

(For ligations of the rectum and vagina see page 446.)

CAUTERIZATION.

DEFINITION.—Cauterization is the burning or searing of tissues with heated metals or chemical caustics. It is called **actual cautery** when executed with a hot iron and **potential cautery** when accomplished with chemical substances. (Actual cauterization of the skin and underlying tissues for the purpose of curing lameness is described under the name of "firing." See page 112.)

INDICATIONS.—The objects of cauterization are numerous in veterinary surgery. Both actual and potential may very frequently be brought into service to excellent ad-

vantage in the treatment of innumerable diseases and to meet many conditions where radical surgical intervention is inadvisable or inexpedient. For example, **a quittor, a fistula of the withers or a poll-evil,** for various reasons may be treated by the introduction of caustics into the fistulous tracts in lieu of the more radical operations, and often with exceptionally good results. In fact, in this day of modern surgery there are still many of the foremost veterinarians who prefer this method of treatment to the modern operations, because of the facility with which such treatment can be carried out as compared with the trouble of performing a surgical operation, and on account of a prevailing aptitude of many practitioners to avoid "the knife" as much as possible. The veterinarian without surgical skill and the charlatan are, however, the chief adherents to the caustic methods of treating chronic fistulous conditions, although the foremost surgeons sometimes adopt it as a convenient recourse.

The benefits of such treatment, often very limited, are sometimes excellent. The caustic substance introduced in a tract destroys the layer of infected granulations, bringing them out in the form of a burned tube—"the pipe"—some few days later after they have separated from the surrounding living tissues. Thus the fistulous tract is widened to the benefit of better drainage, and a healthy reaction is stimulated in the surrounding tissues which bound the tract. But the absolutely satisfactory results are only derived when the **necrotic center** (the necrosed cartilage, bone or ligament) already well separated from its surrounding tissues, is also brought out with the cauterized granulations. Under such circumstances the cauterization of a fistula is at once curative,—cicatrization then supervenes unmolested.

If caustics were used with a full knowledge of the elemental principle that fistulous tracts always direct their course down to some underlying cause whose removal will thereby, sooner or later be effected, their application might then be defended as rational therapeutics. The removal of this underlying cause as the initial or ultimate object of the treatment, places cauterization of fistulous tracts amongst scientific expedients, whilst its use to simply "burn out" tracts stigmatizes it as the recourse of an empiric.

As a **hæmostatic** hot iron cauterization is par excellence the best under many circumstances. In **amputations of the tail** of any of the domestic animals, but especially of the horse, there is no better nor safer method than the hot iron. In the **ablation of exuberant granulations** on any part of the

body, but especially about the feet of horses, the copious bleeding is promptly controlled by searing. The same may be said of **keloids of the fetlocks, abnormal growths of hoof** about the coronet and warts and other growths at different parts of the body. In the execution of **extensive dissections** the pointed cautery can be utilized to excellent advantage in touching up small bleeding vessels whose caliber is too small to twist with the forceps but which, on account of their numbers, yield an annoying hæmorrhage.

In the treatment of **non-operable growths** the caustic is the only resort. Carcinomatous, actinomycotic, botryomycotic, and sarcomatous growths are sometimes controlled indefinitely, and even cured, by the judicious application of cauterant chemicals. It is quite customary now-a-days to treat the "lumpy jaw" in this manner, sometimes after a part of the tumor has been resected, but often by simply introducing the caustic into the existing fistulæ. The vascular field in which these tumors are often located, the inaccessible position they occasionally occupy or the indispensable organs they sometimes implicate, may preclude surgical ablation and thus justify the use of caustics.

Caustics may also be used to advantage in the treatment of **indolent superficial ulcers.** By burning out the layer of inactive, unhealthy cells, a new vigorous reaction may be stimulated underneath, with the effect that normal cicatrization will often supervene. **Ulceration of the cornea** in dogs may often be controlled by touching up the ulcer with nitrate of silver, and **refractory sores about the legs** of all the domestic animals very often yield only to cauterization.

THE CHEMICAL CAUSTICS.—There are many caustics available for these purposes and all of them have the same general effect. They vary only in the degree of the cauterization produced and the time required to completely destroy the tissue with which they come into contact. For example, the strong mineral acids have instantaneous cauterant action while the salts act more slowly. Among the most appropriate chemical caustics for veterinary use are: **Arsenic, cupric sulphate, mercuric chloride, mercuric oxide, mercuric iodide, zinc chloride, silver nitrate, formalin, solution antimony chloride, hydrochloric acid.**

1. **Arsenic and cocoa butter,** one part of the former to four parts of the latter, is probably the most suitable caustic to apply upon the surface of malignant growths, although many other combinations containing arsenic have been recommended. Amongst these are **Plunket's caustic** for the

cure of cancer, consisting of ranunculus acris, eight parts; ranunculus flammula, eight parts; and arsenicum trioxidum, one part; **Luke's ointment** consisting of two grains of arsenic to one ounce of spermaceti ointment; and the **French arsenical paste** consisting of red sulphide of mercury, seventy parts, dragon's blood, twenty-two parts, and arsenic trioxide, eight parts.

These cauterant pastes are smeared over the growth and sometimes bound to it with bandages. After several days the dead cauterized surface separates from the underlying living parts and comes off en masse in the form of a blackened, scab-like body. A second, third or fourth application may be necessary to thus remove, piece by piece, the entire growth.

Cupric sulphate is an excellent caustic for fistulous tracts. In its desiccated form it is wrapped into small tampons with tissue paper and packed, tampon after tampon, into the tract until completely filled. The patient will manifest pain after application of copper sulphate, but the pain is not lasting. The cauterization and final separation of the cauterized tissues requires from five to eight days. When this is removed the tract is submitted to ordinary antiseptic treatment until cicatrization is complete. In quittor, fistula of the withers or poll evil if the necrotic center is still retained in the depths of the tract a second or a third application may be found necessary.

Mercuric chloride.—This chemical may be used dry or in solution. Dry, it is used in the form of triturates or in tampons like cupric sulphate. It is, however, much more powerful than the latter and should be used with much greater caution, especially when the tracts approach synovial membranes. In solution for the purpose of wiping out fistulous tracts, especially of quittor, Hughes recommends the following mixture which has gained quite a local reputation in the cure of that foot disease: Mercuric chloride one-half ounce, hydrochloric acid, C. P. one ounce, and alcohol seven ounces. This strong solution may be freely injected into tracts if the precaution is taken not to allow the overflow to cauterize the surrounding skin. After a few injections at intervals of two or three days the walls of the tract and cavity slough out and leave a healthy surface ready to heal, providing there is no remaining slough to perpetuate the suppurating process.

Mercuric oxide, is a potent caustic, and although it possesses no special virtue as such, it is mentioned here because

of its past popularity in the castration of horses with the wooden clamps. **The caustic clamps** of the old "gelders," prepared by smearing them with a paste made of flour, water and red precipitate, may still be retained when the clamp method of castration is insisted upon, as by this paste the clamps are not only made antiseptic but crushed portions of the spermatic cords slough off much earlier than if the caustic is omitted.

Zinc chloride is an effectual caustic, but it is seldom used alone. It is one of the constituents of most all of the popular caustic pastes that are so often reputed as possessing wonderful curative properties in fistulous conditions. Mixed with equal parts of melted Burgundy pitch to which a little linseed oil is added to soften it, it forms a slow but certain caustic for general use in fistulous tracts. In this form it can be rolled into sticks which can be pushed into deep and tortuous recesses, owing to their properties of being both firm and pliable.

Mercuric iodide, dusted upon granulation surfaces is an excellent caustic wherever indicated. In fistulous tracts it is highly recommended by C. A. Cary, mixed with lard and smeared over gauze which is then packed in the tracts. Its behavior simulates that of all other caustic used in this manner.

Formalin, is a powerful liquid caustic. Injected into fistulæ it immediately mummifies everything with which it comes into contact, but it produces an excruciating and lasting pain that renders its use rather hazardous. In weak solutions, even as low as two per cent, its repeated use will bring about this characteristic mummifying effect that is sometimes desirable in destroying infected granulation.

Argentum nitras is one of the oldest as well as one of the best caustics for general use. It is chiefly used for penciling ulcers and ulcerated surfaces, but may like any of the other ordinary caustics be used for the cauterization of fistulous tracts, either in the form of tampons or in pencils.

Solution of Antimony Chloride.—Among the various liquid substances possessing an active cauterant action solution of antimony chloride is much to be preferred on account of its safety. Applied to diseased surfaces or swabbed into tracts carpeted with granulations, it produces but little pain while at the same time effecting a thorough cauterization of the tissues with which it is brought into contact. It is less apt to destroy tissues beyond point of application, than is the case with the mineral acids.

Hydrochloric Acid.—Among the caustic mineral acids hydrochloric is the most appropriate. It is often applied to nail wounds of the foot by farriers, and generally with very good results. If brought into every part of the wound it effects an instantaneous disinfection and at the same time clothes the breach with an impervious scar against subsequent infection.

LANCING.

DEFINITION.—The word "lancing" in surgery may be defined as the more or less sudden thrust of a knife into a cavity with the object of evacuating its contents. It must be distinguished from "incision," which is a more deliberate cutting process, and from "paracentesis," which is performed with a rounded instrument.

INDICATIONS.—Lancing is indicated in the evacuation of abscesses, hygromata, cysts, sanguineous sacs, and serous sacs which occupy superficial positions, but only in regions where there is no danger of accidentally wounding important structures, such as large vessels, ducts, nerve trunks, and synovial membranes. In fact and in short, the lance should be used only to perforate the skin. Deep cavities, especially when the physiognomy of the region is changed by swelling and the anatomical relations are probably altered and easily misjudged, should not be submitted to this "reckless" surgical process. Senn admonished his students to "beware of the lance," and recommended that its use be discontinued except for strictly superficial lesions whose nature has been positively established, and even here the more calculating methods of evacuation were advised.

In dealing with abscesses that have developed to the stage of "pointing" and in all subcutaneous fluid accumulations of animals, lancing may, however, be defended as a safe and suitable process of evacuation. It provokes less opposition from the patient than the making of a painstaking incision, since the pain is limited to a single pang that is scarcely felt.

RESTRAINT.—The necessity of providing pre-operative restraint is herewith emphasized on account of the especial danger of sustaining personal injury, if not also to render the aim and thrust of the lance more accurate. The thrust of the lance very frequently provokes an unexpected, sudden blow from an apparently tractable patient. In lancing about the jaws, neck, shoulders, the twitch applied to the nose is sufficient. On the fore legs, in addition to the twitch the affected leg should be lifted by an assistant. It is dan-

gerous to lift the opposite leg in lancing about the knees, fetlock and feet, on account of the tendency of the patient to rear suddenly while the surgeon is in a low, crouching attitude, whence escape is impossible. About the hind extremities, tail, thighs, buttocks, and groins, flanks, hips and abdomen, one hind leg must be elevated above the floor with the side line to assure against injury.

INSTRUMENTS.—The common scalpel will answer for a lancet, although the regulation instrument is preferable (Fig. 45) as the cutting edge extends to both sides.

TECHNIQUE.—Lancing is executed by one, forcible, forward thrust of the lancet. If it is desired to make an opening larger than the width of the blade a well gauged sweep

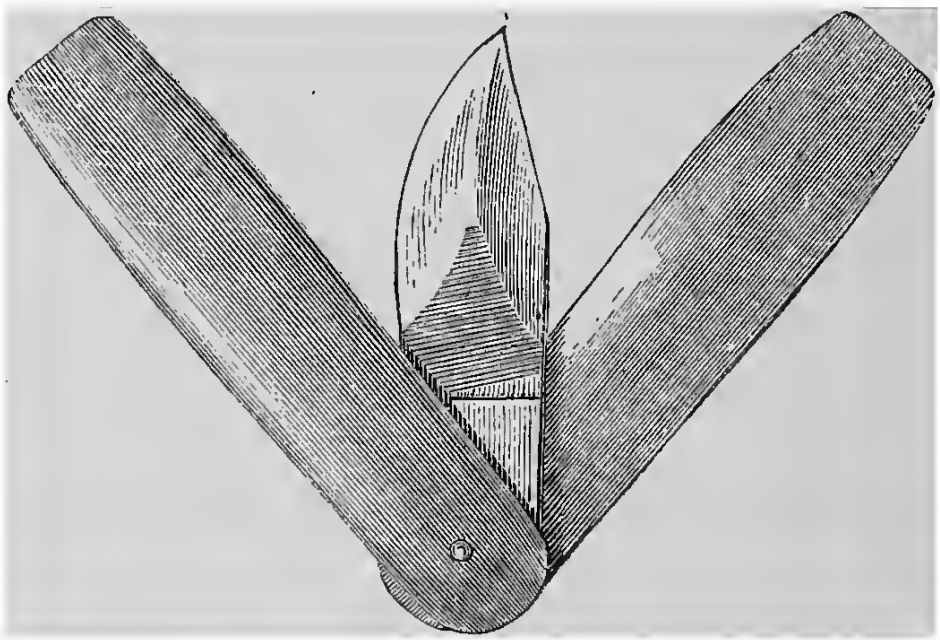


FIG. 45—The Lancet Most Appropriate for the Veterinary Practitioner.

in the desired direction is made almost simultaneously with the forward thrust. The proposed depth of the perforation is first estimated and then accurately attained by guarding the blade with the thumb and index finger.

SETONING.

DEFINITION.—Setoning is the application of tape or other fabrics through or between tissues for the purpose of provoking and prolonging a state of irritation, or for the purpose of maintaining a drainage orifice.

INDICATIONS.—Setons are specially indicated in the treatment of obstinate, **deep-seated lesions of muscles and articulations,** particularly of the **shoulder** and of the **hip.**

When lameness from such lesions persists despite rest and superficial applications, setons are indicated and often accomplish the desired effect promptly. In **muscular atrophy** supervening injuries to motor nerves, setons applied directly over the wasted muscles will stimulate the regenerative process, but only after the nerve itself has already regenerated. In atrophy too much must not be expected of setons before the function of the injured nerve has been restored, because muscle regeneration is incapable of proceeding in the absence of the nerve impulse to stimulate its contractions. But when the innervation has been re-established and the muscle elements become stimulated to renewed activity, the application of setons will materially promote the regenerative process, and thus soon restore the wasted region to its former condition. In the treatment of **"shoulder sweeny,"**—a typical example of atrophy from suspended innervation,—seton after seton may be inserted without effect and the case may finally be abandoned as incurable, when suddenly at a given time it is noticed that the region is filling up. At this moment, which in fact, corresponds to the time that the function has been restored, setons will hasten the growth of the muscle fibers. If the nerve is injured beyond repair the atrophy will be permanent in spite of all treatment. In the **atrophy of azoturia** an analogous situation is encountered. The muscles waste rapidly and remain atrophied in spite of all treatment as long as the nerves remain inactive, but finally, after months, they begin to regenerate and are soon restored to their normal size. It is during this period of spontaneous regeneration that the seton is an effectual auxiliary. In other words, setons are incapable of regenerating paralyzed nerves, but will promote the restoration of the wasted muscles when the nerve impulses are resumed. That is to say they promote muscle regeneration in atrophy.

In the treatment of **navicular disease** the **frog seton** was once a standard treatment, but owing to the poor results generally obtained, its use has been discarded by the modern veterinarian. The results once attributed to this method of treatment were probably always over-estimated, and it is quite evident that errors in diagnosis have been the means of unwittingly placing credit where it was not due.

Setons also very frequently serve a useful purpose in the treatment of **fistulæ** (fistulæ of the withers, poll-evil, quittor, etc.) where the drainage tract is certain to cicatrize before the necrotic tissue has separated and sloughed out. It often happens that fistulous diseases are submitted to operation

before the dead and the healthy parts have separated from each other, or before the dead can be recognized from the living, in which event the surgical wound will heal over at the surface before the hot-bed of the disease (the necrotic center) itself is ready for cicatrization, with the effect that another abscess will point elsewhere and thus perpetuate the identical condition for which the operation was performed. In short the well nourished tissues (skin, muscle, etc.) heal faster than the poorly nourished ones (bone, cartilage, ligaments, etc.) and therefore require something in the form of a seton to delay their healing until cicatrization is complete in the latter. In this connection setons perform about the same function as the caustic, which likewise retards healing of the well nourished, soft tissues while the underlying causative lesion goes through its slow process of cicatrization.

RESTRAINT.—Subcutaneous setons for the most part can be inserted with the patient in the standing position with the aid of the twitch and the side-line. In deep fistulæ of the withers or similar conditions, especially in restive animals, the recumbent position may be found necessary in order to more effectually trace out the depths of the tracts with the long needle, but besides these circumstances the upright posture of the animal rather favors their exact adjustment. Furthermore, the subject that is too restive to endure the pain of insertion is no fit subject for the operation, because of the difficulty of properly caring for the setons and the field thereafter. A docile animal is sometimes transformed into an intractable fiend by the pain inflicted in necessary turning of the setons day after day, hence the advisability of avoiding such treatment in other than perfectly tractable subjects.

EQUIPMENT.—1. Seton needle. (Fig. 46.)
2. Sterilized tape.
3. Scalpel or roweling scissors.
4. Clippers and razor.
5. Soap, water and antiseptic solution.

The seton needle for the application of subcutaneous setons to meet every ordinary requirement should be eighteen inches long, and bendable so that it can be shaped to follow the curves of the body. Its point should be sharp and slightly curved outward in order to facilitate its passage through the skin at any desired point by slightly pressing the threaded end toward the body. Blunt-pointed needles are sometimes preferable to sharp ones in tracing fistulous tracts to a dependent part, owing to the likelihood of the latter leav-

ing the tracts and penetrating the tissues, but when these are used an incision must be made with the scalpel at the point of exit, determined by palpating the blunt point of the needle within.

TECHNIQUE.—First Step.—Preparing the Field.—The hair must always be closely clipped over a liberal surface in the interest of general cleanliness of the operation, as well as to rid the region of long hairs which are certain to be drawn into the seton tract during the after-treatment as well as at the time of insertion. In addition to the clipping the whole area is washed with soap and water and then rinsed clean with mercuric chloride 1-500. At the points of entrance and the points of exit the hair is shaved closely with the razor.

Second Step.—Incising the Skin at the Points of Entrance.—The skin in each of the shaved spots representing

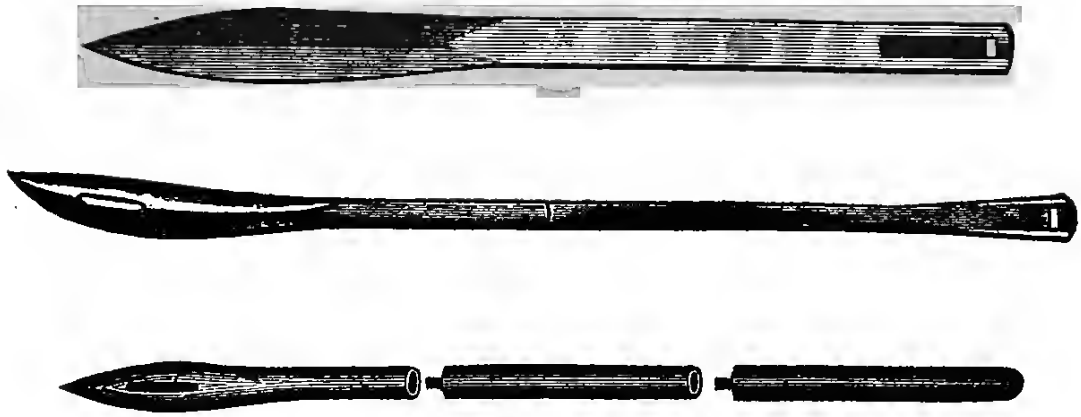


FIG. 46—Seton Needles.

the entrance points, is picked up with the thumb and finger of the left hand and incised about one-half inch with one plunge of the scalpel.

Third Step.—Inserting the Setons.—The needle, previously armed with tape of necessary length, is passed into the incision and then forced downward through the subcutaneous areolar tissue with a firm but gentle pressure. The curved end of the needle, being pointed outward, must be guarded against a premature puncture through the skin by pulling the uppermost end from the body as it passes downward and until the sharp point is felt beneath the skin at the shaved point of exit; then, with a sudden thrust, the needle is forced through and the tape is drawn into the tract.

Fourth Step.—Tying the Tape.—There is the choice of two methods of preventing setons from being pulled out; one being that of tying the two ends together into a loose loop, and the other is that of tying a light, rounded stick of

wood at each protruding end far enough from the points of entrance and exit to admit of considerable movement of the tape. The former is preferable because during the after-treatment it admits of a thorough washing of the tape with antiseptics before it is drawn into the wound, although it leaves the tape in danger of being torn out by the teeth or by accidentally catching upon protruding objects,—accidents which should not be permitted to occur. The latter method, although leaving the tape protected against accidental tearing out, is objectionable because the same portion of the tape is always in the tract and hence cannot be effectually cleansed

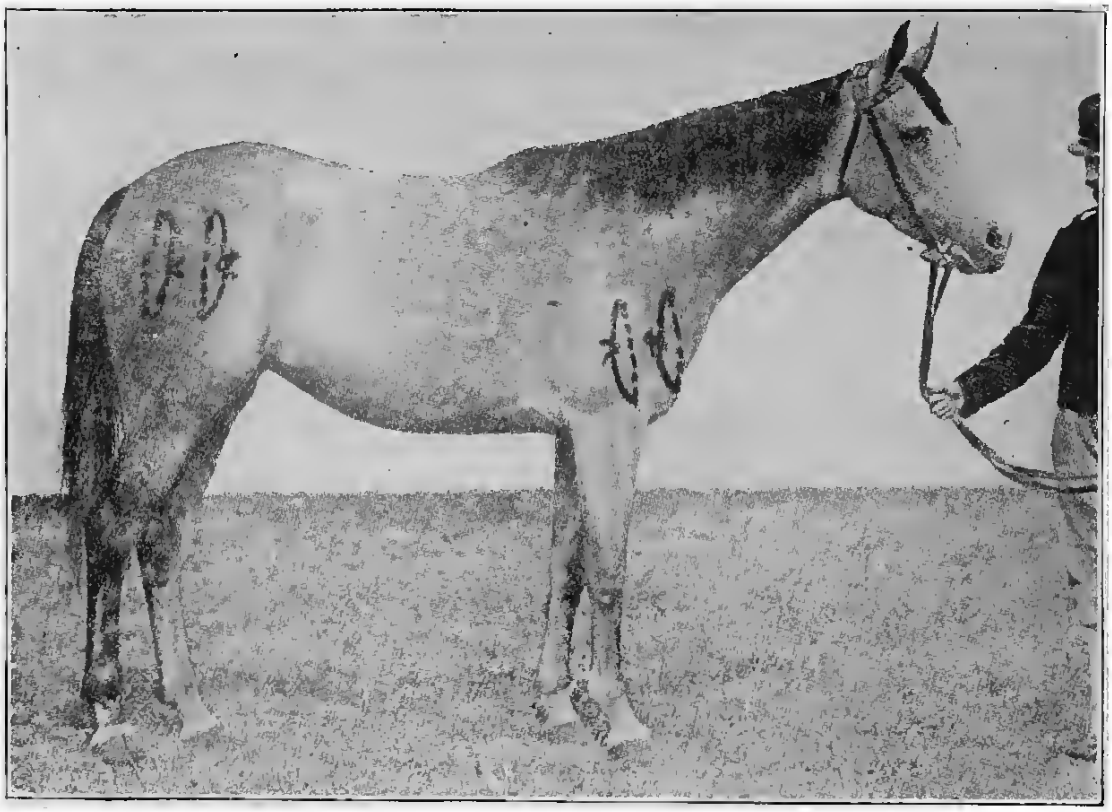


FIG. 47—Setons of the Shoulder and Hip.

during the entire sojourn in the tissues; and, furthermore, its surface being constantly soaked with sleek, slimy pus, its movements do not cause the same amount of irritation as a newly-washed tape.

AFTER-CARE.—Subcutaneous setons inserted against a muscular atrophy or a deep articular lesion are usually retained for twelve to fourteen days, after which they will be found to have provoked a putridity that necessitates their removal. Beginning with the end of the first twenty-four hours the whole region, including the tape, must be submitted to a good antiseptic washing. The buried part of the tape, after the exposed part has been well cleansed, is drawn

out and washed, and then a little iodoform is dusted over each incision. This washing, cleansing and turning of the tape is repeated daily until its removal. At no time must a seton be allowed to remain in the tissues without being moved for more than twenty-four hours after its insertion, because of the danger of serious infections. Tetanus, malignant œdema and septicæmia, frequent enough sequalæ, seldom follow the operation unless the tape is permitted to lie unmoved in the fructuous microbian incubator that the subcutaneous seton creates. After several days there is less danger, because the tissues constituting the boundary of the tract have then protected themselves against the invasion of microörganisms into the surrounding tissues, by the formation of an effectual "pyogenic membrane."

At the end of twelve to fourteen days the tape is removed, the tract irrigated with antiseptic water, and the points of exit and entrance are treated with strong astringents to prevent blemishing. Abscesses which may have formed along the tract, and which do not discharge their pus into it, are lanced and irrigated. At the end of twenty days the region is normal and ready for a second operation if necessary.

When setons are inserted for drainage or to prevent the premature healing of chronic fistulæ they may be retained indefinitely, but it is advisable to replace the tape with a new one occasionally to prevent undue putridity of the fabric from its constant contamination with the secretions.

SEQUELÆ.—Setons create a favorable field for the propagation of **anærobic bacteria**; the sheltered environment they supply is favorable to bacterial growth. This fact alone is sufficient warning as to the possible dangers of this simple operation, and at once suggests to the operator the importance of inserting only strictly sterilized setons, and only in a field that has been disinfected in no perfunctory manner. The insertion of septic setons and then allowing them to remain unmoved for several days, must be avoided. Despite the fact that a seton tract always becomes infected, which in fact is the desideratum, the infection should be allowed to occur only after the tissues have protected themselves against a spreading of the infective inflammation into the surroundings. The mere presence of the sterilized seton in the tissues stimulates the formation of a barrier against microbian invasion, and the moving of it will prevent the incubation of dangerous anærobic bacteria that may have accidentally been drawn into the tract.

Septicæmia, pyæmia, malignant œdema, and **tetanus** are so many formidable complications liable to supervene the insertion of setons, and whenever there is any suspicion of the development of such serious diseases the tract must be laid bare and submitted to an energetic antiseptic treatment.

Frog Setons.

The term "frog seton" is applied to a tape inserted along the course of the perforans tendon, from the pit of the heel to the anterior end of the frog. Its course is between the plantar cushion and the tendon along the entire long axis of the former. Its object is that of combating lameness due to navicular arthritis. In past decades this mode of treatment was commonly practiced by veterinarians, but during recent years it has fallen into disuse through the introduction of better modes of treatment and the general unsatisfactory results usually obtained. The theory upon which the frog seton was defended is that of counter-irritation, which was thus accomplished as near to the seat of the disease as possible, instead of depending upon the application of irritants to the coronet which are too remote to exert a beneficial effect.

The frog seton is inserted in the standing position with a needle about six inches long, which is passed by one sudden thrust from above downward. To facilitate its safe passage through the tissues at one single pang the needle should be exceptionally sharp and penetrant. The operator holds the foot with the one hand, and as the assistant is directed to give the twitch an extra turn to divert the horse's attention, the needle, already carefully adjusted in the pit of the heel directly against the tendon, is sent through the foot with one hard thrust. To facilitate its exit through the sole at the point of the frog the hoof should previously be pared thin, otherwise the hard hoof would block the course of the needle at its destination. The skin at the point of entrance and the hoof at the exit are the only obstacles against the free passage of the needle. Between these two points the needle traces its way with but little resistance along the perforans tendon and its plantar aponeurosis.

It is customary to remove such setons in about two weeks, during which time they are washed and turned daily and protected from stable filth.

SUTURING.

DEFINITION.—The word suturing in surgery refers to the temporary repair of lost continuity in tissues by means of the needle and thread. They are referred to as "temporary" in their action because they only serve to hold separated parts in contact while the tissues themselves construct the permanent uniting object, the cicatrix. Thus sutures perform the function of the scar while the latter is forming into a substantial structure.

INDICATIONS.—Except in cordiform structures, such as nerves and tendons, and in tubular organs, such as bowels and blood vessels, sutures are not absolutely indispensable, as the most serious breach of continuity will be restored without them. Any ordinary gap in tissues will be repaired without their transient assistance by filling up with granulations which soon transform into a firm connective tissue, but when the edges or walls of a breach are brought into closer apposition with them the amount of tissue required to fill the traumatic cavity is reduced to the minimum, to the end that the process will be shortened and the amount of constructive tissue (granulations) lessened. Hence the chief object of sutures in veterinary surgery is to limit the size of the scars, that supervene all wounds. A scar may be small, almost imperceptible, or it may be large and unsightly, according to the amount of formative tissue that was required to fill the gap. To make the gap small, which in turn diminishes the volume of the granulations and finally the size of the scar, restores the surface to a condition as nearly approaching the normal as possible.

When soft tissues are divided their natural elasticity, their tension, and also the swelling that usually follows injuries, all acting together or separately, always produce a gap the width of which will vary according as these influences chance to operate. Thus an incision of the abdomen, if compared with one of similar constitution in the forehead, will be found to be more widely separated, although both of them will gap to a certain degree, as will all wounds which destroy continuity in soft tissues. It is to bring such gaping parts into apposition, or at least to approximate them as near as possible, that sutures are used in veterinary surgery. They are indicated to prevent avoidable blemishes and also to promote a more rapid repair in all of the **innumerable surface wounds, surgical and accidental.** Mucous membranes,

serous membranes, laminæ of fascia, aponeuroses, muscles and skin may all be submitted to this surgical process, but it is the latter that is most frequently approximated by sutures, because it is this integument that determines the physiognomy of the wounded region after the reparative process is complete. To heal the skin by primary union prevents the indelible hairless blemish that otherwise always succeeds wounds on the surface of the body.

Sometimes sutures are indispensable. A severed nerve trunk will much sooner restore the lost innervation if the two cut ends are brought into perfect apposition with sutures; and the tendons will repair much more rapidly and are never in danger of permanently losing their continuity if thus approximated. In surgery of the intestines and of blood vessels sutures cannot be omitted; the life of the patient depends upon them. Whenever an intestine or any other tubular organ (ducts, etc.) is accidentally or surgically incised, the lost continuity must be at once restored artificially. Here, the breach cannot be left to nature's regenerative forces, as in the case of fixed structures, such as skin muscles, etc.

CONTRA-INDICATIONS.—Sutures are very often contra-indicated in wounds on the surface of the body. When a wound has been or is certain to become infected with virulent microorganisms, sealing it over by suturing the skin or other integuments is only "shutting up the wolf in the sheep pen." They may thus be applied to the advantage instead of the hindrance of microbian growth. By preventing secretions, harmless in themselves, from flowing out, food is provided for bacteria which might have died from want of sufficient nourishment or by having fallen prey to the leucocytes. In short, infected wounds or wounds which on account of their nature will discharge more or less profusely, must never be sutured; it is always preferable to leave them wide open. Sometimes, in order to diminish the size of the scar the uppermost part may be closed and the dependent part left open as a drainage orifice.

It is also not advisable to attempt suturing where swelling or the anatomical constitution of the part, will bring great tension upon the sutures. The taut suture, by pressing upon the tissues, cuts them and soon defeats the purpose for which it was applied; by strangulating the circulation it prevents instead of promotes healing; and by causing pain it adds discomfort to the patient.

Conclusions.—(1) Sutures are indicated in all aseptic incised wounds where the secretions will be limited, imper-

ceptible. (2) Where the importance of restoring the lost continuity exceeds the danger of sepsis. (3) Where, as in the case of intestines, nerves, etc., they are indispensable. (4) Where an adequate drainage can be provided beneath them.

(1) They are contra-indicated in all septic wound where adequate drainage is obstructed by them. (2) In all anfractuous traumatisms that will discharge profusely. (3) Where great tension is required to bring the edges together.

EQUIPMENT.—Needles and suturing material. Needles should be of various sizes and shapes to meet every requirement. They are straight, (Fig. 50) full curved (Fig. 48) and half curved (Fig. 49) and the shaft may be flat, (Fig. 50) or round (Fig. 51). The half curved needle is the principal

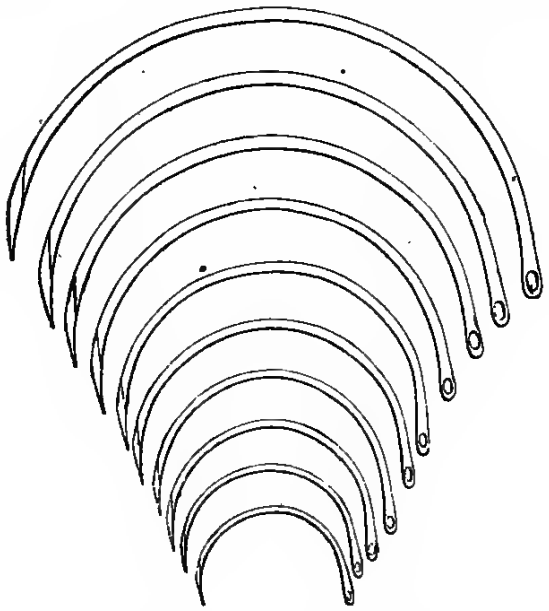


FIG. 48—Full Curved Needles.

needle of the veterinary surgeon; it fills almost every ordinary demand. In deep, inaccessible places the full curved one, however, often facilitates the insertion of stitches which the length of the straight or half curved one would prevent. The round needle is made use of in suturing intestines, mucous membrane and serous membrane, or in any other work demanding the smallest possible perforations.

Suture Materials.—The suture materials which will fill every demand in veterinary surgery are: Braided silk, twisted silk, cat-gut, silk-worm gut, and linen thread.

Braided silk, on account of its great strength, is a very commendable suture material. Even in the smaller sizes its strength is ample for almost any demand. With no objectionable feature, except that of price, braided silk deserves

first place amongst veterinary suture materials. Its tensile strength, its flexibility, its softness and its durability amply fill each essential characteristic. However, when small threads are needed it may be found too large, even in its smallest sizes, and its high cost is no small item when promiscuously used in a large practice.

Twisted silk, has all the properties of the braided variety except that of strength, and may be adopted as its universal substitute where the use of a small thread is desirable. It is slightly absorbable and may, as a consequence of this property, be adopted for buried sutures when in emergencies the more appropriate absorbable thread (cat-gut) is not available. Its absorption is, however, too slow for general use as buried sutures.

Catgut, in veterinary operations, is used only when an

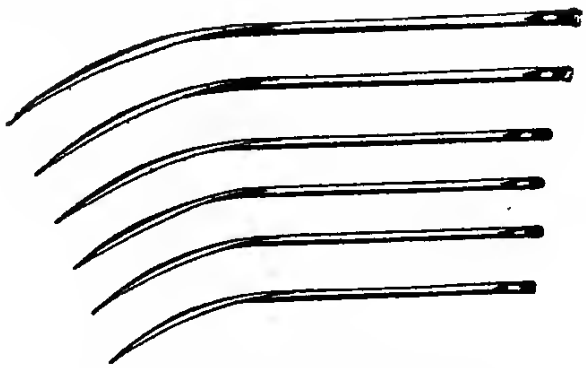


FIG. 49—Half Curved Needles.

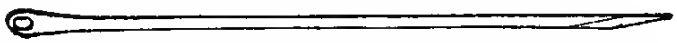


FIG. 50—Straight Needle.

absorbable material is required. It is the standard absorbable material for all kinds of buried sutures. By treating it with chromic acid by special processes its absorbable properties are lessened to definite degrees. It will absorb, according as it has been chromatized, in one week, two weeks, three weeks, etc., which property is indispensable where there is danger that the rapid absorption of the non-chromatized variety might precede the safe union of the sutured edges.

Linen thread, although possessing no property superior to silks, is easily the most suitable suture material on account of its cheapness. Its tensile strength, durability and facility of sterilization, together with its inexpensiveness, at once suggests its universal fitness for nearly every surgical operation performed upon animals. The yellow variety of Barbour's Irish Linen Saddler's Thread has especial value from every standpoint. Although only one size is obtainable, the

single thread will be found suitable for general use, and when the use of a larger thread is deemed advisable it is only necessary to double the strand according to the tensile strength required.

Sterilization of Suture Materials.—The importance of sterilizing all sutures perfectly is sufficient to warrant frequent reiteration. The perfunctory method in vogue, consisting of transient immersion of previously exposed threads in the ordinary antiseptic solutions, is palpably wrong, positively inadequate and grossly illegal. It should be an absolute law with every veterinarian to insert into the bodies of animals only threads that are known to be perfectly aseptic. Contamination during the operation by being handled or by resting upon the tray, table or other object while waiting to be used, is much less frequent than might ordinarily be supposed. The suture that is septic before being handled cannot hurriedly be sterilized, while the one that is aseptic before being handled seldom becomes septic during the opera-



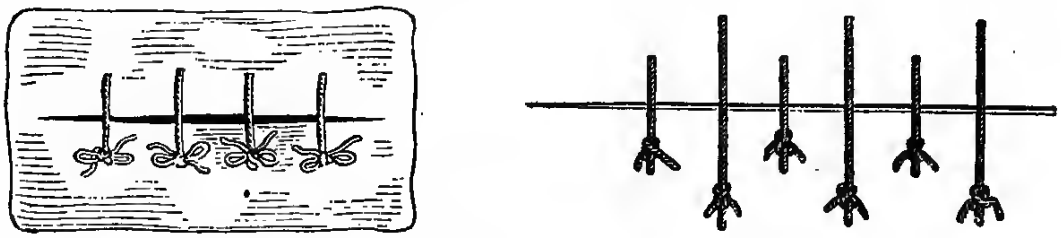
FIG. 51—Round Needles.

tion if ordinary sensible precautions are taken to prevent.

The supply of abundant suture material for field operations may be economically maintained by keeping the silk and linen in salt mouth bottles filled with ether or alcohol, well corked, ever ready for use in any ordinary quantity. Cat-gut should be purchased only in hermetically sealed bottles furnished by manufacturers who vouch for their asepsis. Raw cat-gut will not yield to any practical yet safe method of sterilization that the veterinary practitioner could carry out in his inadequate laboratory. For hospital operations silk and linen threads are best, sterilized in the sterilizer—an equipment that should no longer be absent from the modern operating room. It is preferable to thread as many needles as there will be stitches required, and place them in the steam compartment of the sterilizer in a small basin. Compact balls of thread may be placed in the water compartment, but loose threads become entangled from the turbulence of the boiling water. By using a separate needle basin, the thread, the needles and the basin are brought out perfectly

sterilized when needed; then, if each needle is picked up with a thumb forcep and inserted with the needle-holder, stitch suppuration will become an exception instead of a rule.

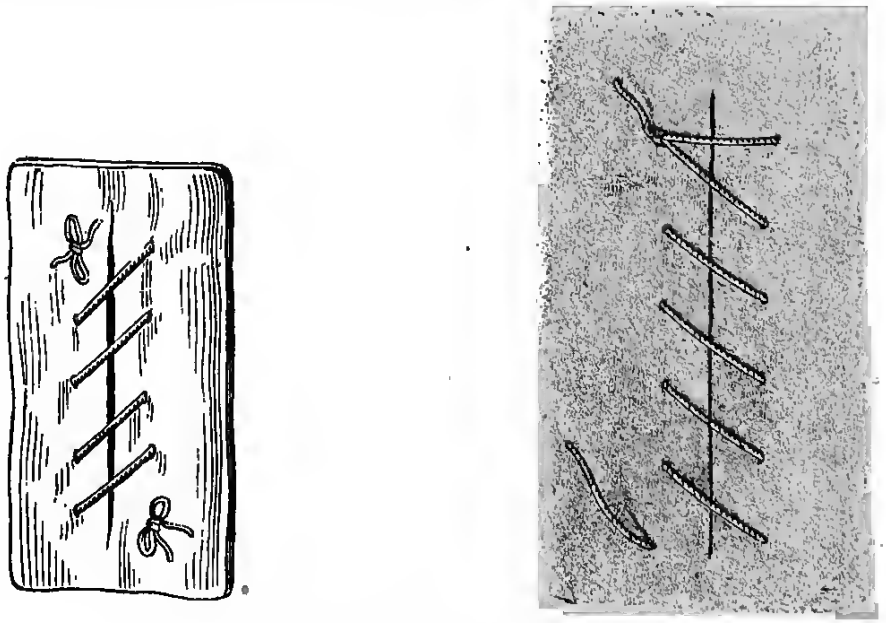
CLASSIFICATION.—We will describe only those sutures especially useful in veterinary operations which are: (1) Interrupted sutures, (2) uninterrupted sutures or con-



FIGS. 52 AND 53—Interrupted Sutures.

tinuous sutures; (3) mattress sutures; (4) button sutures; (5) interrupted crucial sutures; (6) removable buried sutures; and (7) Czerny-Lembert sutures.

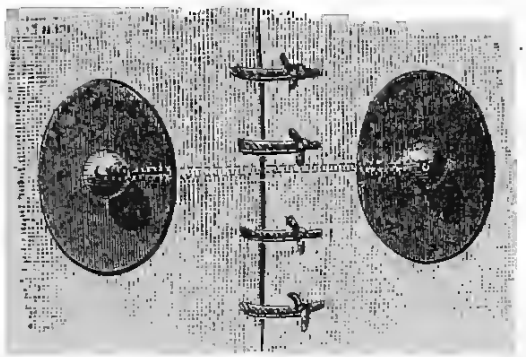
Interrupted sutures consist of a series of single loops, each tied by individual knots. (Figs. 52-53.) These are far the most common sutures used in veterinary surgery, being in fact almost the universal sutures for ordinary surface



FIGS. 54 AND 55—Continuous Sutures.

wounds. They possess the advantage of preserving contiguity, even when component parts of the integral work give way here and there; of effecting a more perfect and more uniform independent apposition at all parts of the breach; and of admitting of a variable tension according as the character of the wound necessitates.

This simple suture is inserted by picking up first one edge and then the other with the dissecting forceps as the needle held in the other hand is pushed through the integument from without inward on the first side and from within outward on the other. The stitches may all be placed one after another along the whole wound before tying any one of them, or else they may be tied as fast as they are placed. The latter course is preferable in all large or irregular wounds, in the interest



56—Combined Button and Interrupted Sutures.

of exactness. When primary union is of capital importance the needle should be made to penetrate from within outward only through both edges so as to forestall the carrying of infection from the outer layers of the skin into the subcutem. This course necessitates the re-threading of the needle for each penetration, but the additional trouble is worth while under certain circumstances, especially when sewing an unshaved skin where hairs are liable to be inverted into the needle tract by the thread.

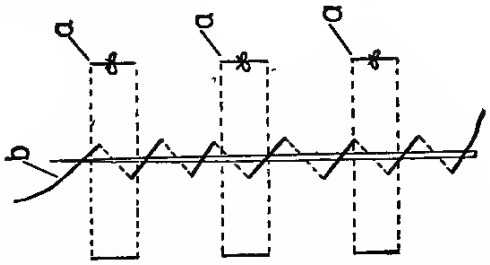


FIG. 57—Combined Mattress and Continuous Sutures.
a, *a*, *a*—Mattress Sutures. *b*—Contiuuous Suture.

The **continuous suture** is made by a simple sewing process after the thread has been knotted at the end to prevent slipping through the first perforation. (Figs. 54-55.) This suture is particularly desirable where the rapid closure of a wound is essential, or where the only object is the temporary retention of dressings in the traumatic cavity.

Mattress Sutures and Button Sutures.—Each of these is but a slight modification of the other. Both of them are

simple interrupted stitches that do not cross over the wound externally, and the latter differs from the former only in that a button is interposed at each point of entrance. (Figs. 56-57.) These sutures are placed some distance from the borders of the wound, and are supplemented by interrupted or continuous sutures which effect the direct apposition of the edges. (Fig. 57.)

Interrupted Crucial Sutures.—In this stitch the thread

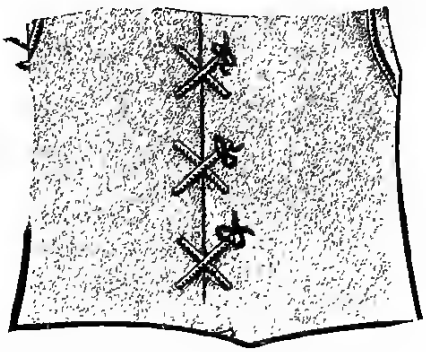


FIG. 58—Interrupted Crucial Sutures.

crosses externally, (Fig. 58) its object being the prevention of pressure,—stitch necrosis. No part of the incarcerated tissues is subjected to severe pressure, as in the case of the simple interrupted suture.

The stitches are inserted as follows: The needle first penetrates from without inward, crosses to the opposite, penetrates from within outward, then is brought back to the original side some small distance from the first point of entrance and passes through both edges as above. When

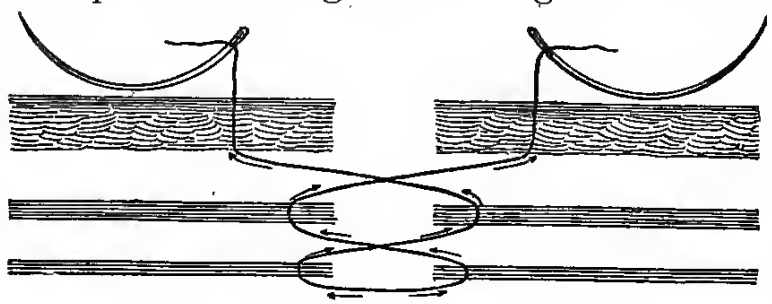


FIG. 59—Removable Buried Sutures.

the two protruding ends are tied the completed stitch forms an "X" over the surface. As many of these individual stitches as necessary to close the breach may be consecutively placed, but the greatest value of the method is found in short incisions (plantar neurotomy) where only one is required to close the gap.

Removable Buried Sutures.—The insertion of the removable buried stitches is an entirely new procedure; it has never

been described in veterinary literature. The reaction which so frequently precedes the absorption of buried sutures in veterinary operations is obviated by the removal of the deep suture without opening the wound to search them out. In the various laparotomies, where skin, aponeurosis, muscle and peritoneum must need coaptation; and in incisions on the extremities where skin, fascia and muscle are divided, these sutures are indeed valuable expedients. They are individual sutures inserted as follows: The needle passes from without inward through the outer integument, from without inward through the inner integument of the opposite side, from within outward through the inner integument of the first side and finally from within outward through the outer integument of the opposite side. The protruding ends are then

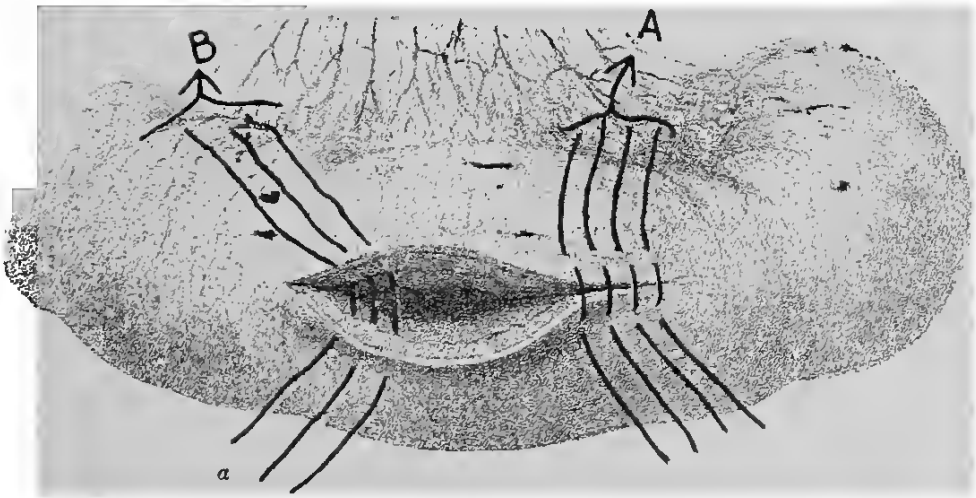


FIG. 60—Three Czerney Sutures and Four Lambert in Enterorrhaphy. *A*—Lembert's Suture. *B*—Czerney's Suture.

carefully drawn taut and tied externally. When tied they resemble the simple interrupted suture. (Fig. 59.)

Czerny-Lembert Suture.—This double suture is the most appropriate to adopt in veterinary surgery for suturing the hollow abdominal and pelvic organs,—intestines, stomach, rumen, uterus, bladder, etc., when these are accidentally or surgically divided. The combination of these two sutures constitutes the most reliable method of closing intestinal wounds, whether for circular, transverse or longitudinal enterorraphy. The two sutures are placed consecutively in the order indicated in the name. The Czerny suture, which is a series of interrupted stitches, is placed as follows: The needle is passed through the serous and into the muscular coat and then out of the cut end of the organ (bowel, stomach, etc.) between the serous and muscular coats; (Fig. 60) then it is brought over the wound to the other edge and

passed between the muscular and the serous coats to the surface. They are placed from 7 mm. to 10 mm. apart and tied after all of them have been placed. When this has been completed the work is fortified by the addition of a second series of Lembert sutures as follows: (Fig. 61) The needle is passed through the serous and muscular coats about 2 cm. from the edge of the groove now made by the Czerny, and then out again about 1 cm. from the groove. It is then brought over to the other side of the groove and entered through the serous and muscular coats 1 cm. from the groove and out again 1 cm. farther (2 cm. from groove). These individual

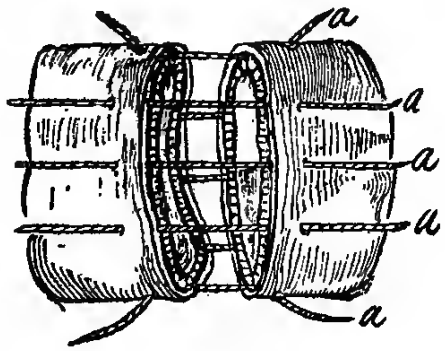


FIG. 1.

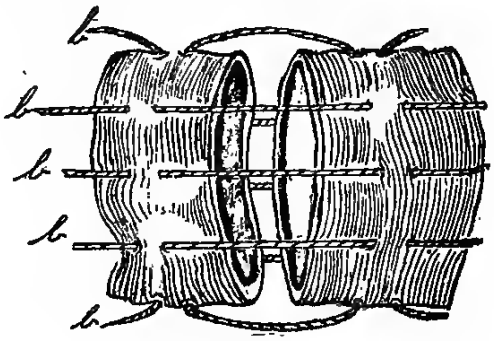


FIG. 2.

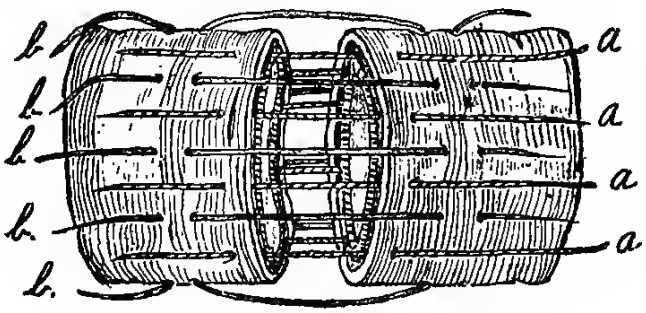


FIG. 3.

FIG. 61—Czerny-Lembert Sutures in End-to-End Anastomosis.
Fig. 1—*a*, *a*, *a*. Czerny's Sutures. Fig. 2—*b*, *b*, *b*, Lembert's Suture.
Fig. 3—*a*, *a*, *a*, Czerny's; *b*, *b*, *b*, Lembert's.

stitches are placed around or along the whole wound 10 cm. apart, and then tied. These latter sutures infold the former deeply into the lumen, and the totality of the process brings a large area of peritoneum into juxtaposition, to the end of assuring a union in the greater number of cases.

Hints on Suturing Wounds.—1. Suture materials and needles must be aseptic because they sojourn so long in the trauma to the advantage of microbian growth. They favor necrosis of the tissues about them by obstructing circulation in the vessels pressed upon by them. They prevent the outward discharge of secretion by closing the wound, and thus harbor food for microbes. If, in addition to these presents,

they act as infection carriers, putridity of the sutured trauma is inevitable.

2. Especial pains must be taken with each part of the wound to bring the edges into neat apposition. As each stitch or each part of the suture is being fixed, care must be exercised to prevent infolding the skin. The skin edges should be "heaped up" rather than infolded, because union of the horny layer of the skin will never occur. (Figs. 64-223.)

3. Whenever tension is required to bring a breach into apposition, primary union is very unlikely to occur; the stitches will soften the tissues incarcerated in the loop and will loosen in a few days. Sometimes mattress sutures or button sutures, placed some distance from the edges, may be inserted to forestall tension at the edges, and at other times lateral incisions (Cherry's operation) may be made to ad-

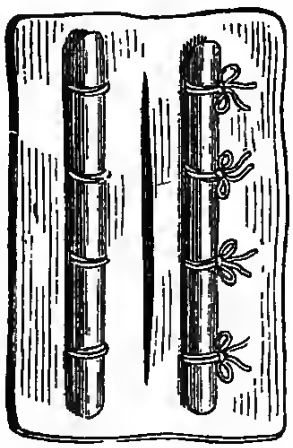


FIG. 62—Quilled Suture.

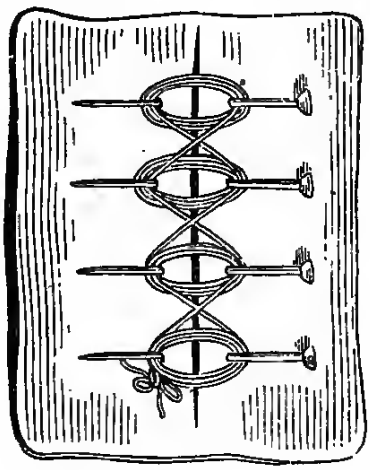


FIG. 63—Pin Suture.

vantage. It is, however, generally preferable to treat traumas as open wounds whenever for any cause great tension is required to bring the edges together.

4. The recommendation, mentioned elsewhere, to thread a number of needles with short threads just sufficient for one or two stitches, while preparing for an operation, will bear frequent repetition in view of its significance. The thread of a needle threaded with a strand long enough for a number of stitches too frequently becomes contaminated with filth from handling; from coming unavoidably in contact with dirty parts of the patient, operating table or bedding; and from being drawn so frequently through the skin or other wounded tissues. In fact, a long strand of thread used to suture any ordinary wound is sure to become unsafe before it is entirely consumed, while short strands, inserted one after another on separate needles, or even carefully threaded

on the same needle, may be placed and tied without being exposed to contamination.

5. To assure absolute asepsis in placing a stitch or two the following technique is excellent: Place a strand of thread long enough for one stitch and threaded with a needle at each end, into the sterilizer; or in lieu of a sterilizer thread a strand of previously sterilized thread with a sterilized needle at each end; then, when the aseptic wound (a neurotomy incision, e. g.) is ready to be closed, pick up one needle with the thumb forcep, place it between the jaws of the needle holder and push it through the skin from within

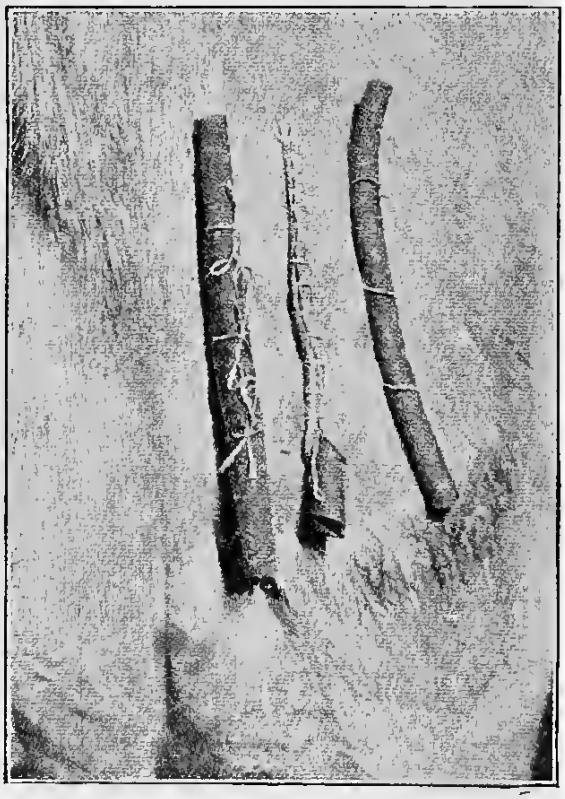


FIG. 64—Quilled and Continuous Suture and Drainage Tube.

outward and then take up the other needle in the same way and push it through the opposite edge also from within outward. In this manner the absolutely sterilized needles and absolutely sterilized thread are not manually soiled and no microbes have been drawn into the wound from the surface layers of the skin which (the reader might be reminded) is never absolutely aseptic. The only chance of infecting the stitch is while tying, but as the parts handled remain external there is no danger of infection therefrom.

6. The impossibility to control every movement of wounded animals or of any part of their bodies, works to the disadvantage of sutured wounds. The friction between the

edges of sutured wounds, even when trivial, interrupts the construction of the first delicate fibers which must cross over from one edge to the other to lay the foundation for a sub-

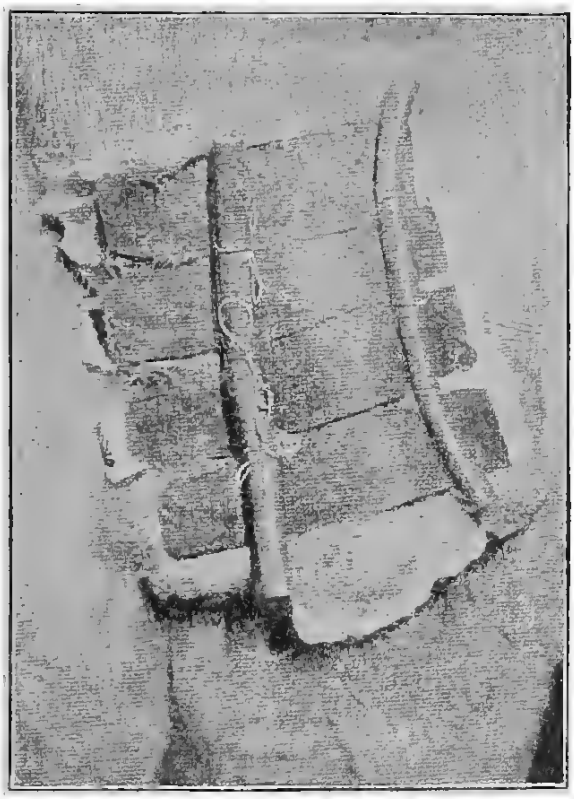


FIG. 65—Bayer's Method of Suture and Protection with Quilled Sutures.

stantial union. Hence the immobilization of the very edges of the wound is of capital importance in every case, and although it can not always be accomplished perfectly, much can be done in this direction by resorting to ingenious expedi-

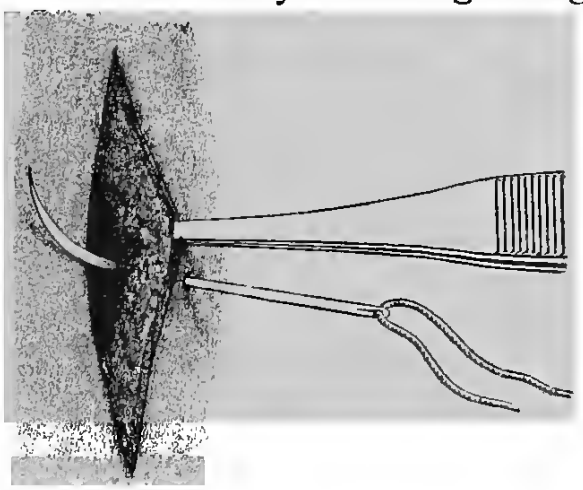


FIG. 66—Method of Holding Edge of Wound as Suture is Inserted.

ents to suit the circumstances presented in each case. Amongst there are:—(1) Tying the patient so as to prevent decumbency. (2) The use of slings. (3) Immobilizing

bandages, casts, and splints. (4) Button or mattress sutures placed some distance from the breach so as to create an immobilized area between them.

7. In fine, **motion, tension, sepsis,** and **obstruction to drainage** are the **four great banes** of suturing that the veterinarian must combat intelligently.

FIRING.

DEFINITION.—Firing is an equine surgical operation consisting of branding or stabbing the skin that surrounds lesions of bones, tendons, ligaments, or sheaths in the form of more or less symmetrical lines or points, for the purpose of curing or preventing lameness. It is a cutaneous, hot-iron cauterization, aimed at underlying disease processes. The word "firing" has a definite meaning in veterinary surgery. It refers to a special operation, in distinction to "actual cautery" which signifies the method by which this and other surgical procedures are accomplished. For example, the cauterization of the amputated tail or the ablated keloid is actual cautery, but it is not firing. The word "firing" is reserved by the modern hippologist as the universal appelation for the branding or puncturing of the skin in the treatment of lameness.

The surfaces of the loins, the buttocks, the throat, the withers, have in bygone days been submitted to firing for deep seated lesions within them, but these treatments are little used by the modern veterinarian. They have been discarded as worse than useless. Deep firing accomplished by first exposing diseased tissues through incisions (subcutaneous cauterization) has also passed into a well-deserved obscurity.

HISTORY.—Firing is too old to determine its origin. It has been described in all books touching upon the diseases of the horse, from the earliest days of veterinary history until the present time. In all epochs it has been favorably mentioned as a markedly effectual method of treatment of various diseases and injuries affecting the limbs of horses, but has been seldom ever mentioned as a treatment for the other domestic species. It has always been, and undoubtedly always will be a strictly equine operation, because of the dearth of suitable indications in the other species. In the early days of modern veterinary medicine it was somewhat more popular than today, having been supplanted by other more rational treatments in many instances. It has always

been more or less objectionable, at all times, because of the indelible blemish it always produces, especially in the horse that will sooner or later be offered for sale. On the American farms it is seldom ever tolerated, because the horse blemished with lines or points is seriously objected to by purchasers even though no traces of the original lesion remain. A spavined horse, still lame and already fired, is regarded as useless,

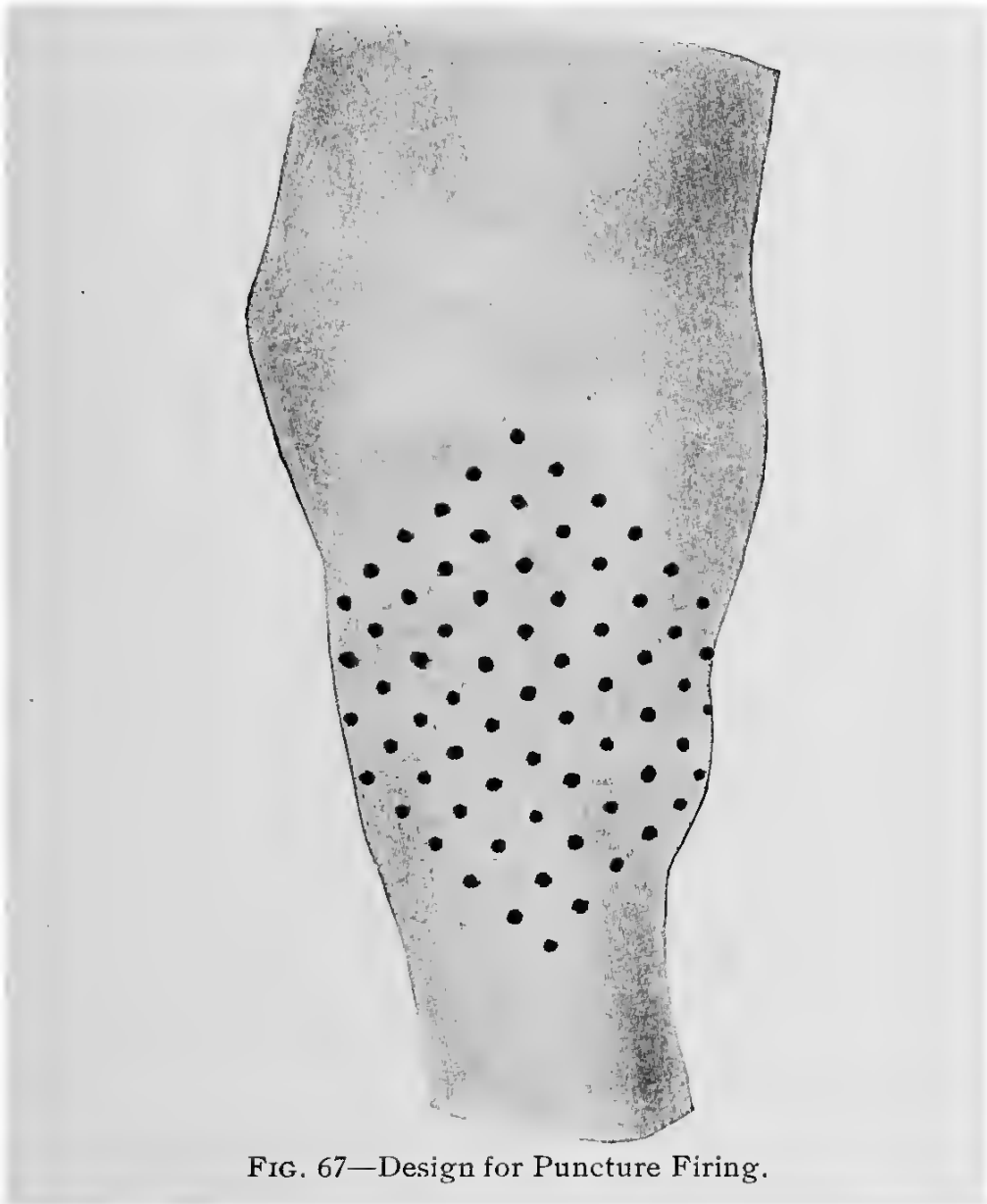


FIG. 67—Design for Puncture Firing.

whilst one showing no traces of having been submitted to this blemishing treatment, whether lame or not, is generally more salable. The cicatrices of firing are always regarded as an unsoundness in examinations by veterinarians, even though the lesion was trivial and now entirely cured. A splint, unfired, is readily over-looked, while a fired one is always considered sufficient reason for condemnation.

In spite of this adverse result, firing continues to hold a

manifest popularity amongst veterinarians. It is still regarded as the standard treatment of many lameness-producing lesions, wherever veterinary surgery is practiced. It is alike the weapon of the empiric and scientific practitioner. It is urged by the practitioner and sometimes demanded by the client, but it finds its greatest popularity in cities where the value of a horse depends upon its ability to work and not upon its salableness. It is very often demanded by the owners of race horses whose value depends upon speed.

The firing of horse's legs reached its highest popularity in England, where it is practiced as a precaution against possible injury. Hunters and thoroughbreds imported to America from England are frequently found to have been fired, evidently for no other reason than that of preventing them from straining or wrenching the flexor tendons.

INDICATIONS.—Rationally, firing is practiced only as a cure for lameness due to some local inflammatory disease of joints, bones, sheaths, or tendons. When the inflammation has become chronic or has left a structural alteration in its trail, and after other less severe methods of treatment have failed, firing is practiced as a severe counter-irritant and to prolong the period of rest. The benefits of the operation lie largely in the fact that a protracted rest becomes necessary, owing to the severe local inflammation it produces in the skin and subjacent tissues. Kept from arduous work, the lesion will heal. Resolution of local inflammations is also favored by the rest or immobilization of the affected part. The strained tendon submitted to a severe firing is kept partially out of commission during the domination of the pain in the fired skin; and a hock joint fired for spavin is scarcely flexed from the same cause and thus gives the inflammatory process the opportunity to effect the desired ankylosis. Firing also excites local nutritive activity to the benefit of the slow, chronic, persistent morbid process, especially when the pointed iron is carried directly to the diseased tissues.

The claim that line-firing supplies a permanent supporting envelope to the flexor tendons in the form of ribbed cicatrices around them laterally and posteriorly, is defended by some veterinarians, while others deny that this effect is ever obtained from-firing. It is barely possible that prominent cicatrices extending around the tendons do have some such action, but that they effectually protect them against future injury is rather far fetched. Firing of ordinary severity does not permanently destroy the elasticity of the integu-

ment sufficiently to construct an adequate supporting envelope. Besides, such a bandage could have but little influence in preventing strain, unless it transferred some of the burden of the tendons to the column of bones by diminishing the phalangeal inclination, and this of course is never accomplished by firing the skin.

The benefits of firing may be summarized as follows: (1) Puncture-firing augments local nutritive activity and thus hastens the termination of chronic processes: (2) Both line-firing and puncture-firing cause more or less immobility of the diseased structures; (3) Both line-firing and puncture-



FIG. 68—General Tarsitis.

firing operations necessitate protracted rest to the decided benefit of the defective organs.

Firing is contra-indicated in recent injuries, new inflammations, or in any lesions accompanied with an active inflammation of the skin. If the skin is sound and not implicated with the underlying inflammation, it may be fired with impunity even though the latter be very acute, but if the inflammation extends into the integument the cauterization may provoke both local and general complications. (See sequelæ.)

For Spavin.—The firing of a spavin can always be defended on the grounds that it is the standard treatment of this serious disease of the tarsus. In this condition **line-firing** gives the best results in the case of **long standing**, while **punc-**

ture-firing is most effectual in hastening resolution in a **recent one.** For those serious cases of **general tarsitis,** in which almost every structure of the whole articulation is involved, line-firing is also the most effectual. For **bog-spavin,** large enough or painful enough to require treatment, line-firing gives the most satisfactory results. In line-firing the hock, the lines are carried around the entire articulation, and

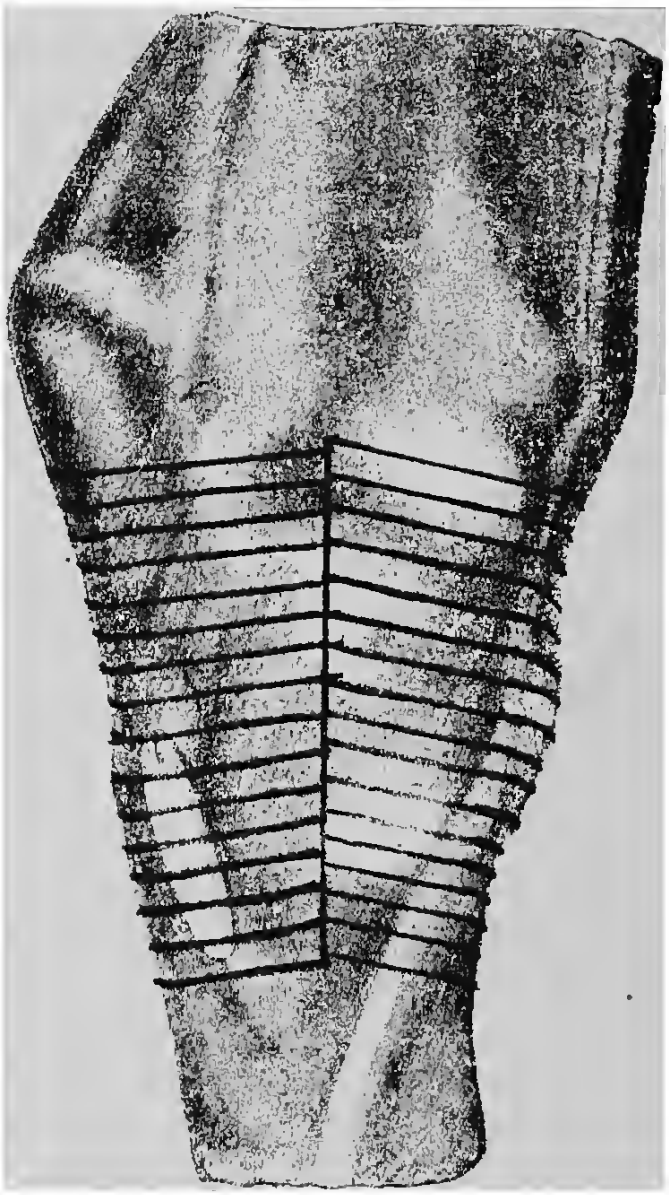


FIG. 69—Design for Spavin Firing.

from the level of the os calcis superiorly to that of the metatarsus inferiorly. (Fig. 69.) Firing a limited area directly over the bone spavin or bog-spavin, or only firing one side of the joint, is absolutely ineffectual except in the case of deep puncture-firing, and even in this instance the stabbing of a liberal area is desirable in order to provoke as much local disturbance of the skin and underlying structures as possible.

For Tendinitis.—For **tendinitis, "bowed" tendons, or sprains of the tendons,** line-firing is preferable. The firing should be carried from the level of the trapezium superiorly to the os suffraginis inferiorly. The operation is manifestly effectual for such abnormalities of the tendons, especially when followed by sufficient rest to permit all of the inflammation to subside. That the rest is not alone the curative factor is shown by the poor results obtained when firing is omitted. In **draft-horse tendinitis** manifested by a characteristic, painful tumefaction at the level of the inferior check ligament line-firing is beneficial but not always curative.



FIG. 70—Design for Firing Knee and Tendons.

Sometimes two or three firings and long rest will fail to entirely correct this refractory lesion, yet no other treatment is half as beneficial. For the so-called **bowed tendon** of speed horses firing is sometimes futile on account of the seriousness of the lesion and the severe strain to which the tendons of such horses are afterwards subjected. Many race-horses, however, have been markedly benefited and many have been cured entirely by the treatment.

For Sesamoiditis.—Lesions about the sesamoids, either in the pectoral or pelvic limb, often furnish suitable indications for the operation. Strains, osteophytes, synovitis, calcifica-

tion of the tendons and sesamoidean ligaments can be given no better treatment than a thorough line-firing extending from some distance above the fetlock to the middle of the pastern. (Fig. 70.) Puncture-firing is much less effectual for sesamoidean lesions.

For Ringbone.—The treatment of ringbone, by firing, is always more or less unsatisfactory, especially when the osteophytes engage the coronet or extend beneath the hoof. In these events nothing seems to help them until the inflammatory process has spontaneously subsided, then firing or any other treatment is often unwittingly credited with the results. Puncture-firing is the appropriate form of treatment,



FIGS. 71 AND 72—Specimens of "Bowed" Tendons, in which Line Firing is Indicated.

but as much of the diseased bone is hidden beneath the coronet and hoof, its effects are limited indeed. The osteitis of ringbone continues in spite of firing, in spite of blistering, in spite of rest, in spite of special shoeing, and in spite of all of them combined. The lameness of ringbone may finally diminish or even entirely disappear, but the cure can seldom ever be attributed to the treatment administered for its relief.

Firing for ringbone, while appropriate enough as a step in the right direction, is well known to generally end in disappointment. It is practiced because there is no better treatment available. In order to take advantage of every possible helpful expedient, the firing is preceded by the application of a roller-motion shoe, raised slightly at the heels and suc-

ceeded by a protracted period of rest, during which time one or two strong blisters should be applied.

For Curb.—The lameness of curb usually yields to epispastic treatment and a rest of two or three weeks. Sometimes, however, it returns with work, even after several blisters and six weeks of rest. In this event a severe line-



FIG. 73—Design for Firing Curbs.

firing is indicated and generally it terminates the lameness most satisfactorily. Puncturing is less effectual.

For Carpal and Tarsal Tendo-Synovitis.—We apply these names arbitrarily to inflammations of the carpal and tarsal sheaths accompanied by more or less distention of the synovial sacs. In the tarsal sheath the name **"thorough-pin"** is usually applied. In the pectoral limb the name "knee-thorough-pin" is sometimes used. These conditions, while sometimes perfectly compatible with normal locomotion, often

cause very obstinate lameness that will yield to no other treatment than severe line-firing. In addition, the accumulated synovia may be aspirated, with aseptic precaution, immediately after the operation and again two to three weeks later, with very flattering results. When these synovial inflammations and distentions produce lameness it is always an obstinate one that will not yield to treatments less harsh than very severe firing, and not infrequently a second firing is found necessary before a permanent cure of the lameness is effected.

EQUIPMENT.—Firing irons, forge, clippers, single side-line, and a cantharides blister, 1-8, constitute the essential appliances. Firing irons are of many different patterns. No two veterinarians seem to use the same pattern. Figs. 74-75 exhibit the various types used by the modern vet-

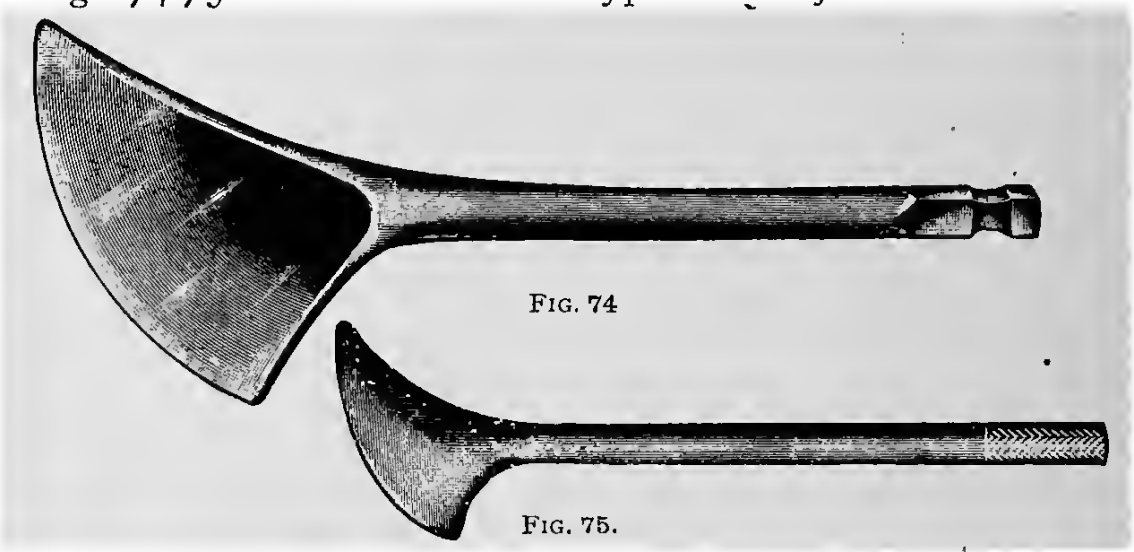


FIG. 74

FIG. 75.

FIGS. 74 AND 75—Patterns of Firing Irons for Feather Firing.

erinary surgeon. Some prefer large irons, some small ones, but in every case the edge should be curved and blunt enough to prevent cutting through the skin. The head should be heavy enough to retain heat well and the handle of handy length. For puncture-firing the benzine thermo-cautery is par excellence the best apparatus, but in lieu of this, the pointed irons will answer. The large point of the thermo-cautery may be used also for line-firing to very good advantage, but the most experienced veterinary surgeons prefer the irons heated in a coal forge.

The lines are made from one-half to three-quarters of an inch apart.

By adopting the **irons for line-firing** and the **thermo-cautery for puncture-firing** the most satisfactory results are obtained.

In puncture-firing, the point of the cautery is made to

penetrate through the skin, and even directly through the subjacent ligaments to the bones. The depth of the penetration must be judged according to the character of the structure beneath. Synovials and veins must be specially considered. The points are made from one-half to three-quarters of an inch apart over the entire surface.

RESTRAINT.—Firing should always, when not prevented by an exceptionally restive horse, be performed in the standing position. By simply applying the twitch to the nose and elevating the opposite leg from the floor with the side-line, almost every horse can be fired with little annoy-

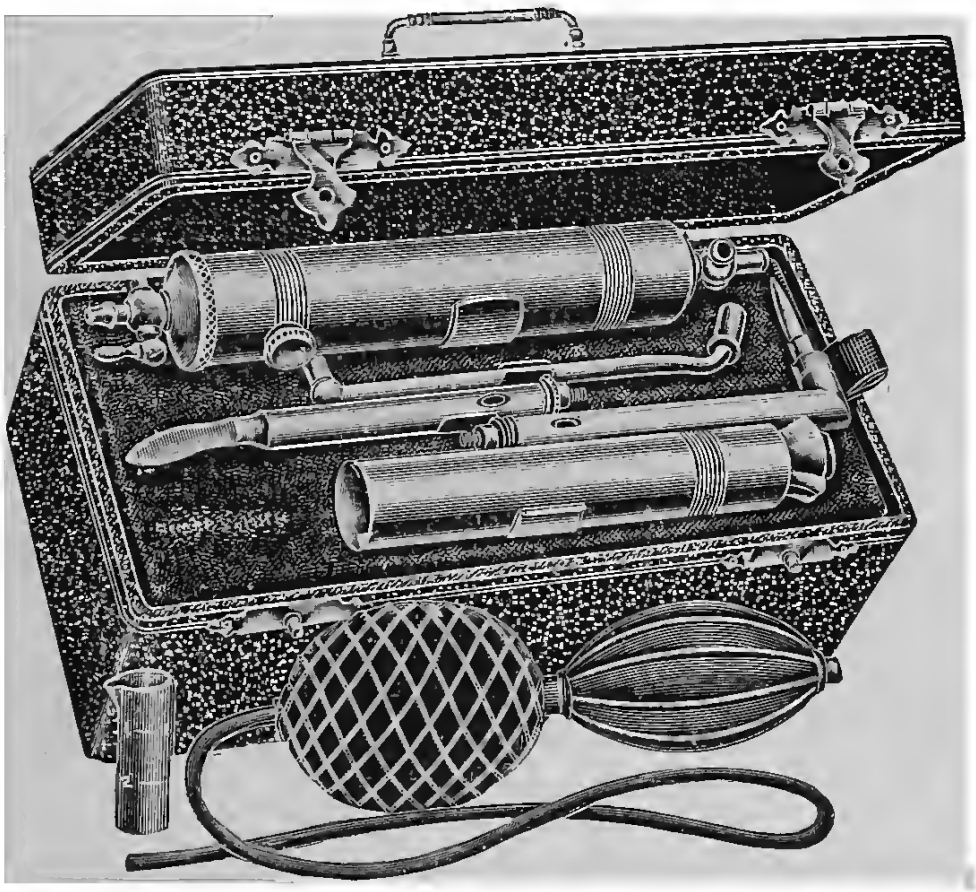


FIG. 76—Sands' Thermo-Cautery.

ance during the operation. Occasionally, however, an individual is encountered that will resent every touch of the iron by plunging into the air and otherwise preventing successful execution of the operation. In these events the recumbent position will be necessary. The standing position is preferable, also, on account of the fact that the lines can be drawn more symmetrically, and can be made to conform more gracefully and artistically to the shape of the joint or region fired, than is possible in the recumbent attitude. The same

artistic effect is seldom ever obtained in the recumbent position.

TECHNIQUE.—First Step.—Preparing the Field.—Although it is not customary with most practitioners, disinfection of the surgical field is as necessary before firing as before any other surgical operation, in fact more so, because of the severe and extensive inflammation it provokes in the skin and underlying tissues. Sloughing of the skin, acute cellulitis, chronic cellulitis, laminitis, and even fatal septicæmia and tetanus, are among the complications traceable to uncleanly methods of firing. A too severe or too deep burning is often blamed for sequelæ caused only by septic infections. These two evils combined are especially to be avoided.

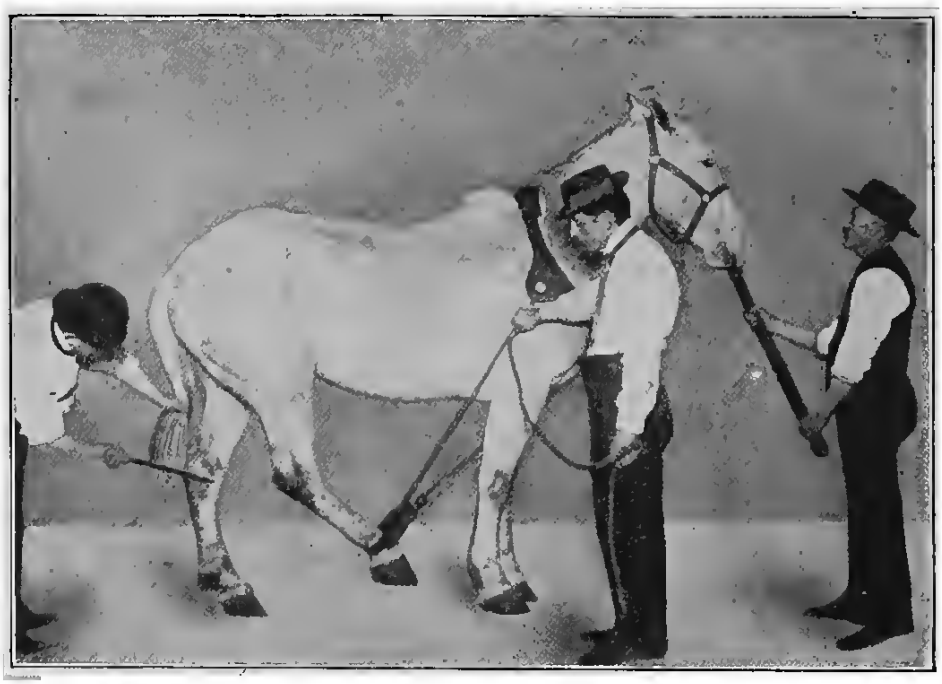


FIG. 77—Restraint for Firing Hind Legs.

The skin over the surface to be fired and a liberal area above and below, is closely clipped, well brushed out and then washed with a soapy antiseptic water. This step may precede the operation several hours to allow the hairs to dry thoroughly; otherwise the surface must be dried with the rub-cloths.

Second Step.—Firing.—In line-firing the irons are heated to a cherry-red, and when brought out of the fire the detritus on their surface and edges is filed off with a worn out file. The edge must always be rid of projecting particles which, when cooling, will cut keenly into the skin and often cause an annoying bleeding as well as a prominent indelible scar at the point cut through. The lines are drawn almost at

arm's length and with a graceful swing, bringing almost every part of the curved edge into use at each sweep. **The speed of the iron is gauged according to the degree of heat,** so that the degree of cauterization at every part is exactly equal. As the iron turns dark it is replaced with another already heated and filed smooth as above directed. The first firing is scarcely more than a marking out process; the skin is not much cauterized, especially where the hair is thick and coarse, as around the fetlocks. The second firing over the same lines, by the same rules governing the speed of the iron, brings a brown effect to the skin and thus indicates a slight degree of cauterization. If it is desired not to mark the horse conspicuously, passing the irons twice over the same lines is sufficient. If a nominal degree of cauterization is desired the iron is passed over the same lines three or four times, and for severe cauterization five times. These recommendations may be adopted as absolute laws if the irons are always heated to the same degree and then passed over the lines with decreasing speed as they gradually cool. It requires some experience and some care to accomplish a given amount of cauterization in a given number of times the iron is passed over the lines, but the attainment is one worth possessing. In order to earn a good reputation in this operation the surgeon must take into account the relative delicacy of the skin of different regions and of different individuals; he must be able to judge the amount of cauterization produced by an iron of certain heat and drawn over the skin at a certain speed; and thus finally predict the exact appearance of the fired surface at every stage of the healing process and thereafter.

Third Step.—Applying the Blister.—A blister of powdered cantharides one part, and lard seven parts, is by far the most reliable epispastic for the fired surface. It is much less painful than mercurial blisters, more uniform in its effects, much less liable to produce sloughing of the skin, and may always be depended upon to produce sufficient irritation. Mercurial blisters are painful and treacherous upon fired legs.

This blistering ointment is applied with nominal friction immediately after the firing. When the cauterization has been slight, as for example when conspicuous branding is to be avoided, the ointment is rubbed in for five to ten minutes and when the cauterization has been severe, it is only smeared over the surface.

The parts below the fired and blistered region are

anointed with vaseline to prevent blistering beyond the desired limits.

AFTER CARE.—The horse is placed in a single stall and tied closely to prevent lying down for forty-eight hours. At the end of this time the surface is submitted to a thorough washing with soap and hot water in which is dissolved a small amount of mercuric chloride or carbolic acid, and then, when dry, liberally smeared with vaseline. Thereafter, for the next two weeks, the vaseline is applied every day with sufficient friction to disseminate it through the scabby surface. On every third or fourth day the inunction may be preceded with a washing of soap and antiseptic hot water. At the end of fourteen to eighteen days, the scabs having loosened from the underlying surface, an astringent lotion, consisting of acetate of lead one ounce, distilled extract of witch hazel eight ounces, and water one quart, is applied twice daily until cicatrization of the lines or points is completed and all of the swelling has subsided. At the end of the fourth week the horse is ready for work, exercise or the pasture.

In view of the fact that firing is always performed for more or less serious conditions, protracted rest is always found exceedingly beneficial. Two, three, or even four months' rest is desirable in almost every case, and during this time a second blister can often be applied to good advantage.

SEQUELÆ.—It is possible to broil the skin between the lines in line-firing and thus provoke extensive **sloughing.** In puncture-firing the point may accidentally be plunged into an articulation, bursa or sheath and thus cause an **articular** or **thecal abscess** that may terminate seriously and even fatally. **Septic inflammation** of the whole fired area, often extending deeply into the subjacent textures and in every direction around it, followed by sloughing, multiple abscesses, and general systemic disturbances occur occasionally from severe firing and blistering of a dirty skin, or from filthy methods of after-treatment. Dirty water, rancid lard, or filthy oils may carry infection into this favorable field for microbian growth. When both fore legs are submitted to a severe firing **laminitis** sometimes follows, and in some instances it is serious. **Chronic cellulitis** followed by the production of much new permanent subcutaneous tissue may supervene and thus produce a permanent tumefaction of the legs. **Unsightly scars** follow severe cauterization, sloughing and abscesses. **Flexion crevices** behind the carpus, in front of the tarsus, and behind the pasterns follow severe cauter-

izations of these parts or failure to properly lubricate them during the convalescent period.

In the light of all of these sequelæ it is very evident that firing is by no means a simple, harmless operation, but is instead, one that requires good judgment in diagnosis, skill in performance, and precision in after care.

CHAPTER II.

NEUROTOMY.

DEFINITION.—The word "neurotomy" in its strict literal sense denotes the surgical division of a nerve trunk. In veterinary surgery it is the universal designation for operations consisting of the removal of a small portion of a sensory nerve trunk with the purpose of permanently destroying its continuity. For a time, the word "neurectomy" was quite generally substituted on the grounds that it more clearly defined the operation as performed in veterinary practice. This stand was, however, erroneous, because the word "neurectomy" when preceded by the name of a nerve trunk (e. g. plantar neurectomy) readily led the unsuspecting reader to suppose that the operation sacrificed the entire nerve named. The qualified name would easily lead to the impression that the nerve operated upon was inimical to the patient's well-being and therefore required surgical ablation in its totality. The fact that the purpose of the operation is that of destroying the nerve's continuity, that of simply interrupting the communication between periphery and center, at once qualifies the word "neurotomy" as the appropriate designation.

HISTORY.—Neurotomy in veterinary practice until very recently was but a synonym for "plantar neurotomy" of the present day. The operation included but a single procedure,—that of dividing the plantar nerve a short distance above the fetlock joint. The operation was at first given the vulgar appellation of "nerving" which name is still applied among laymen. It was first performed by English veterinarians during the second ten years, and was introduced into France during the third ten years, of the nineteenth century. Professor Sewell is tendered the credit of priority in its performance. He performed first the plantar and then later introduced digital operation. During the same epoch Moorcroft performed the same operation in India, apparently without knowledge of its previous invention in England.

Sewell, by giving publicity to the operation and by improving it so as to include only the posterior digital nerve, undoubtedly deserves the full credit ordinarily given him of

originating this principle in the treatment of incurable pains of the joints and tendons of horses. During the first three-quarters of the nineteenth century these two operations (plantar and sometimes digital neurotomy) were not, however, methodically adopted. They were performed in the most desultory manner imaginable. Sometimes they were credited as being capable of accomplishing wonders, and at other times they were condemned as being nothing short of malpractice. Some defended them and others, equally prominent and capable, condemned them as harmful, ruinous, cruel, ineffectual and unreliable surgery. The discrepant opinions expressed from time to time since the beginning are still found among the veterinarians of the present day and the two operations are still condemned by some from the ethical standpoint, it being argued that lame horses are thus prepared for sale and that the veterinarian is a conscious co-conspirator in the fraud. Others continue to condemn them from the standpoint of unreliability, and still others because of the unfortunate sequelæ that often follow their performance.

The tendency today is toward a more careful selection of proper indications toward a more painstaking effort to arrive at an exact diagnosis of the morbid process causing the pain, toward the exclusion of such operations where the chances of doing harm are great, and toward a greater effort to divide only the nerve that contributes the sensation to the very seat of disease.

Median neurotomy was first given publicity in this country by Pellerin, whose small manual on the subject was translated into English by Liautard in 1896. It may be described as the third neurotomy operation introduced into veterinary surgery. About the same time tibial neurotomy, peritoneal neurotomy and ulnar neurotomy were attempted and performed by veterinarians all over the world, in a frantic endeavor to cure the various lamenesses commonly affecting the horse. Like all markedly effectual lines of therapy, they were all so much over-done and over-lauded that they left a trail of discreditable failures and havoc in their wake, with the result, again, of meeting with wide-spread condemnation from many sources. Their history during the past fifteen or twenty years is not unlike that of plantar neurotomy before better pathology and more common sense dominated the veterinarian's actions in applying them.

The various neurotomy operations are now largely performed by city practitioners, owing to the greater prevalence

of proper indications for them in cities and towns. They are not applied promiscuously to all kinds of diseased conditions, nor as universal cures for the lameness of any one disease. They are given a place among veterinary surgical operations with an unequivocal restriction to their application. The extent of disease, the activity of the disease process, the nature and function of the diseased structure, the occupation of the diseased animal, the usefulness of the animal before and after the operation, etc., etc., are all taken into account before any particular neurotomy is recommended. Then when it is decided to operate, an attempt is made to unnerve only the seat of disease instead of sacrificing the sensation of a large region.

GENERAL INDICATIONS.—The ideal indication for any neurotomy is a **chronic unchangeable, slight** lameness, due to a diseased process that has produced the minimum amount of structural alteration. In such circumstances if the affected spot is accurately located and the nerve supplying it with sensation is accessible to division, neurotomy is a strikingly effectual commendable and a perfectly satisfactory operation. It prolongs the working life of the animal, relieves its pain and leaves no destructive sequel in its wake.

In every case the inflammation must be of a chronic, inactive character; the structures implicated must be capable of supporting the strain to which they will be subjected after their sensibility has been destroyed, either alone or by artificial assistance; and the unnerved parts thereafter must be submitted only to such strain as they will be capable of withstanding.

These restrictions markedly curtail the number of indications, and with the limited means at hand for making the accurate diagnosis demanded by them, they often leave a doubt as to whether a given case is really an indication or a contra-indication. It is therefore very evident that even though neurotomy be preceded with a very careful and intelligent meditation over its prudence, the errors in judgment, exemplified by post-operative sequelæ and failures, will still be legion. The best judgment of the best diagnostician may be found wanting in one case, while the luck of a novice may bring crowned success in another. Withal, there are extenuating circumstances which render the operation justifiable, here and there, where the chances of failure are great; there are cases and cases in which there is always some degree of certainty as to its success; and there are the small number of ideal indications all of which in their totality create a no small demand for the neurotomy operations in a veterinary prac-

tice. To urge, to recommend, to perform these operations at every turn is undefensible and disastrous. But by selecting suitable cases, wisely weighing every circumstance connected therewith, and acquainting the interested persons as to the possible outcome, a city practitioner's usefulness can be manifestly enhanced.

GENERAL CONTRA-INDICATIONS. — Neurotomy must never be advised for **new, acute, changeable, or severe** lamenesses; for any lameness due to an active inflammatory process; for lameness due to an exostosis encroaching upon a ginglymoid articulation; for lameness accompanied by extensive alterations of important structures whose diminished strength will prove inadequate to support the added strain; for lameness in horses submitted to violent exercise; for lamenesses in horses afflicted with a rarefying disease of the bones, whether directly due to the condition or not.

A review of these innumerable conditions shows at once the great number of restrictions to be placed upon neurotomy operations. These restrictions must be respected absolutely. It matters not how eager is the desire to effect a cure; how obstinate any given condition is certain to prove with the ordinary palliative lines of treatment; or how vigorously the operation is urged, neurotomy is forbidden under circumstances above mentioned. It seems that every veterinarian with a penchant for surgery, has yielded at one time or another to this burning desire to cure every lame horse by neurotomy, until brought to the realization of his error by numerous disasters, such as casting off of hoofs, breaking down of supporting tendons or failures to relieve the lameness.

Active inflammations or severe lamenesses must be carried along with palliative treatments until they pass into a chronic stage before they become indications for any kind of nerving operation. The exostosis that is just beginning to encroach upon a hinge diarthrosis is exceptionally hazardous. It is only when the exostosis has completely or at least almost completely, ankylosed the joint, that neurotomy becomes at all safe. Whenever there are extensive structural alterations, such as degenerated tendons, deformities of the feet, especially dropping of the soles, the operation is positively forbidden, because in these instances the strength of the feet is insufficient to withstand the strain which was minimized by lameness while the sensibility was undisturbed. Horses submitted to violent exercise, whether racing, fast road work, fast street work or heavy draft work, are not

ideal subjects for neurotomy under any circumstances. These animals will seldom survive the ordeal for any great length of time. Often the first day's work will prove their undoing, but more often they break down a few weeks after the operation. Such horses become suitable subjects only when they are given more favorable occupations after the operation. In districts where osteoporosis is prevalent the surgical subject must be selected with greater caution, as in this instance dissolution of the unnerved parts is certain to occur early after the operation. Mules are less welcome subjects than horses, other things being equal. Wrenching of the attachments of tendons is a common termination of the neurotomized mule.

SEQUELÆ AND ACCIDENTS.—The sequelæ and accidents of the various neurotomies are (1) breaking down of the diseased unnerved parts; (2) return of the lameness; (3) unsightly and painful cicatrices; (4) neuromas, so-called; (5) hæmorrhage; (6) shock; (7) failure to cure the lameness.

1. **Breaking Down of the Diseased Unnerved Parts.**—This sequel is by far the most serious incident attending neurotomy. It is the feature that has so often brought the operation and the operator into disrepute. The sequel appears at any time from two days to two years after the operation. In the acute lameness, severe lameness or the flat-drop-sole foot affected with laminitis, it comes early and runs a short, fatal course, while in the chronic lameness the accident may be long delayed and will appear gradually. In the former event it takes either the form of shedding of the hoof or loosening of the plantar aponeurosis. The hoof first loosens around the coronet and then finally is cast off entirely, leaving only the keratogenous membrane to support weight. When the plantar aponeurosis loses its attachment the condition is manifested by dropping of the fetlock, which continues rapidly until the ergot touches the floor and the toe is turned upwards, or upwards and to one side. There is also considerable swelling of the leg upwards and more or less lameness and suppuration of the exposed tissues. The patient sickens and dies from exhaustion or is destroyed to end its existence. In the chronic form of break-down the condition presents an entirely different picture. The skin and hoof remain unbroken and do not expose the subjacent structures. The first appearance of the chronic case is tumefaction of the tendons and synovials beneath the fetlock, followed by lameness of greater or lesser intensity. As the patient continues to work sometimes it may be intense enough to cause a break down,

the tumefaction accentuates and soon becomes enormous. The fetlock is held in volar flexion, in its normal position, or in aggravated dorsal flexion, according to the amount of pain and the strength of the supporting tendons. If there is much pain the volar position of the fetlock will delay the eventual breaking away of the tendon attachments, while on the other hand if the pain is not much in evidence the dissolution will rapidly follow under the strain of ordinary work, and soon render the patient useless.

After the higher neurotomies, median and tibial, the sesamoidean ligaments are often the sole seat of dissolution. This form is manifested by marked dorsal flexion, swelling of the region and early ruination of the subject. In these events, the occurrence usually follows soon after operation, generally when the horse is first given severe work.

The following is a fair example of break-down after tibial neurotomy: A draft horse affected with chronic sesamoiditis of one year's duration supervening thecal abscess, was unnerved above the hock. Twenty days later he was put to light work and seemed to progress favorably. On the thirteenth day, while working in a tram hitched to a heavily laden wagon, the fetlock suddenly gave way and descended to the ground. The horse was killed, and post-mortem dissection showed that the suspensory ligament, the x, y and v ligament and the perforatus tendon were wrenched from their attachment.

The delayed sequelæ are preventable to a certain extent by giving the unnerved horse a less arduous occupation, by the application of supporting bandages and by shoeing with high heel calks. The acute forms are not preventable, as they occur under the strain incident to supporting the weight of the body.

The **cause of break-down** of the acute variety is always traceable to the indiscreet application of neurotomy to acute inflammatory conditions, or else to lameness accompanied with deformed, weak hoofs. In the chronic variety it is generally the result of continued violent work without adequate efforts to protect the weakened organs.

These accidents are due strictly to the mechanical violence (supporting weight, trotting, pulling, etc.) inflicted upon structures too weak or too diseased to withstand the strain. They have sometimes been attributed to mysterious **trophic disturbances** incident to the removal of the innervation, but this theory is not well founded, because the operation, when performed upon strictly sound horses, is never fol-

lowed by any trace of dissolution. The unnerving of healthy parts never causes them to break down. Whole regions may be accidentally or experimentally unnerved with impunity and without any subsequent degeneration or disintegration of any part of the unnerved structures. In the case of divided motor nerves the muscles supplied by them will rapidly undergo simple atrophy from disuse but no degenerative changes are ever observed. Disease, deformity, and weakness are the essential pre-requisites to breaking down conditions following neurotomy. The removal of the nerve supply has only the indirect influence of leaving the diseased parts exposed to increased strain. The interrupted nerve supply is not directly causative. The lesions never exhibit any evidence of progressive degenerations to which the appellation "trophic disturbance" could be appropriately applied.

2. **Return of the Lameness.**—The return of the lameness following neurotomy occurs at variable times after the operation. Sometimes the first two or three days of work will bring back a lameness more marked than the previous one, and at other times two years may elapse before there is a recurrence. The cause of increased lameness or its early return is spreading of the inflammation from the initial seat under the influence of the added strain or concussion to which the inflamed area is subjected. Sometimes this new inflammation will persist and leave the patient permanently lame; and at other times it will subside and leave the subject permanently relieved of the lameness. Lameness occurring a few days after the nerved horse is returned to work is not always serious nor an indication of failure. Longer rest, return to pasture, etc., very often turns into success what at first appears to be a hopeless failure. The return of lameness from every point of view is a spreading of the inflammation and **not a restoration of the nerve supply.** Nerve supply once interrupted by removing a section of a nerve trunk is destroyed forever. It can not be re-established by reunion of the cut ends of the trunk, because nerve regeneration is not so effected. (See regeneration, Vol. II.)

3. **Unsightly and Painful Cicatrices.**—The incisions into the skin and underlying structures often leave indelible blemishes in the form of prominent unsightly scars, which are not infrequently permeated with highly sensitive nervous elements. Aside from their unsightly appearance these scars are harmless unless sensitive, in which case they are capable of causing a very acute and lasting lameness. They are caused by the error of allowing exuberant granulation to

form within the incisions. They are prevented by aseptic methods of operation, careful stitching, stretching the nerve before dividing and keeping the patient quiet during the week following the operation. When the sensitiveness persists, total ablation of the scar and a portion of the nerve trunk above it may be necessary to relieve the lameness.

4. **Neuromas.**—The neuromas following neurotomy operations appear in the form of small pea-like nodules attached to the proximal cut end. When they follow in the wake of a well healed incision they are found to be movable and not attached to the skin, while in the badly healed incision they are naught but the sensitive scar previously mentioned. They are not true tumors as the name given them would indicate, but the result of a futile effort to re-establish communication with the distal cut end. They are analogues of the **amputation neuroma** of human surgery. , They consist of new-formed neurolemma infiltrated with axones vainly attempting to grow, but which become lost in the more rapidly formed connective tissue. As to special cause the neuroma is an enigma. They appear as sequelæ of any technique that may be tried to prevent them. As in the case of the sensitive scar the lameness they provoke may demand their ablation. Hughes recommends stretching of the nerve so as to bring a considerable length out of the wound before cutting it off, claiming that the cut end will then recede some distance above the wound, out of the reach of influences which would tend to promote regenerative activity. The stretching probably causes an ascending degeneration. They can always be prevented to a certainty by pulling the nerve out bodily instead of cutting it off, but this method is very painful and often causes a very intense pain in the legs for some days after the operation.

5. **Failure to Cure the Lameness.**—Neurotomy may fail to cure lameness from various causes, but more often it is due to error in the diagnosis. Sometimes the diseased process is rather too wide-spread to admit of unnerving, and at other times the motion of a joint is mechanically obstructed and this prevents any possible amelioration of the lameness.

6. **Fracture of the navicular bone** sometimes constitutes the injury sustained in breakdown, and the accident indicates that the bone had undergone a too serious structural disintegration to perform its weight-bearing function.

6. **Hæmorrhage.**—The hæmorrhage that occurs during the ordinary neurotomy although troublesome, is always

trivial except when one of the collateral vessels is accidentally divided or incised in the course of the operation. The plantar or digital vessels are sometime wounded in the course of the dissection or else divided transversly after being mistaken for the nerve. The posterior radial vein and artery are so closely related to the median nerve at the seat of operation as to expose them to the same danger. Serious hæmorrhage results from cutting these vessels should be controlled by proper ligation.

GENERAL TECHNIQUE.—Only the principles will be considered under this head as the details will be given in the description of each special neurotomy.

Restraint.—Neurotomy is a very painful operation, necessitating an adequate form of restraint. The incision through the skin, the dissection of the nerve, the elevation of the nerve from the surgical wound, and the final division of the nerve, constitute so many manipulations that are so promptly and forcibly resented as to demand restraint or anæsthesia or both. Depending upon the temperament of the patient and the particular operation to be performed, either the standing or recumbent position may be selected. Some veterinarians recommend the **recumbent position** with complete **chloroform anæsthesia** for all of the neurotomy operations, while others prefer the **standing position** with **local cocainization** for the plantar operations and the recumbent position with local cocainization for the higher and deeper operations. In this connection the practitioner should be guided largely by certain circumstances. **Median, tibial, peroneal, and ulnar neurotomy** require the recumbent position. The standing position is unsatisfactory in some of them and absolutely deficient in the others. Median neurotomy, for example, can only be properly performed when the patient is in lateral decumbency with the leg well stretched from the body. The dissection in these deep operations is facilitated greatly by the use of cocaine solution subcutaneously, immediately before the operation begins. In the case of the plantar operations either the standing or the recumbent positions may be selected. If the horse is inclined to be gentle and the operation is only to be performed upon one limb, the standing position will often answer, but when the patient is restive or when both limbs require the operation the recumbent position will give the best general satisfaction. After one, two, or three nerves have been dissected out and divided the patient will very often bcome so uncomfortably resentful as to prevent further progress. Sometimes the restive state is due

partially to the exhilarating influence of the cocaine, which at this stage is becoming evident, and at other times it is due to the combined influence of the cocaine and the uncomfortable duration of the procedure. Aside from the cocaine exhilaration, which is very frequently noticed, the terrible agony of dividing two or three partially cocainized large trunks consecutively, will often provoke a state of frenzy in the most complacent horse. **Standing neurotomy as it is vulgarly called is acceptable only in the unilateral case.** For the bilateral case it is much less satisfactory in the great majority of cases. The practitioner may also be guided by other circumstances; scarcity of help, unskilled help, lack of a suitable place for casting, extreme age of the subject, etc.

The recumbent position gives a much better opportunity to thoroughly disinfect the field, to perform a neat and clean dissection and to approximate the edges of the incision, than the standing position. The operating table is par excellence the best restraint, every thing considered. Aseptic operations are easily performed in the position attained upon the table. In the ropes there are always more dangers of soiling the wound, hands and instruments from the close proximity of the field to the litter upon which the horse is cast. This adverse element is eliminated entirely with the table. Furthermore the parts are much better immobilized than with the ropes; however, the latter can be utilized to very good advantage when the table is not available. The horse is cast in the usual manner and the affected leg released and fixed in the extended position, where it is held by strong assistants. The use of a small amount of cocaine at the seat of operation will still farther facilitate matters. When one side is finished the horse is rolled over for operation on the opposite side of the leg or for the opposite leg as the case may be. On the table the bilateral operations are somewhat prolonged because of the necessity of casting the horse twice to expose the surgical fields, but this disadvantage is one of speed only.

The standing position as before stated, is specially commendable for unilateral operations. Only the plantars and digitals can be properly divided in this position. A tourniquet is applied to the shin, the seat shaved and disinfected, the twitch applied, the field anæsthetized by subcutaneous injections of cocaine, and the leg held up into a comfortable position for operation by an assistant. In addition to the cocaine the shaved surface may be still further anæsthetized by spraying with ethyl chloride. When the nerve has been exposed cocaine solution may be applied directly to it on a

small pledget of cotton. With these precautions the plantar operations can be nicely executed without much ceremony. Here and there, however, a patient is encountered that will defeat the operator and will need to be placed under more adequate restraint.

THE TECHNIQUE OF NEUROTOMY.—Neurotomy is a simple operation. It is performed upon strictly healthy tissues; the tissues are only incised, divided; there is no necessity for mutilation; there is no drainage required; the skin is thick and well nourished at the various points of operation. In fact everything is favorable for prompt healing of the wound, providing the technique is made to conform to the ordinary rules of clean surgery. The field of operation requires thorough cleansing with antiseptics after having been shaved; the instruments are sterilized; the hands are kept clean and digital manipulations avoided; the sutures used for closing the wound are always sterilized sutures removed from the sealed glass containers only at the time of use; the blood is bailed from the wound with sterilized sponges or cotton; and finally the wound is protected with appropriate surgical dressing recommended for incised wounds requiring no drainage.

The Incision and Dissection.—The exact seat of the incision is located and its length decided upon after a careful and patient palpation and inspection of the region. Legs of horses differ somewhat in their contour, in their conformation, and they may be abnormal from disease to the extent of actually deceiving the casual operator unless the parts are carefully surveyed. The aim should be to make the incision exactly over the nerve trunk. When the location is decided upon the skin is held tense with the left hand without disturbing its normal relations, while the incision is carefully carried through it with the right one. When the skin is cut through throughout the whole length of the incision the dissection forcep is taken in the left hand to be used as a retractor of one of the edges of the skin. At this stage some operators have recommended the use of various retractors to dilate the incision. The forcep retractor and the elastic retractor (Fig. 90) are chiefly mentioned in this connection. These expedients are necessary only in the deep neurotomies (median tibial, peroneal, etc.) In the plantar operations the dissection forcep is quite sufficient to open up the wound to facilitate the division of the subjacent tissues, unless some unexpected situation arises.

The technique that usually gives the best satisfaction and

shortens most of these operations to the minimum is to grasp one edge of the wound with the dissection forcep, instruct the assistant to bail the blood thoroughly and then make a stroke or two with the knife parallel with the incision, through the areolar tissue covering the underlying structures. This will generally bring the anatomical structures into view for easy identification. If the areolar tissue is bathed with blood it is picked up carefully here and there with the forcep and dissected away with the scalpel. All of the time the assistant is keeping the blood from masking the work. When the nerve comes into sight (and no further step is taken until it is fully identified) it is partially loosened along a small part of one of its edges so as to give a point of entrance for the nerve elevator. The elevator is then taken in the right hand and passed beneath the nerve to the opposite side of the surgical field and held firmly to prevent its disturbance by struggles of the animal, which are quite certain to follow at this point of the operation. The nerve is then dissected from its adjacent structures along the whole course of the wound and then pulled out with some force as the probe-pointed bistoury divides it at the proximal commissure of the wound. Dividing it at the distal commissure, sewing the incision and dressing it with appropriate dressing completes the procedure.

Nerves are sometimes difficult to find and sometimes they are not easily differentiated from the other structures,—aponeuroses, arteries, empty veins, etc. The operator must remember, as a general principle, that nerves are, on the whole, quite superficial, and that failure to immediately locate them is no reason to dig deeply into the wound. Deep digging into the wound leads to more confusing situations than all of the other errors and deficiencies combined. **The nerves of horses usually operated upon are not deep.** When they are not promptly found it is generally because they are hidden in a mesh of blood-saturated areolar tissue. Always dissect away carefully the superficial areolar tissue with the forcep and scalpel before searching elsewhere for the nerve. By shifting the skin to and fro a very wide range of underlying tissues can be explored, and these must be thoroughly examined before the dissection is carried deeper. A nerve denuded of its sheath reveals itself in the form of a glistening flattened ribbon, closely blended to an adjacent vein in nearly every instance. After it has been dissected free from its neighboring structures it appears more cylindrical, and may then be mistaken for an artery, which is always round, even

on first sight and before it has been loosened from its surroundings. An artery is bluish and roughened, and never presents the longitudinal fibers so characteristic of the nerve trunk. It is also more elastic and lifts from its trough more easily than the nerve trunk. It has not the same substantial attachment to its adjacent structures as the nerve. The differentiation between nerve and artery, if difficult to the casual operator, is quite easy for the experienced surgeon, from inspection. When there is any doubt, after taking its physical appearance into account a prick of a pin above the cocainized portion will serve to make the differentiation more certain.

The **length of the incision** is not restricted so long as the technique is so directed as to assure primary union of the skin, but when the wound suppurates the smaller the incision the smaller will be the scar. About one-half inch is sufficient for the plantar operations, and one and a half inches for the higher and deeper neurotomies. It is possible to elevate the digital and plantar nerves through very small dermal incisions, but there is no notable advantage in the method where cleanliness prevails.

Control of Blood-flow.—The flow of blood in neurotomy is controlled chiefly for the purpose of facilitating dissection. It is accomplished by the application of a rubber tourniquet above the seat of operation and by bailing the oozing blood from the incision with a sponge or pledget of cotton. In neurotomies above the tarsus or carpus the tourniquet is not applicable, and only the latter method applies, with the occasional twisting of a spurting vessel with the forcep. When any of the large vessels are accidentally cut they must be promptly ligated before the operation is carried into the advanced steps. It is never admissible to arrest such hæmorrhage by compression. With a little effort these vessels can always be isolated and properly ligated, to the decided benefit of the healing process, in contra-distinction to the harmfulness of the wadding or the compressing bandage.

Suturing the Wound.—The wound is always closely sutured so as to heal without drainage, with the exception of that of median neurotomy, which will be considered later. In applying the stitches the edges of the wound are lifted consecutively with the dissection forcep and the needle passed through with the needle holder, instead of manipulating them with the hands, which at this stage of the operation are liable to have become soiled. The crucial stitch (Fig. 58), the mattress stitch (Fig. 57) or the simple inter-

upted stitch (Fig. 52) may be decided upon. The crucial stitch gives somewhat the best results in that it leaves no marks except the four points of entrance.

After-Care.—Immediately after the operation, as soon as the horse has returned to the standing position, the region is well rinsed with mercuric chloride solution to rid the parts of accumulated blood, litter, etc., that may be attached to the field and surroundings, then a liberal wad of cotton well saturated in mercuric chloride solution 1-500 is loosely bound to the wounds with a muslin bandage. The horse is then kept in the standing position for twenty-four hours, when a liberal dry dressing of boric acid and iodoform is applied and retained with cotton and bandages. This dressing

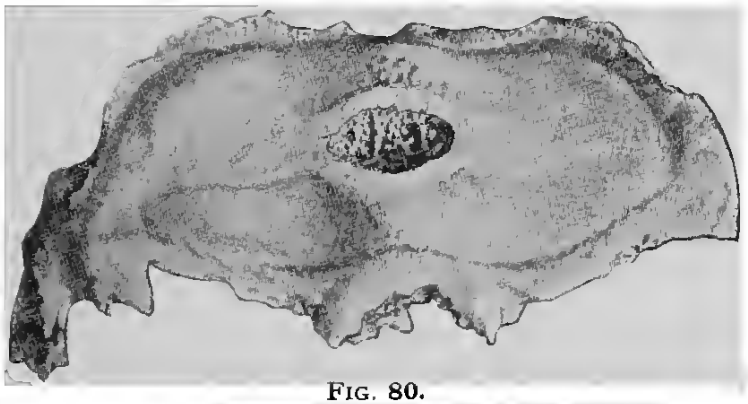


FIG. 80.

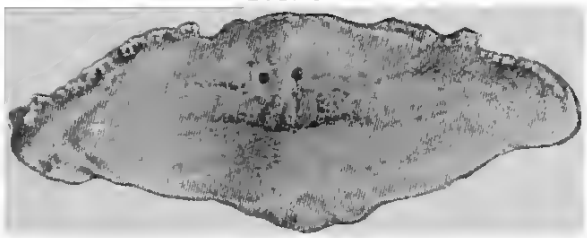


FIG. 81.

FIGS. 80 AND 81—Structural Changes in the Navicular Bone in Navicular Disease.

is left undisturbed for five days, when it is removed to remove the stitches. These are cut closely to the level of the skin on one side of the wound and gently removed. The dry dressing is re-applied for several days and then discontinued entirely.

The neurotomized subject is ready for work in fourteen days, but more time is advisable. In fact three or four months' absolute rest in a paddock or pasture is none too long if the best possible results are desired. The unnerved parts are thus given ample time to accommodate themselves to the new condition, the disease itself is given an opportunity to heal, and all of the neuritis incident to cutting the nerve trunk will have subsided. Plenty of rest under favorable

conditions is highly advantageous after any of the neurotomy operations. The immediate return to heavy work is generally disastrous.

Bilateral and Unilateral Plantar Neurotomy

SYNONYMS.—Plantar neurotomy; high plantar neurotomy; metacarpal neurotomy; the high operation.

DEFINITION.—The surgical division of one or both of the plantar nerve trunks a short distance above the metacarpo-phalangeal articulation, performed for the purpose of destroying the sensibility of diseased structures related or belonging to the articulations beneath.

HISTORY.—The history of plantar neurotomy is that of neurotomy in general, owing to the fact that this was the first of the neurotomy operations introduced into veterinary surgery, as well as the only one that was performed to any extent for more than half a century after its introduction. (See page 126.) During the past decade, that is during the real evolutionary cycle of veterinary surgery in America, it was the only neurotomy operation performed by the rank and file of the profession. The so-called "low operation," although generally known and understood, was avoided, except possibly here and there by certain well known practitioners and teachers in some of the leading colleges. Slowly, however, the digital operation gained prestige and largely supplanted it in the treatment of navicular disease, except as a kind of last resort operation when all other lines of treatment, including the low operation, had failed.

When first introduced into this country it was given an entirely too wide range of application. A number of European graduates, some of the earlier American and Canadian graduates and some few of the bolder empirics of which the profession was largely constituted, encouraged by the magical cure of various forms of lameness, perhaps laudable enough in their intentions, performed the operation right and left, anywhere and everywhere, for the trivial lameness and the severe lameness, for the acute case and the chronic case, for corns, ringbones, sidebones, and in fact for almost every diseased condition that is capable of causing a lameness. The result of this incongruous application is easily foretold in view of what is now known of neurotomies in general. Horse after horse was ruined. Feet disintegrated, hoofs were cast off, tendons were loosened from their bony attachments to the extent of bringing a justified prejudice against

the very thought of the word "nerving." Experienced horsemen justly condemned the procedure and the phrase "nerving a horse" became synonymous with "ruining a horse."

With a better understanding of the pathology of disease and a better judgment of what might be the result of depriving a diseased structure of its sensory innervation, the scientific veterinarian discarded the operation, except for certain special indications and for certain specific conditions not taken into account by the earlier enthusiasts. The result has been that high plantar neurotomy has again become a common operation, from which certain effects may be depended upon, without any great danger of disaster.

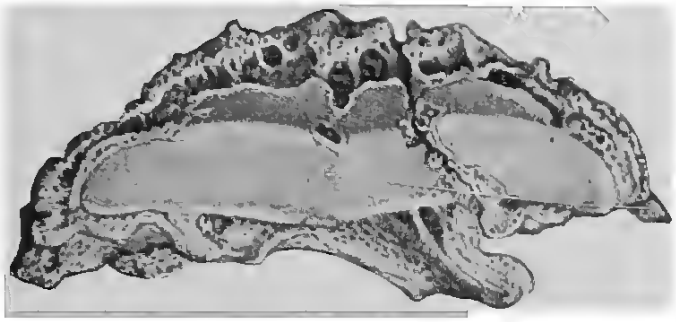


FIG. 78.

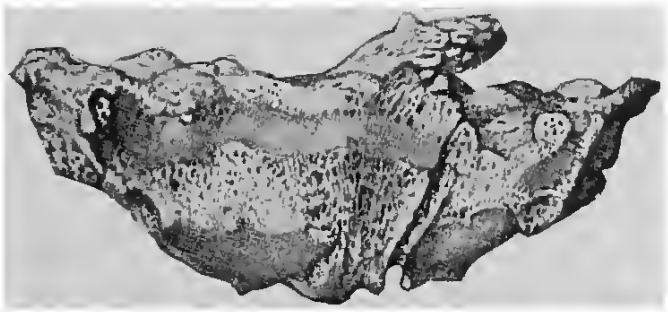


FIG. 79.

FIGS. 78 AND 79—Fracture of the Navicular Bone Following Neurotomy.

INDICATIONS.—In the treatment of **navicular disease,** which has heretofore been the chief indication for the operation, the low operation is recommended as par excellence the best one. It is only as a last resort that the high operation can be judiciously recommended. When the diagnosis is certain and the low operation has been given a fair trial, then and then alone should this operation be mentioned in the treatment of navicular arthritis. It is not always advisable even under such circumstances, for a lame horse or a stiff horse is generally more valuable than a hopeless broken down one. The most striking feature of "low" neurotomy is the frequent disappearance of the lameness, even after several months. Sometimes the lameness is increased in severity and then gradually subsides week after week. All of

these possibilities must be weighed deliberately before the performance of "high" can be justified. It is not in navicular disease that this operation finds its greatest usefulness. In this common affliction it might be truthfully said that any horse that does not receive a marked benefit from the "low" operation is too badly diseased to long survive the "high" operation. While there may be some exceptions to this rule, the practitioner will seldom encounter them. The practitioner who will take a positive and firm stand against the too free application of this operation for incurable navicular disease, will in the end gain more favor than the one who enthusiastically recommends it at every provocation.

Sidebones present by far the best indication for plantar



FIG. 82—Sidebone.

neurotomy. In these lesions it is a specific remedy, especially the **unilateral operation for the unilateral sidebone.** Here the operation is almost universally curative. It does not matter whether the patient is a heavy draft horse, a coach horse, a roadster, a hunter, or even a race-horse, the results are satisfactory. The exceptions are found only in the general contra-indications. Acute lameness is, of course, a restriction, as should be the case under any similar circumstance, and in very large sidebones the lameness may not always be entirely cured because they may mechanically obstruct the motion of the phalangeal articulations and thus cause a defective gait even when all of the pain is banished, but even in this event the patient is sufficiently benefited. The operation is equally beneficial for the large and the small

sidebone, for the one located anteriorly as well as the one situated at the posterior aspect of the lateral cartilage. The most important precaution is the examination of the heels for corns. The corn is often a serious complication of sidebone, in fact, frequently the latter has its origin in the former. This fact warrants a careful inspection of the heels to determine whether the corn is in fit condition for the operation. Sometimes the heel is intensely reddened, painful, threatening suppuration, or even fissured along the wall, so as to readily admit septic matter. Under these circumstances the operation is hardly advisable. It should at least be postponed pending a marked amelioration of this feature of the lameness.

In regard to side-bones Prof. W. Owen Williams truthfully says: "Neurotomy is more successful in removing this

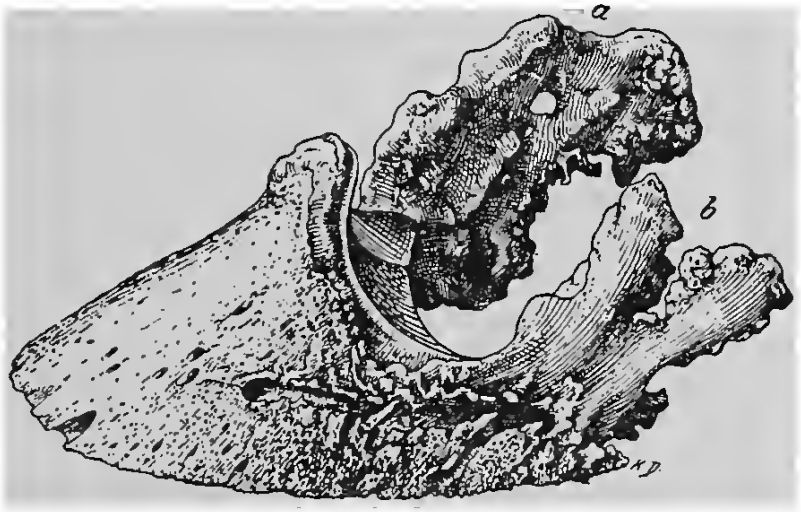


FIG. 83—Sidebone. Bilateral.

form of lameness, and it is attended with more permanent beneficial results than when performed for navicular disease." Reeks does not mention neurotomy in an exhaustive description of this disease, and like Moller gives his readers the impression that side-bone lameness is not important because it is trivial and transient. These tenets are a direct contradiction to our own observation among hard-worked horses and fast heavy-harness horses, both of which we have frequently found suffering from a chronic, troublesome lameness from side-bones that proved refractory to any of the ordinary lines of treatment, but which yielded finally and permanently to plantar neurotomy. If the condition chances to be unilateral, the division of the plantar nerve on the affected side may always be depended upon to effect a lasting relief of the lameness.

For **ringbones** the operation is not as universally successful, in fact it is sometime very treacherous. This indication must be more carefully judged. When the lameness is recent and pronounced it is strictly contra-indicated in every case, but in the old case in which the motion of the joints is already manifestly limited by a more or less firm ankylosis, plantar neurotomy very often transforms a useless animal into a fair worker although some lameness remains. The cure is seldom complete, but the degree of relief is often satisfactory. Ringbone may also be included among the indications for plantar neurotomy when all other remedies have failed. Here it is defended as an operation of last resort; the patient being worthless, any expedient may be tried. Quite frequently horses lame from very large ringbones are much improved by plantar neurotomy followed by the application of a roller-motion shoe to compensate for the obstructed joint action.

In both ringbone and sidebone the operation is often followed by a marked reduction in the size of the exostosis. They seldom increase after the operation has been performed; the productive process seems to be arrested by the interrupted innervation.

Lesions following nail pricks are sometimes suitable indications, but in no case must the operation be performed too early. It is only after a year or more that plantar neurotomy is a safe procedure in such cases, and then only when the lameness is not too pronounced. Too frequently the seat of mischief is located at the attachment of the plantar aponeurosis to the semilunar ridge. If the stability of the attachment is weakened rather than fortified by the inflammatory process, there is always considerable danger of a dissolution of the union, which, of course, would complete the ruination of the patient. On the other hand, when the inflammatory adhesions are stable, the removal of sensibility by neurotomy is perfectly safe and palliates or entirely cures the lameness. High heel calks are additional expedients.

Chronic lameness following quittor sometimes offers a suitable condition for unilateral plantar neurotomy, but here too, some time must elapse before the operation may be safely resorted to. A year or more after the quittor has healed is the appropriate time for intervention. In no event should it be performed earlier, on account of the grave danger of degeneration of the affected area.

Osteophytes of the os suffraginus, sometimes referred to as high ringbones, frequently produce an obstinate lameness

that will yield to no other treatment then the division of the nerve on the affected side. However, these cases are more effectually reached by the medium and the ulnar operations than by plantar. The latter nerve is somewhat too near the seat of disease to account for all of its innervation.

CONTRA-INDICATIONS.—The contra-indications for plantar neurotomy have already been mentioned under general contra-indications for neurotomy. It might, however, be advantageously repeated here that the operation is positively dangerous under many circumstances. Too often it is followed by casting of the hoof, or wrenching of the tendons and ligaments of the pedal articulations, to warrant a too liberal recommendation under any circumstances. In pronounced lameness of navicular disease, in any recent acute disease process or in subjects with weak, flat, deformed feet, its exclusion must be made an absolute law. Plantar neurotomy is an operation to be recommended with great caution. The practitioner must use the greatest discretion in the selection of every case, and the owners should always be made cognizant of the possible disastrous results. To fail in this is to invite discredit. **Chronic laminitis, recent ringbones** and **acute navicular disease** are the three principal conditions in which the operation is most likely to be misapplied. Feet affected with serious corns, especially those which have suppurated or threaten to suppurate, are likewise unwelcome subjects, whether they are causing lameness or not. In fact, the foot itself, aside from the disease for which the operation is to be performed, must be known to be sound and strong, and in no way predisposed to new dangers; otherwise it must be considered as a contra-indication. **Weak hoofs, hoofs with rough, friable horn, hoofs** affected with serious **corns, cracks, seedy toes,** or **convex soles** are sufficient reasons to exclude neurotomy in every instance. Another undesirable condition is the pastern that slopes below the normal angle in aggravated dorsal flexion. The straight pastern is much more favorable for neurotomy than the one excessively sloped; although the former will sometimes favor stumbling, the latter creates a greater susceptibility to degeneration.

Plantar neurotomy is always contra-indicated in the **hard-worked horse.** The nerved horse that is slammed recklessly along the stone-paved streets will never survive the operation for many months, and precisely the same may be said of the **horse occupied in pulling very heavy loads,** and the **one engaged in racing** or in very fast road work. While these

facts can not be erected as absolute rules, the exceptions are too few to ignore them as such.

RESTRAINT.—The recommendations made for digital neurotomy may be applied bodily to plantar neurotomy, with

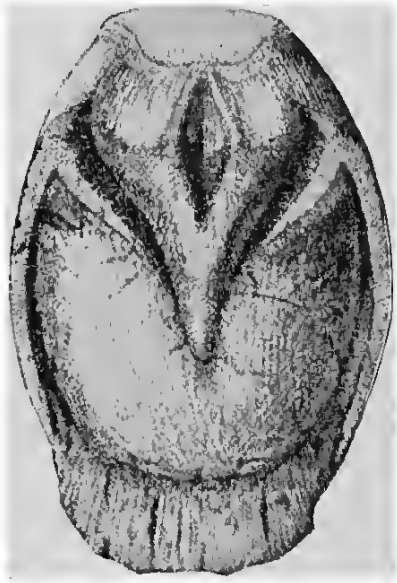


FIG. 84.



FIG. 85.

the difference that the latter, being so much more easily performed, is much more favorable for the **standing position.** The plantar nerve is easily found on dissection, it is superficial, it is located in an accessible place, its environs are

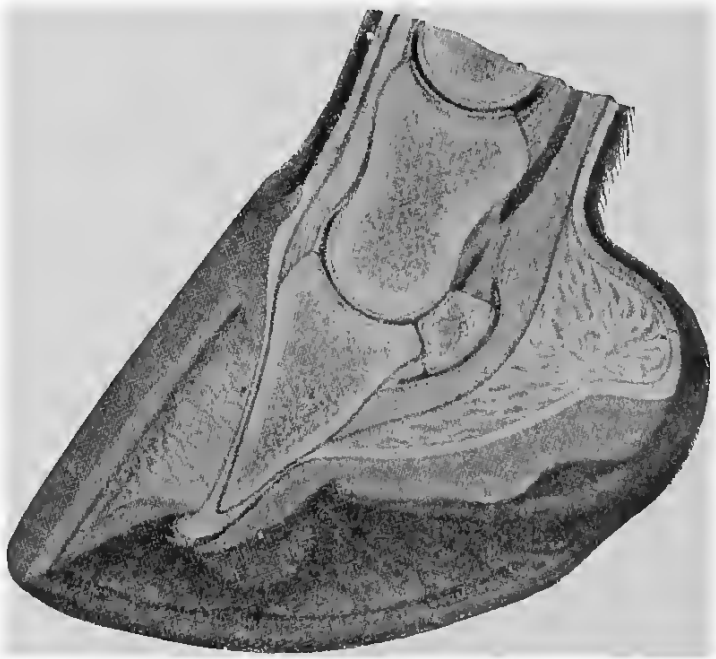


FIG. 86.

easily cocainized. The standing position suffices in most cases, especially when only a single leg is to be operated upon. The cocainization of four seats of operation and the dissection and division of four separate nerves, required in

operating upon two legs, sometimes provokes a troublesome restiveness that is deplored by a careful and particular surgeon. These facts suggest the standing position for the single-nerve or single-leg operation, and the recumbent for the double operation. The temperament of the patient may,

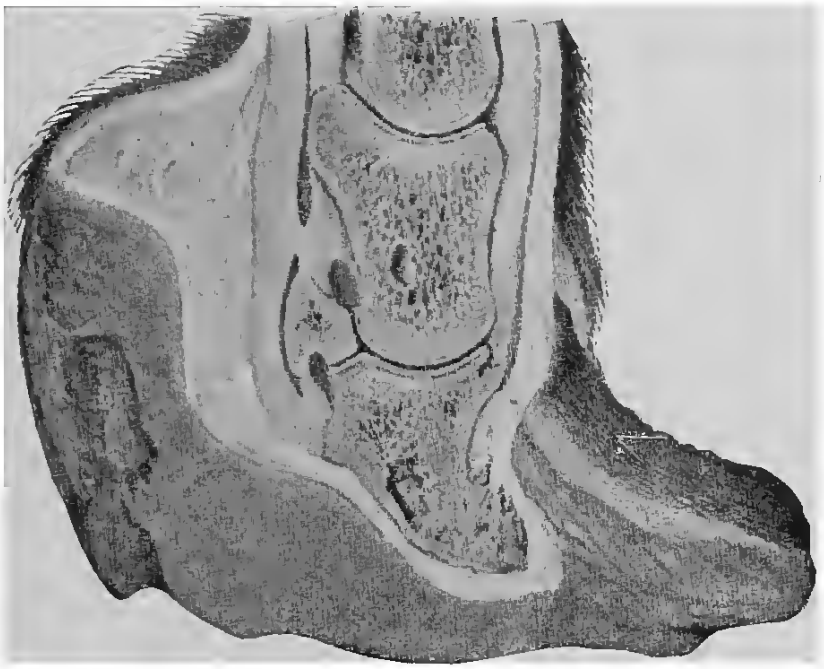


FIG. 87.

however, be regarded as sufficient reason for reversing this order.

EQUIPMENT.—The equipment recommended for digital neurotomy will answer, without addition or change, for

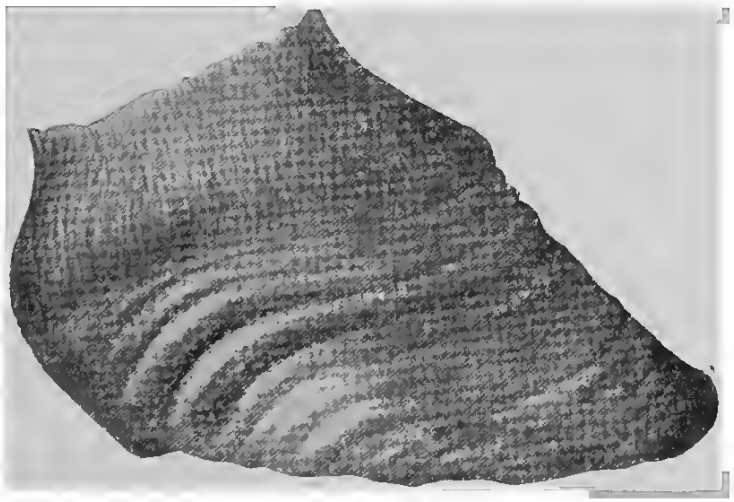


FIG. 88.

this operation. The elastic wound retractor (Fig. 90), not previously mentioned, is sometimes recommended as an effectual instrument to facilitate the dissection after the dermal incision is made. It is of no special service if the incision is made directly over the nerve, and besides the ten-

sion it brings to each edge of the wound is often so unequal as to draw the wound out of range and thus confuse rather than facilitate subcutaneous dissection. However, if the leg is abnormal from disease so as to require a long wound, and especially if the surgeon is without an assistant to bail blood, the elastic retractor is of service.

TECHNIQUE.—The operation proper is not unlike the digital operation in general, yet there are some sufficiently

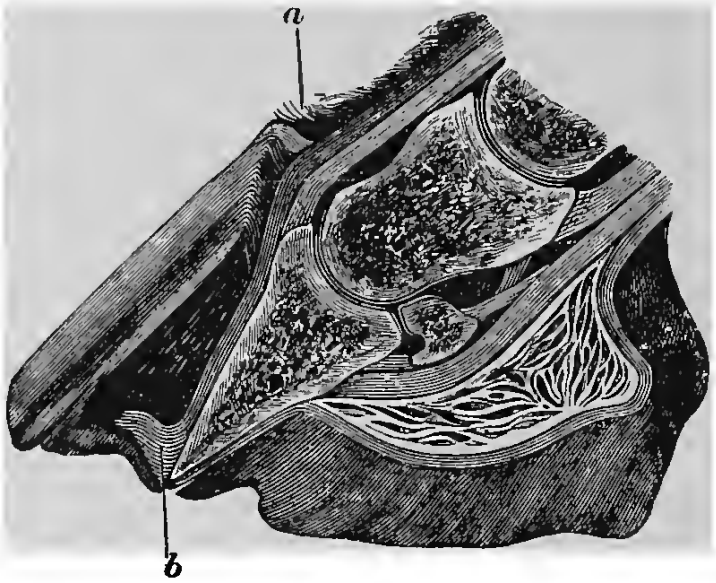


FIG. 89.

FIGS. 84, 85, 86, 87, 88 AND 89—Forms of Feet in which Neurotomy is Strictly Contra-Indicated.

salient variations in the details to demand a separate description.

First Step.—Locating the Seat of Incision.—The incision is made over the groove dividing the tendon of the flexor pedis perforans from the great suspensory ligament. It is made near the tendon rather than in the middle of the groove or too near to the ligament. The antero-posterior



FIG. 90—Elastic Retractor.

position of the incision must vary somewhat with the proximo-distal location selected. That is, if the nerve is to be divided high the incision is made in the middle of the groove some distance from the tendon, but if a lower location is decided upon it is made near the tendon, in fact almost over its level. At the low position (Fig. 92) the nerve lying in close contiguity to the vein is easily felt with the fingers and thus immediately suggests the exact location. There is always

more danger of making it too far anteriorly, than too far posteriorly, because the nerve is located posterior to the vein. If the incision is made so as to carry the wound in front of the vein, confusion immediately arises because no landmarks are disclosed in the subsequent dissection, but if made so as to bring the wound immediately behind the vein, the nerve will promptly come into the foreground. The aim should be to make the incision about two millimeters posterior to the center-line of the vein. The proximo-distal location varies according to circumstances. For the great majority of cases a certain location, just above the fetlock, at the very point where the round contour of the perforans tendon becomes indistinct, may be universally selected. Sometimes, however it must be made higher on account of some abnormality at the usual point. A large windgall, or a large cicatrix from interfering, will necessitate



FIG. 91—Highest Position of Incision in Plantar Neurotomy. The Elastic Retractor Applied.

a higher location; and again, when the operation is decided upon for a lesion some distance above the foot, a higher division of the nerve may be thought expedient. When the high location is decided upon the lower part of the middle third of the metacarpus is selected as the most appropriate spot. Here, where there are no synovials to injure, the nerve can be found quite as easily as at any other point except at the one already described, just above the fetlock, where the nerve is located by palpation.

Second Step.—Preparing and Disinfecting the Field.—As the wound in this operation occupies a rather conspicious position on the leg, special effort should be made to heal it with an invisible cicatrix. The preliminary requisite to such a result is a painstaking effort to disinfect the field adequately. It is advisable to clip and shave a rectangular space one and a half inches long and one inch wide around

the seat of incision, flood the region with water to wash off loosened hairs, bathe the denuded spot with a strong solution of mercuric chloride (1-500) for some moments, and then dry the surface by washing with pure alcohol. When the alcohol has evaporated the rubber tourniquet is wound tightly around the upper third of the metacarpus and the operation proper is begun.

Third Step.—Locating and Dissecting the Nerve.—An incision through the skin one-half inch in length is sufficient if the lower position (just above the fetlock) is selected, for here the nerve is superficial and easily found. The exact location is determined by palpation, as mentioned in the pre-



FIG. 92—Position of Incision for High Plantar Neurotomy.

ceding step. At the point thus indicated the scalpel is carried through the skin, exposing the subcutem at one firm, deliberate stroke. The skin must be cut completely through from one angle of the wound to the other so as to expose the underlying tissues throughout its entire length, and thus allow as much space as is possible for the subsequent dissection. When this incision is perfected one edge of the wound is stretched to the side with the dissecting forceps, and as the assistant bails out all of the blood, a few gentle longitudinal strokes with the scalpel will usually bring the glistening, whitish ribbon-like nerve into view. If this result is not immediately forthcoming, similar search is made at different points of the wound whose range is widened at will with the

dissecting forcep. If these manipulations are not fruitful the depth of the wound must not be increased until all of the blood-soaked areolar tissue in the foreground is picked up and dissected away. Most always this procedure will unmask the desired structure, which is then separated nominally along one edge preparatory to its elevation.

Fourth Step.—Elevation and Resection.—The elevator is forced under the trunk from before backwards or vice versa according to which edge was loosened in the preceding step, and then taken with both hands or between the second fingers of one hand and pulled quite forcibly outward from the superior commissure of the wound. This pulling process brings out one and a half and often two inches of the trunk, causes it to degenerate a considerable distance upwards and thus prevents the formation of sensitive scars and neuromas. When thus stretched the bistoury is passed beneath it as near to the superior commissure as possible, dividing it with an outward stroke. The divided trunk is then picked up with the dissecting forceps, loosened along the whole length

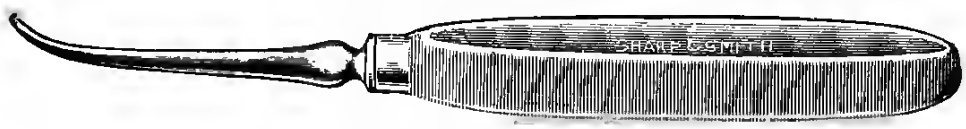


FIG. 93—The Author's Nerve Elevator.

of the wound with the scalpel and then divided at the inferior commissure.

Fifth Step.—Suturing.—The needles previously threaded and retained in an appropriately clean container are then picked up with the forceps, and needle holder. One edge of the wound is held with the dissecting forceps as the needle is inserted through the skin at the proper location with the needle holder held in the other hand. When the needle is pulled through this edge of the wound the other one is similarly elevated with the dissecting forceps as the needle, which has again been picked up with the needle holder, is passed through it. This manipulation of the suture, a recommendation belonging to the domain of general surgery, is repeated here because of the great importance of healing these conspicuous surgical wounds without the contamination that is certain to follow digital contact. During the course of such an operation the fingers are generally soiled in one way or another, and are at this stage unfit to handle the needle and thread that were so carefully sterilized. The single interrupted suture is generally sufficient except for long wounds where two might be required to assure perfect coap-

tation throughout the whole length. The mattress suture or the crucial, recommended for digital neurotomy, may also be applied with advantage.

Sixth Step.—Applying the Dressings and Wound Treatment.—Before the permanent surgical dressings are applied the whole region is rinsed liberally with the mercuric chloride solution to rid the surface of all blood or other attached particles. Then a large antiseptic-soaked piece of cotton is bound to the wounds with an appropriate bandage. This dressing is removed at the end of twenty-four hours and substituted by a dry antiseptic powder,—boric acid or iodoform, —which is renewed every day without molesting the wound

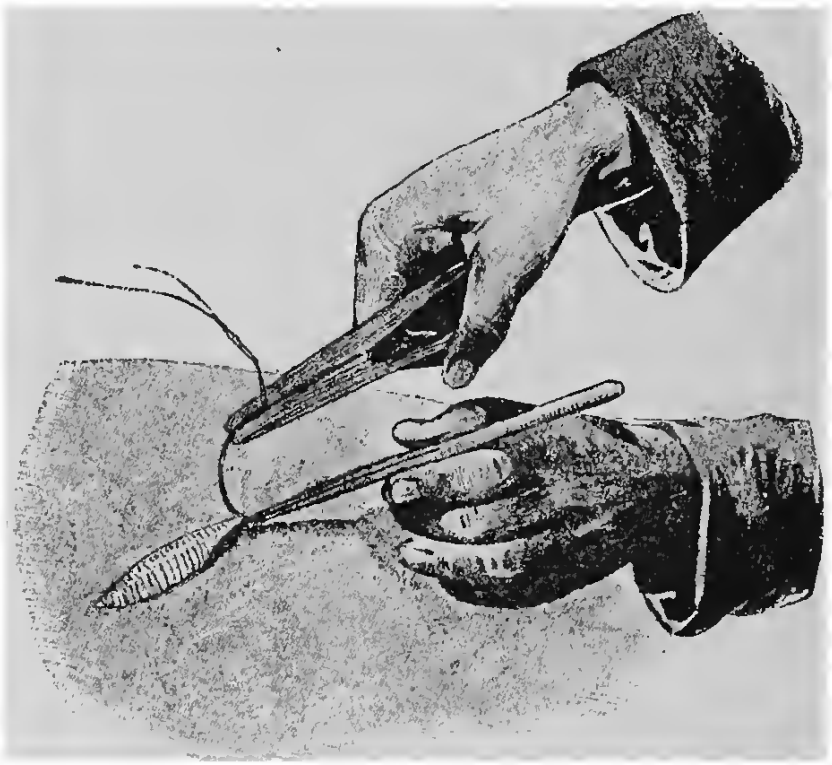


FIG. 94—Correct Method of Suturing Neurotomy Incision.

with washes of any sort whatever. At the end of six or seven days the sutures are removed, but the wound is submitted to the same treatment during the subsequent week, after which it will be found well healed.

AFTER-CARE.—The after-care of horses submitted to this neurotomy is special, owing to the grave danger of disaster to the feet from various causes. The feet of the neurotomized horse must be kept under a constant surveillance. They must not be submitted to the same insults as the healthy feet. Protection against wounds, bruises, nail-pricks, corns and cracks must not be omitted. Although these do not always develop into serious conditions if promptly

placed under appropriate treatment, they nevertheless always cause a justified anxiety to the experienced observer, because of the serious complications that may arise from them. In this connection it may be concluded that these lesions to neurotomized feet are always **much more serious affairs than similar ones in healthy feet,** in spite of the fact that they sometimes heal with more or less rapidity and without encroaching beyond the initial seat of injury. The greatest danger seems to emanate from their late discovery. The nail-prick or corn for example, escapes notice until manifested by a grave and extensive inflammatory condition that has passed the curable stage; and besides these acute infectious inflammations, often serious enough in healthy feet, are accentuated, insulted, abused by the reckless use of the affected part, which requires the great element,—pain,—to protect it against further injury. It is advisable as a protective expedient, to clip all of the hair from the coronet of the neurotomized horse so that wounds, cracks, etc., in that region may be more promptly discovered. To protect against nail-pricks suitable **sole-leather or metallic pads** covering the sole and frog, are nailed beneath the shoe, and the feet are examined daily for a possible penetration of these protective coverings. **Tar and oakum** packing beneath the pads will preserve the moisture of the hoof, as well as a more healthful condition of the hoof structure. Shoeing with **rubber pads** and iron tips answers very well where this style of horse-shoeing is available.

A protracted rest at pasture after the operation is always admissible, but is by no means as essential as after digital neurotomy. Exceptional care of the feet, preservation of their natural moisture, good shoeing, and a constant lookout for accidental wounds, are so many precautions to keep inviolate.

But, above all, the neurotomized subject, if its usefulness is to be preserved for any length of time, must be given an occupation that harmonizes with the seriousness of its pedal lesions. Otherwise the whole affair is certain to terminate unfavorably. Racing, speeding or heavy traction will not long be survived. A neurotomized, large draft horse will soon become absolutely useless from pulling a large dray or coal wagon, but the same subject, hitched only to a light express wagon at slow work, will often prove an exceptionally useful horse for many years. The speedway horse, in the same manner, makes a useful roadster or family horse, and so forth through the whole category of equine types.

SEQUELÆ AND ACCIDENTS.—Operative and post-operative accidents are more numerous from high plantar than from any of the other neurotomy operations. It was this operation that brought "nerving" into disrepute during previous epochs, and in many communities at the present time, but these need no repetition here, having been discussed at length in a previous paragraph under "Neurotomy." The most common unfavorable termination, described under the head "Breaking down of the diseased unnerved structures" follows in the wake of this operation with uncomfortable frequency. Unless all of the recommendations governing the selection of suitable cases, and unless all of the post-operative precautions are respected, high plantar neurotomy will prove more of a bane than a blessing to the veterinary practitioner and his clients. This sequel occurs in both an **acute** and a **chronic** form. In the former, it sometimes presents itself before the surgical wound has healed, or as soon as subject is returned to work, and may be manifested by wrenching of the plantar aponeurosis from its attachment, followed by turning up of the toe or by a rapid shedding of the hoof after two or three days of tumefaction around the coronary cushion. In the chronic or delayed form its encroachment is gradual, appearing first in the form of a tumefied, painless condition of the tendons above the hoof, and ending either in a severe lameness with volar flexion of the fetlock, or in only slight lameness with a gradually developing dorsal flexion of the same articulation. A **delayed break-down** is sometimes seen to follow the accidental wounds previously mentioned.

Among the accidents sometimes occurring during the operation is the accidental opening of the superior cul de sac of the sesamoidean synovials. This occurs during the dissection, as the result of a careless wielding of the scalpel or from a sudden jerk of the improperly restrained leg. It is a harmless incident if infection does not enter into the situation, at the time or during the healing of the wound.

Bilateral Digital Neurotomy.

SYNONYMS.—Low plantar neurotomy; digital neurotomy; the low operation.

DEFINITION.—Bilateral digital neurotomy is the surgical division of the posterior branches of the plantar nerve a short distance below the level of the metacarpo-phalangeal articulation.

HISTORY.—Digital neurotomy, so far as we are able to ascertain, was first performed in the London Veterinary College by Professor Sewell about the year 1817, some years after he had demonstrated the results of division of the whole



FIG. 95.



FIG. 95½.

FIG. 95 AND 95½—Wrenching of the Flexors (Break-Down) Following Plantar Neurotomy.

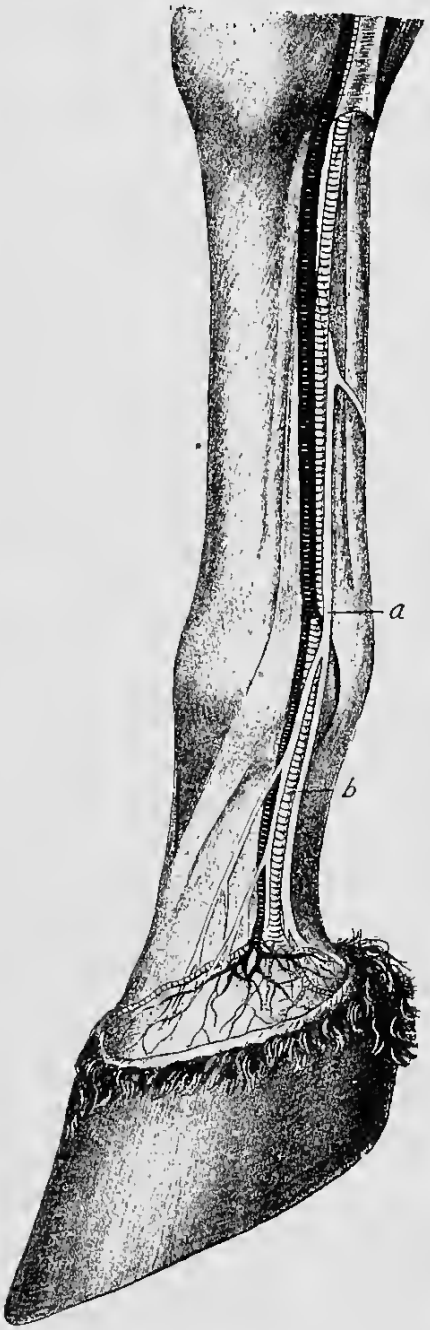


FIG. 96—Course of the Internal Plantar Nerve.
a—Seat of Section in High Plantar Neurotomy. *b*—Seat of Section in Low Plantar Neurotomy.

plantar nerve above the fetlock joint. There is little available history of the procedure during the succeeding years, beyond record of isolated cases here and there, performed

throughout civilized countries where scientific veterinarians were located. It was introduced in this country by graduate veterinarians from English colleges. The operation was mentioned by lecturers on veterinary medicine and surgery in the first American colleges, but it was little practiced until the '70's, when scientific veterinarians became more numerous throughout the American cities. During later years when colleges adopted better methods of teaching surgery, it gained more favor than any of the other nerving operations. It has been given precedence over the other operations, and was always recognized as the most valuable of them all, but being somewhat more difficult to perform than the high operation, there was some delay in its general adoption by the veterinary profession. Veterinarians who would have performed it in preference to the high operation denied their clients the benefit of its greater appropriateness because of the fancied difficulty of its performance. Today digital neurotomy is a standard veterinary operation, performed without ceremony by almost every veterinarian who makes any pretense to practice the surgical features of animal therapy.

INDICATIONS.—Digital neurotomy is performed for the single purpose of curing lamenesses due to painful diseased processes located in the region of the postero-inferior aspect of the second interdigital articulation. Lesions of the plantar aponeurosis, the navicular sheath, the navicular bone, described generally under the single appellation of "navicular arthritis" are the indications for the operation. The posterior digital nerve, the largest branch of the plantar, distributes its end organs largely to the solar aspect of the foot. It is the sensory nerve of the perforans tendon as it nears its strong attachment to the semi-lunar ridge; of the synovial apparatus that furnishes lubrication to the bursa interposed between the tendon and the inferior, fibro-cartilaginous face of the navicular bone; of the navicular bone itself; of the major portion of the velvety tissue and plantar cushion, and of the posterior and internal parts of the third phalanx. These structures are the seats of many of the morbid conditions which produce lamenesses of variable degrees of intensity in horses working upon paved streets. Sometimes the disease is an osteitis, sometimes a synovitis, sometimes a tendinitis, but more often it is a combination of all three. As to its cause, it is generally attributed to concussion, strain, rheumatism, etc., but from the very nature of its inception, course and termination there is every reason to suspect the

existence of a mysterious predisposing diathesis, probably a general abnormality of the bones, that contributes more to the cause than the traumatisms previously enumerated.

Aside from the disease known under the name of navicular arthritis, digital neurotomy is indicated in lesions of the same structure from direct wounds of the feet (nail-pricks) which have left a chronic lameness behind. In these cases the lesion is usually a partial adhesion of the plantar aponeurosis to the navicular bone, due to destruction by suppuration of the navicular synovials. In these cases it is only effectual when the lameness is not severe and when the lesion is not very extensive. Hughes recommends digital neurotomy very highly in **side bones,** for which disease he resorts to the operation freely and without fear of disastrous consequences under any circumstances.

The value of digital neurotomy depends upon the fact that the superficial foot structures are not unnerved, and that the hot bed of foot lesions is centered generally within the structures receiving sensory impressions from the posterior digital nerve.

The ideal case of navicular disease for the operation is the one with a slow progress that has never at any time been manifested by severe lameness, with a tendency to point the foot in the stall, and with a lameness marked enough when first going out but gradually diminishing with exercise. The foot may be somewhat smaller than normal and somewhat contracted at the heels, without distracting any of the prospects of a cure. The patient should, however, not be too old. Digital neurotomy is much more effectual in the young animal.

RESTRAINT.—The operation can be performed in either the **standing** or the **recumbent position.** The former is advisable only when but one leg is to be operated upon, as many patients become rather too restive before each of the four nerves have been exposed and divided. The seat of operation is anæsthetized subcutaneously by injecting about thirty minims of a five percent solution of cocaine hydrochlorate along the course of the nerve, some five to eight minutes before the incision is made. A twitch is applied to the upper lip and an assistant supports the leg, flexed backward as shown in Fig. 97. The operator sits upon a low stool, kneels or leans forward at a comfortable distance from the leg.

The recumbent position is advised for operations upon both legs and in restive animals. Either the casting har-

ness, the hopples, or the operating table will answer. The latter is, however, preferable, owing to the elevated position of the field of operation, the perfect immobilization of the leg, and the possibility of performing the surgical work much more cleanly than is possible upon a litter of straw, shavings or peat. To take the best advantage of the table restraint, the two legs are first tied tightly to each other with a strap or rope arranged in form of a figure 8 just above the knees, or if in hind legs, above the hocks. (Fig. 22, Vol. II.) The affected leg is released from its hopple and fixed forward with a smaller strap fastened around the coronet and passed over the heel. This places the fetlock in dorsal flexion and brings a desired tension upon the region to be incised. Co-

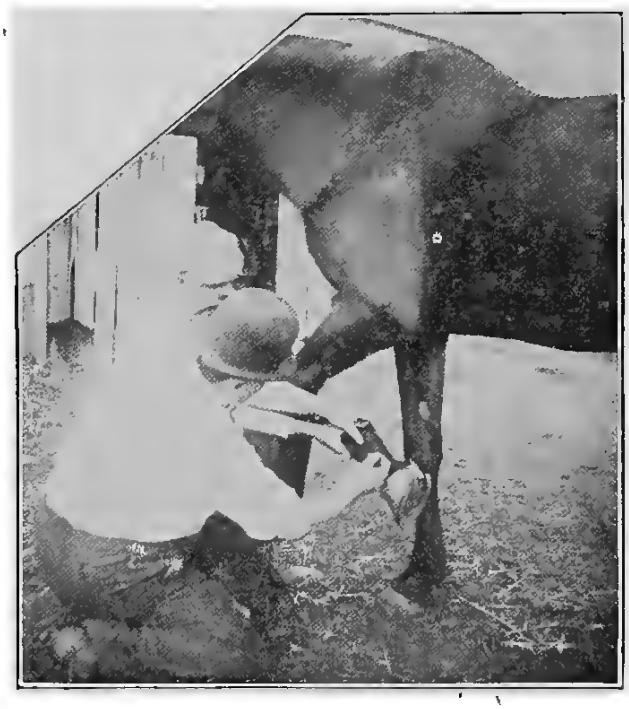


FIG. 97.

cainization of the field completes the restraint. When one digital nerve has been divided, the wound is covered and the legs reversed, to similarly secure the other leg for division of the opposite nerve on the opposite leg. When this has been done the patient is returned to its feet and placed end for end upon the table and the same manipulations repeated. This form of restraint requires careful protection of the previously made surgical wounds against bruising in the hopples and contamination with dirt while the operation is proceeding and while the patient is being reversed upon the table.

If the casting harness is used, several methods are available for immobilizing the leg. One of them consists of fixing it at a right angle from the body by a rope extending from

the knee to the hopple of the hind leg, and another around the coronet to the hands of one or two strong assistants, who pull forward. Another method adopted to advantage by many surgeons consists of fixing the leg along its entire length to a board. This method fixes the leg quite thoroughly by preventing flexion of the knee. The board may be made to extend outward some distance from the foot so as to give the assistant holding it more advantage.

The English hopples are not as applicable to this operation as either of the above apparatuses, although they are



FIG. 98.

FIGS. 97 AND 98—Digital Neurotomy in the Standing Position.

Fig. 97—Position of Operator and Assistant while Operating upon the External Nerve. *Fig. 98*—Position of Operator and Assistant while Operating upon Internal Nerve.

very often used. The best advantage is taken by releasing the affected leg from the hopple and then fixing it tightly to the hind leg with a strap or rope. The disadvantage here is found when the patient is rolled over to expose the opposite side. The operating field will be found hidden beneath the horse's body and is only made accessible after it is released from its fixed position, far enough to bring it from under the body. The leg is then found to have too much freedom for careful surgical work. The board method above described may, however, be resorted to with some degree of safety, but

on account of the extended position of the three hoppled legs the operator may be constantly molested.

Whatever restraint is selected, the operator should see to it that the seat of operation is perfectly fixed, or at least perfectly controlled, because a badly secured leg will often demoralize the whole affair, especially with a young, inexperienced surgeon at the helm. With a good restraint and with a good tourniquet to eliminate the blood from the surgical wound during the dissection, the operation itself will be found a very simple one.

In casting horses upon litter some precaution must always be taken to prevent soiling the wounds with flying particles whirled about by the patient's struggles. On this account cocainization should not be omitted, and when the patient is rolled over the sutured wound on the opposite side of the leg requires some protection. A clean cloth or rubber sheet may be placed beneath the leg to very good advantage from this standpoint. The operation can be performed by rolling the patient over but once by operating upon the external nerve of one leg and the internal one of the other consecutively. It is, however, preferable to operate first upon one side of a leg, roll the patient over for the other side, apply the permanent bandage, fix the leg to its original position and then repeat the same procedure on the opposite leg. This course prevents any unnecessary exposure of the wounds and saves some time required in tying and releasing the legs, but necessitates rolling the patient over twice. Either course may be selected.

General anæsthesia is never an absolute necessity in digital neurotomy, because pain is fairly well banished with the local anæsthesia. The latter, from the standpoint of humanity, should, however, never be omitted in the recumbent operation. In the standing posture it is essential, as few horses would submit to the pain unless the seat of operation is partially or completely anæsthetized.

EQUIPMENT.—The following are the essential articles required to perform the operation in the proper fashion:

1. The securing apparatus, harness, ropes, hopples, table, or twitch, according to the kind of restraint decided upon.
2. Rubber tourniquet to control the hæmorrhage.
3. A pan of warm water containing soap, razor and sponge to wash and shave the field.
4. A pan of mercuric chloride solution, 1-500, containing a sponge or cotton pledgets to disinfect the field.

5. A small bottle of alcohol to dry the field and complete the disinfection.

6. A pan containing sterilized water or a clean solution of mercuric chloride 1-2000, to be used by the assistant to bail blood from the wound as the dissection proceeds.

7. Bandages and cotton to temporarily protect the wound on one leg as the other one is being operated upon. (Necessary only in table restraint.)

8. Bandages and cotton to protect wounds permanently when operation is complete.

9. Scalpel, dissecting forcep, nerve elevator and needle holder.

10. Tray for the instruments.

11. Needles threaded with sterilized silk, one for each wound.

12. Hypodermic syringe and 5 per cent solution of cocaine.

TECHNIQUE.—The technique of the operation, beginning after the horse has been secured and the leg brought into the appropriate position, is as follows:

First Step.—Locating the Seat of Operation.—The line of incision extends along the border of the tendon of the flexor pedis perforans on the inferior aspect of the fetlock joint. (Fig. 99.) The posterior digital nerve, the plantar artery and the plantar vein are located superficially in the groove intervening between the border of this tendon and the posterior border of the os suffraginus. These three anatomical structures are grouped together in a sheath of areolar tissue, the nerve occupying the posterior location closely related to the vein. The artery occupies the anterior position in the group, located somewhat deeper than the nerve and on the opposite side of the vein. Counting from before backwards these structures are arranged as follows: Artery, vein and nerve.

Second Step.—Disinfection of the Field.—The hair is clipped with the clippers or scissors, well lathered with soap and water and then shaved over a surface one inch square. The field thus shaved is well rinsed with water to rid it of loosened hairs, washed for some moments with the mercuric solution, 1-500, and then dried with alcohol.

Third Step.—The Incision.—The incision is made through the skin three-fourths of an inch long, at one stroke if possible, made slowly and deliberately. The nerve can often be elevated through a much shorter incision, but since

the wound will heal by primary union there is no object in hindering the manipulations by a too short incision.

Fourth Step.—Locating and Dissecting the Nerve.—The incision is held apart with the dissecting forceps holding one edge, the blood is bailed out and the scalpel is stroked cautiously through the underlying subcutaneous areolar tissue. If there is any blood-soaked areolar tissue to mask the anatomical elements it should be picked up gently with the dissecting forceps and cut away. Usually these manipulations reveal the **ligament of the ergot,** an aponeurotic structure that is frequently mistaken for the nerve. A close



FIG. 99—Position for Incision for Low Plantar Neurotomy (Digital Neurotomy).

inspection, however, readily discloses its identity. The nerve will be found lying just beneath the posterior border of this aponeurotic structure, which is now pulled aside with the dissecting forceps as the scalpel is made to cautiously separate the connecting areolar stroma, which feebly unites all of the structures to one another. One or two longitudinal strokes through this stroma will usually bring the glistening nerve trunk into view in the form of a whitish ribbon very closely attached to the round blue vein. If the nerve is not immediately discovered the incision must not be immediately carried deeper. The blood must first be well bailed out and the masking areolar stroma must be picked

up with the forceps and cut away as before. Sometimes, when the region is abnormal from disease, or when the incision has not been accurately made, the ligament of the ergot may not be observed in the dissection. In such an instance superficial search of the parts is made to locate either the nerve or the vein. If the nerve remains hidden the vein can be used as the land-mark for further search. In every case the nerve will be found adjacent to its posterior aspect, never far beneath its outer level and never anterior to it. In some rare instances anomalies of these relations may exist, but these are so very rare as to require no consideration whatever. Suspected changed relations are generally found to be non-existent when the nerve is finallly discovered.

Fifth Step.—Elevation of the Nerve.—Once discovered, the trunk is loosened at one part of one border to give a point of entrance for the nerve elevator, which may then be easily slipped beneath it to the opposite side of the wound. Unless this is respected the elevator, if pointed, might perforate the vein, and if blunted the parts are unnecessarily disturbed, mutilated. When once the elevator is safely passed beneath the trunk, a little tension is brought upon one end so as to draw the trunk outward as the scalpel loosens it from its loose areolar attachments from one angle of the incision to the other. This done the elevator is grasped with both hands, one at each end, and drawn firmly outward until about one inch of the nerve trunk is dragged out from above.

Sixth Step.—The Neurotomy.—The nerve thus stretched and now hanging loosely out of the wound, is divided first at the proximal angle and then at the distal angle. The object of thus stretching the nerve trunk before dividing it is to encourage a degeneration as high up as possible. Any divided nerve trunk will degenerate several nodes proximally; if stretched the degeneration will extend much higher and as a consequence no neuromas nor painful scars will supervene the operation.

Seventh Step.—Suturing the Wound.—The incision is freed from all blood and examined for hairs that might have possibly floated into it, and is then sewed with a single interrupted stitch, mattress stitch, or preferably the crucial stitch, which is par excellence the best one for the small incision of neurotomy. (Fig. 58.)

Eighth Step.—Applying the Surgical Dressing.—In the recumbent operations the patient might advantageously be

allowed to regain the standing posture before the dressings are applied. When they have been already applied, as a matter of protection as the operation is proceeding, their removal and re-adjustment is commendable. The lapse of a few minutes between the completion of the operation and the application of the first permanent dressings is advisable, because all of the hæmorrhage will then have stopped and no blood will saturate the bandage. It has been the writer's practice, when performing the operation with table restraint, to first return the patient to the standing position and then rinse the region well with liberal quantities of mercuric chloride solution to rid it of all blood, dirt, hairs, etc., that are certain to contaminate the parts more or less during the surgical work. After this rinsing, a large pledget of cotton, well soaked in the same solution, is bound to the wounds with muslin bandages.

AFTER-CARE.—The horse just operated upon is placed into a single stall and tied to prevent lying down for at least five days, at which time union will have become firm enough to resist the molestation caused by flexing the legs in the act of lying and rising. At the end of the first twenty-four hours the mercuric chloride pack applied at the completion of the operation is replaced by a potent antiseptic powder (iodoform) held in place by cotton and bandages. This may be renewed every day, but always without disturbing the wound. Washing, wiping, or any form of cleansing is prohibited because of the great danger of molesting the agglutinating edges before stable tissue has formed between them. It is only when there is evidence of sepsis that such treatment is advisable. At the end of six days the stitches are removed, the dry dressing applied for several days more and then discontinued. On the fourteenth day the healing process is well advanced, in fact completed.

To obtain the best possible results from digital neurotomy for navicular disease the horse should not be immediately returned to work, but instead should be given a protracted rest lasting at the very least one month. If kept in the stable the shoes must be replaced and the feet kept moist by occasional tub baths, swabs and clay or oil meal packing. The soles should be pared thin, the toes shortened moderately and the heel-calks slightly elevated. It is, however, preferable to turn the neurotomized horse into a large paddock to pasture, there to remain for several months, and when finally returned to work the occupation should not be an arduous one. The subjects thus operated upon and

managed remain sound and useful for a whole life-time at light occupations, while others will become lame again under the strain of hard or fast work.

ACCIDENTS AND SEQUELÆ.—While digital neurotomy is much less hazardous than any of the other neurotomy operations, it is not entirely free from adverse elements. (1) During the operation there is some danger of accidentally opening the inferior cul-de-sac of the sesamoidean synovials with the scalpel. A sudden jerk of the poorly secured leg or a slip of a sharp scalpel when this sac is highly distended is sometimes the cause of this unfortunate incident. If the wound thus made is aseptic and no septic matter is permitted to enter it afterwards no bad results will follow, but on the other hand, if the sac becomes the seat of an intense purulent inflammation, severe lameness of long duration, the formation of numerous abscesses at different parts of the sheath with a final tumefaction of the fetlock are certain to follow. (2) Wounding or division of the plantar artery or vein occasionally occurs during the dissection, or by deliberately cutting them through when mistaken for the nerve. When this accident occurs the cut vessel should be dissected loose and ligated proximally and distally, leaving the ends of the ligature threads to protrude through the incision to facilitate their removal. (3) Neuromas and painful scars sometimes supervene. The former is prevented to some extent by stretching the nerve well before dividing it, and the latter by promptly healing the wound. (4) Break down, so-called, does not often follow this operation, although it does occasionally occur, in the form of a partial dissolution of the plantar aponeurosis from the semilunar ridge, manifesting itself in the form of a very acute lameness, and a pronounced tumefaction of the tendinous structures at the heel of the foot. Loss of the foot has never been reported from this operation.

MEDIAN NEUROTOMY.

DEFINITION.—Median neurotomy is the surgical division of the median nerve at the level of the humero-radial articulation, (the point where the nerve passes superficially over the internal tuberosity of the radius).

DISTRIBUTION OF THE MEDIUM NERVE.—The medium nerve is a radicle of the great **brachial plexus,** although its course in a dissection is easily traced beyond this aggregation of nerve trunks, to the eighth cervical and

the two dorsal spinal nerves, from the plexus of which it is an important component part. It accompanies the humeral artery along the arm to the internal aspect of the humero-radial articulation. Descending from this point it first becomes very **superficial** on traversing the level of the internal radial tuberosity, but soon turns rather sharply in an outward direction to take its place behind the radius in company with the posterior radial artery and vein. From a point one inch below the radial tuberosity it is **quite deeply imbedded** between the radius anteriorly and the flexor muscles posteriorly, which position it maintains to the level of the carpal sheath, where a **large branch** is given off to join the ulnar in forming the **external plantar nerve,** while the main trunk continues on the inner aspect of the leg as the **internal plantar nerve.** In the region of the arm it gives off a large branch—the **antibrachial nerve,** which, after supplying the surrounding muscles, passes down the anterior aspect of the leg, losing itself in the skin and antibrachial fascia as far down as the carpus. At the level of the elbow a **large branch** is supplied to the flexor muscles of the phalanges, passing backward to an obtuse angle from the trunk to reach the fleshy portion of these muscles.

In the region of the arm the medium nerve is a mixed one, its branches furnishing both motor and sensory impressions to the adjacent structures, but after passing the elbow, and probably at some small distance above, it contains only sensory fibres. The antibrachial branch proceeding from the region of the arm is mixed, but is chiefly concerned in furnishing sensation to the skin and fascia of the fore arm. The branch to the flexor muscles of the phalanges is largely sensory, as its division leaves no depreciation of the motion of the muscles. Its most interesting and important behavior occurs at the carpus, where it **contributes to the formation of both plantars,** a small part only going to the ulnar to form the external plantar, the major portion continuing in its downward course as the internal plantar. The median nerve, therefore, contributes to the innervation of the external aspect of the leg and foot below the carpus, as well as furnishing all of the sensation to the internal aspect. When divided at the elbow, sensibility is banished from the internal portion of all of the structures from the lower third of the metacarpus to the sole of the foot with absolute regularity. The tendons, the bones and the skin of the middle and upper thirds of the metacarpus are only partly unnerved —a certain part of their sensibility is retained. On the ex-

ternal portion of the leg the insensibility is incomplete throughout, for here the ulnar nerve contributes largely to the innervation. Complete banishment of sensibility by dividing the median nerve is limited to parts of structures; no entire articulation, bone, tendon or synovial is entirely deprived of its nerve supply. The greatest effect is upon the internal half of the sesamoidean apparatus and the skin covering that region. The external half of the sesamoidean apparatus and the skin covering it are but partially benumbed. The skin of the internal heel and the internal part of the navicular apparatus, lateral cartilage, os pedis and laminae are unnerved but the external portions of the same structures, like those of the fetlock, retain a part of their sensibility.

HISTORY.—Median neurotomy is a comparatively recent acquisition to the surgery of horses. It was first performed by Peters in the year 1885 at Berlin Veterinary College, and was introduced into America during the 90's, being performed for the first time in this country by Prof. Harger, of the University of Pennsylvania. Its introduction to the profession generally occurred through the medium of a translation of Pellerin's small manual entitled "Median Neurotomy," translated from the French by Prof. Liautard. Following the instruction given in this small book American veterinarians practicing in the large cities, promptly began applying the operation to the indications for which it was recommended. At first, like almost all new lines of treatment, it was credited with rather extravagant results, but experience subsequently simmered this fallacy to a sensible level. It was championed as an absolute cure for the lameness of draft-horse tendinitis, coach-horse carpitis, splints, osteophites, ringbones, sesamoiditis and navicular arthritis, but later it was proved that its appropriate range of application was somewhat more limited. Today median neurotomy is regarded with more suspicion than at any time in its history, because of its proven uncertainty, and is being recommended only as a kind of last resort operation when all other treatments have failed.

INDICATIONS.—Median neurotomy banishes the sensibility from such a wide range, from so many important structures, from structures other then those implicated in the disease causing the lameness, that it must never be hurriedly resorted to. Other expedients having failed, it is sometimes excusable. The obstinate cases of lameness, due to lesions in the supporting structures supplied by this

nerve, that have proven to be absolutely refractory, are the only indications considered by the cautious practitioner. A hurried resort to median neurotomy should be avoided, because other methods—firing, blistering, etc., may determine a better result, a more lasting cure.

The operation is, however, not without its redeeming features. In fact, it has a sphere of usefulness in cases of lameness where chronicity and diffusion of the lesions render other lines of treatment ineffectual; where the lameness, in spite of everything, persists; where the subject is deemed worthless. It sometimes occurs that horses have a combination of diseases along the course of the leg. Thus **navicular arthritis** may be complicated with **lesions in the bones, synovials and tendons** as far upwards as the carpus. When such an aggregation of lesions continue to cause lameness after the usual palliative methods of treatment and have failed to yield entirely to digital neurotomy, very often median neurotomy will promptly give a satisfactory degree of relief. The acme of its value is reached in this particular instance. When the operation is performed for a definite lesion; wherever located, it usually fails to bring the desired effect, except in certain lesions about the fetlock, or when accompanied with ulnar neurotomy.

Osteophytes located on the internal aspect of the os suffraginus, after having resisted the usual treatment of firing, blistering and rest, require the operation in lieu of any other treatment. In these cases a lasting benefit is sometimes derived, but when the lesion occupies an external position or extends across the entire bone, the benefit is only a partial amelioration of the lameness. Periosteal inflammations often produce osteophytes at different points of the legs, on the os suffraginus, on the metacarpus, or in the region of the splint bones. These may or may not implicate the articulations. When such abnormalities are non-articular and located on the internal aspect of the leg, median neurotomy will effectually, and often permanently, dispatch the lameness resulting from them. On the other hand when located externally, or when transgressing upon the ginglymoid articulations, the operation is ineffectual or dangerous.

Tendinitis.—The circumscribed lesion of the tendons of draft horse located at the level of the upper third of the metacarpus due to severe traction-strain or rupture, and manifested by a painful tumefaction, lameness and volar flexion that often persists after firing and rest, has been from the start, regarded as the chief indication for this oper-

ation. Peters, Pellerin, Harger, Adams and others have recommended it for this condition during the earliest days of its history. Their attitude toward it today is not known to the author.

In nearly every case the benefit is only a partial relief of the lameness; sometimes the relief is scarcely perceptible, while at other times a satisfactory degree of amelioration is obtained. In short, median neurotomy is far from being a pronounced success in curing the lameness accompanying **draft-horse tendinitis.**

For the **"bowed tendon"** of the race horse, whether located at the lower third or the middle third of the metatarsus, median neurotomy cannot be recommended in the horse intended for racing purposes, although quite effective when the horse is given but slow work thereafter. The unnerved "bowed tendon" will not long withstand the severe strain to which it is subjected in racing. Firing and blistering is a much better treatment, all things considered.

Carpal synovitis or **carpal osteitis** (knee spavin) is seldom sufficiently benefited to warrant a further recommendation of the operation in their treatment. The knee structures receive innervation from other nerves and from branches originating above the seat of operation. Purely carpal inflammations must, therefore, not be submitted to median neurotomy with the expectation of relief from the pain and lameness they produce.

Ringbones, after having been treated unsuccessfully by the usual palliative treatments, are suitable indications in very many instances. Here median neurotomy is preferable to the high plantar operation because the entire nerve supply is not cut off from the seat of disease. The ulnar nerve, through its plantar fibers, still preserves some of the sensation, and thus leaves the parts less exposed to injury, but prevents a complete cure of the lameness. Often however, the benefit is ample, in that the subject is made more serviceable. The ringbone that is confined largely to the internal aspect of the digital bones is the ideal one, especially if old and if no longer in the siege of an active inflammatory process. It is preferable that the bony deposit has already obstructed the motion of the articulation. A bony prong or two transgressing upon a joint without mechanically limiting its motion will grind into the surrounding soft structures and promptly cause a serious incurable disturbance in the latter, when sensation has been banished from the region. Thus new ringbones or the rather trivial periarticular oste-

ophytes are seen to be much more unfavorable conditions for neurotomy than the old or more diffused lesions of the same class. The lameness of ringbone may be marked without distracting from the results, but in no case should the operation be performed when the lameness is acute or changeable.

Sesamoiditis.—Inflammatory conditions localized in the sesamoïdean apparatus,—sheath, bones or ligaments,—of known chronicity, are ideal indications for median neurotomy. The cure of the lameness from such lesions is an absolute certainty in almost every case. The median nerve seems to supply the sensation for this region. The ulnar nerve seems to have relatively less influence in the sesamoidean apparatus than in the other structures it assists the median to supply. It is essential that the process be chronic, and preferable that it be confined to the internal aspect of the region. Diffuse sesamoiditis, however, yields to the operation in almost every instance, but if any lameness remains the ulnar operation will perfect the cure.

Sidebones.—Unilateral sidebones are best treated with unilateral high plantar neurotomy, but it sometimes happens that the internal one is large and the external one small, or that the former causes proportionately more of the lameness than the latter. In this event median neurotomy is advisable over the bilateral plantar operation because some of the sensibility of the foot is retained.

CONTRA-INDICATIONS.—Median neurotomy should not be performed with impunity in any case whatever, as there is always some danger of wrenching some of the ligaments of the diseased part, of loss of the hoof, or of aggravating the lesion, whatever its location or character may be. It must be applied with the same respect for the limitations governing all the neurotomies. Acute, new, serious, aggravated or highly painful diseases constitute so many forbidden conditions. In these states there must be no exceptions, and the feet, like in plantar neurotomy, should be of good quality and conformation, free from threatening corns or traces of chronic deforming laminitis. The legs and the feet should be strong, and capable of performing their several functions after the pain no longer acts to protect them against injury. A **serious sesamoiditis** is more likely to terminate badly than any of the other diseases for which the operation is performed. Very often the fetlock will become painful, swollen and hot as soon as the horse is put to work. The sesamoidean ligaments are torn from their attachments and the whole region becomes the seat of a serious diffused

inflammation which may suppurate and break down entirely. In serious **navicular arthritis** loss of the hoof sometimes occurs but this danger is not so liable to result as in the high plantar operation.

RESTRAINT.—Median neurotomy is performed in the **lateral recumbent position,** with the affected leg undermost and **pulled out at an obtuse angle from the body** so as to plainly expose the internal level of the elbow joint. The more the leg is pulled out from the body the more accessible is the seat of operation. The casting harness, the casting ropes, the English hopples or the operating table may be used, each with good advantage. Whatever apparatus is used the leg to be operated upon is released from its tie and brought out at an angle of forty-five degrees from the long axis of the body and there held or fastened firmly. The seat of operation is anæsthetized subcutaneously with a five per cent solution of cocaine hydrochlorate. General anæsthesia is unnecessary, although it greatly facilitates the work of retaining the leg in the indispensable position above mentioned. The operator none too confident of his ability, or the practitioner who operates only occasionally, should administer a general anæsthetic (chloroform) with the object of securing perfect immobilization of the seat of operation. In performing median neurotomy, it is found that the relations of the structures of the region change considerably with different positions of the leg. An incision made directly over the nerve with the leg in a given position may be found some distance to one side or the other when the leg is drawn to another position. This fact necessitates keeping the limb at a certain given point from beginning to end, which is not possible if the animal struggles. This circumstance may be of no importance to the experienced surgeon, but it is always certain to greatly confuse the novice. When the casting harness is being used the leg is secured by first fastening it at the proper angle with a stay rope extending from the knee to the hopples of one of the hind legs, and then looping another rope around the pastern to be held forward either by passing it around a convenient post or ring, or directly to the hands of one or two strong assistants. The latter is preferable because if the horse changes position by struggling the assistants can more easily change theirs than if the rope is stayed by a post or ring. On the operating table, which is the most satisfactory apparatus for this operation, the fixation of the leg is simple. It is released from the hopple, brought forward to the proper angle and

re-fixed with straps that will prevent any movement.

EQUIPMENT, necessary to perform the operation of median neurotomy:

1. Securing apparatus.
2. A pan of water containing soap, razor and sponge.
3. A pan containing mercuric chloride solution, 1-1000.
4. A tray for the instruments.
5. One needle armed with silk enough for two stitches.
6. Scalpel, small probe-pointed bistoury, nerve elevator, dissecting forceps, and artery forceps.
7. A pair of wound retractors (useful but not always essential).
8. Hypodermic syringe and 5 per cent solution of cocaine hydrochlorate.
9. Cotton pledgets for bailing and washing.

TECHNIQUE.—After the subject is cast and the leg brought to the appropriate position already described, the technique is as follows:

First Step.—Locating the Seat of Operation.—Median neurotomy is performed over the internal radial tuberosity, the level of which is brought prominently into the foreground by securing the leg in the proper position. This bony protruberance is easily located by palpation. If the finger tips are pressed into the groove between the internal border of the radius and the flexor muscles, and gradually slid upward with firm pressure, a hard, rounded obstacle will be encountered as they approach the level of articulation. This is the radial tuberosity, over which the median nerve passes rather superficially, and upon which it can be felt by lateral movements of the finger tips. The exact seat of incision is a line passing vertically over the radial tuberosity, exactly parallel to the internal border of the radius, but about one-half an inch behind it.

Second Step.—Disinfecting and Anæsthetizing the Field.—The region is washed, shaved, well rinsed with mercuric chloride solution, and then anæsthetized with subcutaneous injections of cocaine.

Third Step.—The Incision.—The skin is tensed with the first and second fingers of the left hand, care being taken not to disturb its normal relations. The skin here is so loosely arranged that it is very liable to be carried in one direction or other while tensing it, and thus leave the incision some distance from the desired location when the tension is removed. The incision through the skin is then made with the scalpel by one firm stroke from above downward.

Only the skin is divided at this time. The underlying areolar tissue may then be picked up here and there and cut away in search of one or more rather prominent veins which cross the field. When these appear upon the foreground they are twisted with the forceps to avoid a masking but trivial bleeding.

The **subjacent muscle** now exposed is divided from one commissure of the skin incision to the other by a number of cautiously directed strokes of the scalpel. As this incision proceeds the dissecting forcep in the left hand is used to separate the divided muscle in search of the underlying thick fascia which bounds the muscle internally. This fascia must

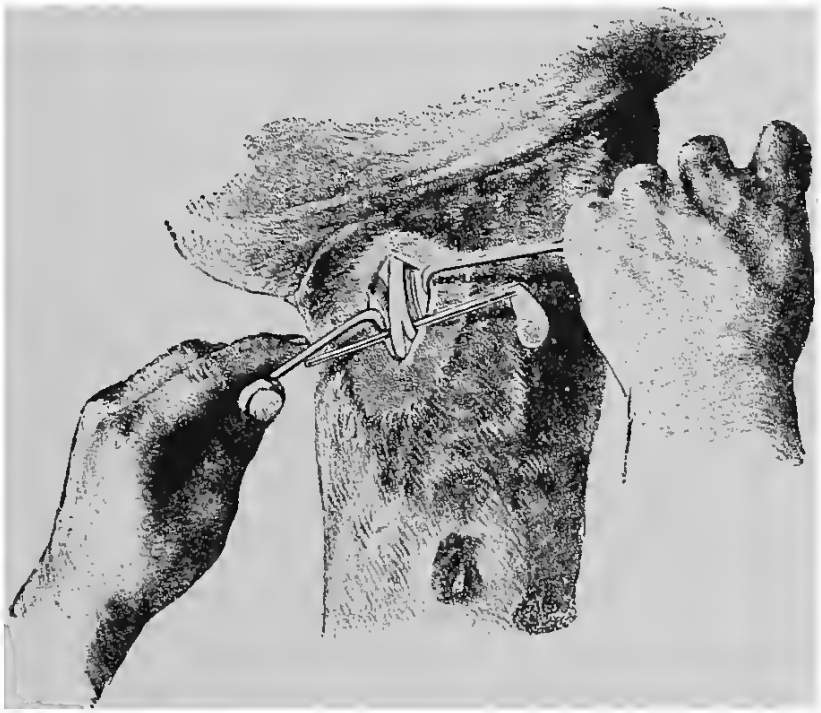


FIG. 100—Position of Incision in Median Neurotomy, showing Median Nerve and Flexor Branch. End of fourth step (Bayer).

be brought into clear view without accidentally wounding it, and all bleeding must be controlled, before proceeding farther.

The **fascia** (the antibrachial) is a very thick, whitish, tough membrane at this point. It lies in close relation to the median nerve, the radial vein and the posterior radial artery. The greatest danger of median neurotomy lies in the improper division of this structure. If incised with a scalpel the radial vein may be wounded in spite of the greatest caution. To avoid this very serious accident the fascia is divided with the **probe-pointed bistoury, cutting upward and outward** after making a very small point of entrance with the tip of the scalpel.

Fourth Step.—Search for the Nerve.—When the incision has been advantageously located the nerve will promptly bulge through the incision in the fascia, and thus end the search. Usually, however, the division of the fascia reveals first the brown flesh of the flexor muscles or else the radial vein. These two structures may be mistaken for each other on account of their similarity in color and their roundness. The retractors are then adjusted under the cut edges of the fascia and tension enough brought upon them to expose a wide range of underlying surface. If it does not yield enough to bring the nerve within range it may be incised transversely with the probe-pointed bistoury. When the fascia is thus dilated the nerve is searched out by carefully picking up the masking areolar tissue and dissecting it away here and there as the assistant bails out every vestige of blood. During this dissection the nerve usually appears upon the foreground in the form of a whitish ribbon slightly less than a quarter of an inch in width, closely united to the vein to which it is attached with a loose connective tissue. If the search is still fruitless it is evident that the incision has been made too low, where the median nerve has already curved outward in its descent. In this event the whole incision, skin, muscle and fascia, should be carried upward a half inch or more where the nerve is more superficial. Whenever any confusion arises in the search of the nerve there must be no haste to dig deeply in every direction through the surrounding structures, as this course will always terminate disastrously as well as fruitlessly. The median nerve is superficial; it is closely related to the antibrachial fascia. Searching deeply into the region is, therefore, useless. Failure to find the nerve may be due to a trivial amount of areolar tissue bathed with blood which, when dissected away, brings the nerve into prominence where it had not been expected.

Fifth Step.—Elevating the Nerve.—The elevation of the nerve, when found, is not without danger in view of its close proximity to the radial vein. A sharp pointed elevator may easily penetrate the vein and produce a very serious complication in the form of a hæmorrhage that is difficult to control. The nerve is elevated by first carefully loosening one of its borders from the vein, and then forcing a blunt elevator under it. It is loosened from the vein along the whole course of the wound by simultaneously lifting it with the elevator and breaking down the connecting areolar tissue with the handle of the scalpel.

Sixth Step.—The Neurotomy.—This step is simple, and now without danger. It is performed, as all other neurotomies, by first dividing the nerve superiorly and then inferiorly.

Seventh Step.—Closing the Wound.—The wound of median neurotomy never heals by primary union. If the fascia, the muscle and then the skin are consecutively sutured with the greatest caution, the wound will burst open in spite of everything, in spite of every precaution, because the relations of these structures and the several parts of each of them, change considerably from the recumbent to the standing position. A wound sutured neatly in the recumbent position will always be found distorted when the stand-



FIG. 101—Fifth Step of Median Neurotomy. The Nerve Elevated.

ing posture is attained. The irregular tension of the sutures on the different parts of the wound precludes prompt union. With this fact in view it is found advisable to close the wound with only one or two loose stitches, leaving the breach to heal by secondary intention.

AFTER-CARE.—The patient is kept quiet in the standing position for two or three days and then turned into the loose box during the remainder of the convalescence. The wound requires no special attention if the operation has been clean. The only medical treatment required is a nominal washing of the internal surface of the forearm to rid it of the little secretion that flows over it from the wound during the first week. The wound itself needs no irrigation nor

other treatment unless it becomes purulent, then the usual antiseptic irrigation is required. The stitches are usually removed on the fifth to the sixth day. Healing requires twenty to twenty-five days, at which time the horse may be returned to work. A longer period of **rest** is, however, advisable.

ACCIDENTS AND SEQUELÆ.—During the operation there is always danger of **wounding the radial vein** or even the collateral artery. It is the former, however, that is most likely to be cut or pricked during the search for the nerve which is so closely related to it. This accident is prevented by avoiding the use of the scalpel after the antibrachial has been exposed. The division of the latter structure and the subsequent dissection should be done with blunt-pointed instruments (the probe-pointed bistoury, the dissecting forceps and blunt nerve elevator); otherwise this accident will occur with great frequency. Sometimes small branches of the vein are cut near the main trunk if sharp cutting instruments are used, and these may bleed profusely enough to give the impression that the vein itself has been cut. The search for the exact seat of the breach is not always fruitful; on the contrary it may augment the flow by still farther widening the breach. Whether branch or trunk is wounded, the flow is always copious; the blood gushes out so rapidly, and is so difficult to control while the breach is sought that often the operation must be abandoned. Sometimes by pressing the fingers forcibly into the course of the vein both above and below the wound it can be stopped long enough to render possible the continuation of the operation. More times this is useless. Again, the artery forceps may be successfully adjusted to the breach while the flow is momentarily controlled by pressure. When this is successful the operation may proceed and the forceps may be left undisturbed for the first twenty-four hours after its completion. Ligation of the vein is generally very difficult to accomplish. The dissection of the vein to facilitate the passing of ligatures below and above the breach often makes matters worse by opening up branches which are very numerous in this particular region. When these manipulations fail the wound is packed taut with wadding and sutured firmly.

Wounding of the radial vein is always followed by a very painful œdema of the limb, lasting six to eight days, but is otherwise of no serious consequence. It is never fatal. It can always be controlled. The **radial artery may also be**

wounded in the course of the operation, but this accident is much less liable to occur, because the artery is readily recognized, has thicker coats and is more remote from the nerve. When it does occur ligation is the only remedy, otherwise fatal bleeding will rapidly ensue. Animals survive ligation of this artery. The accident occurred to Dr. ——— of Chicago several years ago. The accident was successfully met and the patient, after a very long period of convalescence, made an incomplete recovery. The accident was survived well enough, but the nerve was not divided and, of course, the lameness continued.

Œdema of the leg due to pressure of the swelling upon the radial veins, or to septic infection, sometimes appears threatening several days after median neurotomy has been performed, the wound being an open one, but serious blood-poisoning seldom follows. Gross carelessness in operating may, however, be followed by serious complications because of the nature of the wound. The operation must be a clean one.

Pruritus of the Fetlock.—Itching of the internal surface of the fetlock occurs with great frequency during the second and third week of convalescence. It is manifested by an inclination to first lick and then to gnaw that region until the skin bleeds and becomes the seat of a large sore that refuses to heal. This remarkable sequel is undoubtedly due to the irritation of the nerve stump at the seat of operation. It might be compared to the cold or painful foot the human often complains of after a leg has been amputated. This sequel is serious on account of the great difficulty of healing the wound caused by the gnawing. It may require months to heal the wound. The sequel must be prevented by the prompt application of a protecting bandage to the fetlock or by tying the patient short, as soon as the tendency to lick the region appears.

Breaking down of the ligaments and tendons, and shedding of the hoof does not occur after median neurotomy as frequently as after the high plantar operation, because no whole portion of the leg is entirely unnerved. But these accidents sometimes follow, especially in the region of the inferior sesamoidean ligaments. The hoof may sometimes threaten to loosen and then heal up without falling off. Occasionally it is shed entirely, as after plantar neurotomy. These sequelæ are prevented by avoiding the operation in the treatment of new, acute or serious inflammations whether tendinous, ligamentous, synovial or osseous.

Tibial Neurotomy.

SYNONYMS.—Posterior tibial neurotomy; sciatic neurotomy.

DEFINITION.—Tibial neurotomy is the surgical division of the posterior tibial nerve some four to six inches above the tarsus.

DISTRIBUTION OF THE POSTERIOR TIBIAL NERVE.—The sciatic nerve, sometimes called the tibial, or the posterior tibial nerve, in the region of the tibial, is the chief radicle of the lumbo-sacral plexus. It is a mixed nerve in the femoral region, but after traversing the popliteal space the distribution of sensation is its only function. In the tibial region it occupies the space between the belly of the flexor pedis perforans and the tendo-Achilles. At the level of the os calcis it bifurcates into the **internal and external plantars,** which have an analogous distribution to the plantars of the pectoral limb, with the exception that they distribute many ramuscules to the hock before proceeding to the foot. From a number of careful dissections of this nerve made by Thompson, it is very evident that much has heretofore been omitted in its study by the equine anatomist. The tibial nerve is prominently concerned in giving sensibility to the tarsal structures. Its first effort in this direction is that of providing a large branch which separates from the main trunk four inches above the os calcis, passes down with the trunk, and then enters the hock at the level of the astragalus. At the level of the os calcis it divides into the plantars, external and internal, each of which furnish ramuscules to the articulation in their course along its posterior aspect. The internal plantar furnishes the branches for the anterior parts of the hock, and the external one to the posterior portion.

In addition to this nerve, the hock receives sensory innervation from other sources, which, according to Thompson's dissection, have never been correctly interpreted. The **deep peroneal or anterior tibial,** an indirect branch of the sciatic, passes down the tibial region somewhat deeply imbedded between the extensor pedis and peroneus muscles. Upon approaching the hock it is related to the tibial artery and tendon of the extensor pedis. In front of the hock it gives a branch which divides into numerous ramuscules, and directly ramifies amid the tarsal bones at the internal aspect. That is to say, it penetrates the usual seat of spavin. But

besides this branch it also supplies another, which accompanies the perforating pedal artery directly into the depths of the tarsal articulations. The continuing branch traces its course over the anterior aspect of the metatarsus, where it is lost in the skin. This nerve is, therefore, important in the surgical treatment of spavin. The **superficial peroneal,** or musculo-cutaneous nerve, runs parallel to the deep peroneal in the tibial region, but is much more superficial. It lies directly beneath the tibial fascia in the groove between the peroneus and extensor pedis muscles. Approaching the hock it lies along the external side of the extensor pedis tendon, traces its course over the external aspect of the tarsus about midway between the latter tendon and that of the peroneus, and then is lost in the skin of the metatarsal region. This nerve probably has little influence over the bones, but furnishes sensibility to the peri-articular structures along the region it traverses.

The **external saphenic** nerve is related to the tendo-Achilles externally in the tibial region. At the level of the os calcis it reflects forward and is distributed over the external aspect of the hock posteriorly, and then over the region of the external splint bone, to become lost cutaneously. The **internal saphenic** nerve, unlike the others concerned in the innervation of the tarsus, is not a radicle of the sciatic. Its remote origin is the anterior portion of the lumbo-sacral plexus, while that of the sciatic is the posterior portion. This nerve occupies the internal aspect of the femoral and tibial regions, terminating on the anterior portion of the hock and metatarsus. It gives off a number of branches to the femoral muscles, and in the upper third of the tibial region divides into three or four branches. Two of these branches accompany the internal saphenic vein, one on either side; another large branch winds over the belly of the flexor metatarsi in the middle third of the tibial region and loses itself around the anterior part of the hock, while another one continues down the internal aspect of the tibia over the front of the hock internally, and thence downward into the skin of the metatarsal region. The ramuscules of this nerve are easily traced into the tarsal synovials anteriorly and are therefore prominently concerned in supplying sensibility to important tarsal structures.

Conclusions.—The hock receives sensibility from the following sources, named in the order of their importance: (1) The deep peroneal. (2) The internal plantar. (3) The unnamed branch leaving the posterior tibial four inches

above the os calcis. (4) The external plantar. (5) The external saphenic. (6) The internal saphenic. All of these nerve trunks are purely sensory nerves below the upper third of the tibial. Above that point they may contain motor fibers enough to produce permanent paralysis of certain muscles when surgically divided.

INDICATIONS.—The large size of the tibial nerve renders its division for surgical purposes somewhat hazardous at all times. The area it supplies with sensibility is large and includes the most important structures of the pelvic limb;—the hock, the tendons, the fetlock, the foot. Its division banishes the sensibility over too great a surface to warrant its application for circumscribed lesion here or there. If the hock is the seat of a lameness the sensibility of the foot and fetlock is also uselessly sacrificed. If the foot is the seat attacked with disease the others are needlessly deprived of their innervation. Herein lies the greatest fault with tibial neurotomy. Tibial neurotomy has been too highly recommended. It is effectual in promptly dispatching lameness of the fetlock and hoof, but too often the relief is purchased at the expense of the patient's life. For diseases of an acute character it is positively disastrous. The hoof sheds, the sesamoidean ligaments loosen from their attachments, or the flexor tendons give way. Sometimes the dissolution is an aggregation of all of these unfortunate events combined.

In **spavin** lameness the operation has been recommended highly in conjunction with deep peroneal neurotomy. This double operation, true enough, often promptly terminates the limp of spavin, but, unfortunately, the whole fetlock and foot being deprived of sensibility, nail pricks, treads, hoof cracks, wounds from interfering, flexion crevices (scratches), etc., too often enter into the situation sooner or later and develop into incurable, fatal complications. In view of this fact it is doubtful whether the veterinary practitioner should recommend the operation. Certainly it must not be too hurriedly resorted to. Other treatments, firing, cunean tendinotomy, etc., should at least precede it. It is only when these have failed that this double operation becomes a justified treatment. To recommend it as the first effort in the treatment of spavin will sooner or later bring the operation and operator into just disrepute.

In **chronic sesamoiditis** tibial neurotomy is often of great service. This condition in the hind legs is very often a highly refractory one. The lameness persists in spite of

everything. It yields to palliative treatments only to return again. In this event, when the inflammation is chronic and the lameness not too pronounced, tibial neurotomy will make a useless subject useful as long as it escapes serious accidental wounds of the unnerved region. There is never any doubt as to the effect of tibial neurotomy on lesions in the sesamoidean apparatus. The pain of this region is always promptly and totally dispatched. It is the sequelæ that limit its value.

In **chronic lesions resulting from serious nail pricks,** where the navicular synovial has been implicated, tibial neurotomy is also strikingly effectual. But like sesamoiditis this lesion must not be in the siege of an active inflammation nor productive of much lameness, if a lasting result is to be expected. These lesions sometimes consist of rather trivial adhesions of the plantar aponeurosis to the navicular bone and navicular ligaments. The integrity,—the strength,—of these affected structures is not greatly impaired, and the inflammatory process is latent, probably cured. Under such circumstances it is admissible to perform the operation, after four, six or eight months have elapsed and the lameness still persists.

Knuckling, that is, constant volar flexion of the fetlock, often exists in the absence of any perceptible lesion. There is no swelling, no pain on manipulation, still the flexion accentuates more and more with hard work. Rest and blisters correct the defect only temporarily. The condition returns when hard work is resumed, and very soon becomes chronic and incurable. Once satisfied that this state is not due to spavin or any definite lesion along the course of the tendons, the sesamoids may reasonably be suspected of being the seat of pain that induces the horse to hold the fetlock in volar flexion, and thus gradually cause the tendons to compensate by contracting. Tibial neurotomy, by dispatching the pain responsible for this state, will always gradually correct the deformity. The fetlock will straighten and then soon resume its normal backward inclination.

Here again the operation does well enough for the purpose intended, but unfortunately leaves the subject susceptible to the usual accidents.

In **ringbone** tibial neurotomy is not always successful. Sometimes the relief is only partial on acount of the distribution of other sensory nerves, which reach the anterior part of the affected region. In most instances, however, it may

be depended upon so far as terminating the lameness is concerned.

In **obstinate curb lameness** tibial neurotomy cannot be depended upon and should not be resorted to. The subject is better off with the impediment than with the benumbed leg.

RESTRAINT.—The operation is performed in the recumbent position with the affected leg undermost. The operating table is par excellence the best apparatus to immobilize the leg and bring it into an advantageous position. The casting harness or hopples in lieu of a table will answer, however.

On the table the leg is secured some distance behind the uppermost one, and in a slightly flexed position. When the hock is slightly flexed the space between the tendo-Achilles and the perforans muscle is widened and this brings the nerve into a more available position. When the leg is stretched in extension the nerve is pressed against the muscle anteriorly and is more difficult to find.

When the casting harness is used the same flexed position of the hock is desirable, but it is much more difficult to maintain against the patient's struggles. About the best method of overcoming this difficulty is to fix the leg in the desired position to a plank, by means of several straps at different points encircling both the plank and the leg. Cocainization of the seat completes the restraint.

EQUIPMENT.—The instruments required are identical to those for median neurotomy. Scalpel, dissecting forcep, artery forcep, nerve elevator, probe-pointed bistoury, wound retractors, needle and thread, needle holder, hypodermic syringe, cocaine 5 per cent, mercuric chloride solution, razor and scissors are the essential requirements.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The seat of operation is a hand's breadth above the point of the os calcis, in the groove between the tendo-Achilles and the perforans muscle, on the internal aspect of the leg.

It is made against the muscle rather than too near the tendon, as the tibial nerve, when the hock is flexed, lies in rather close apposition to the former. An incision made in the depths of groove will answer, but the one made slightly anterior to this point will more nearly parallel the nerve. If made too near the tendo-Achilles some difficulty will be encountered in locating the nerve, which will then be found to lie somewhat anterior to it.

Second Step.—Disinfecting the Seat of Operation.—The hair is clipped from the groove with scissors; the field is then moistened and shaved. The shape of the region renders this step somewhat difficult. The razor cannot be easily carried into all parts of groove on account of its sharp and deep depression at the very point where the incision is to be made. It will be found necessary to press the fingers into the groove beneath and lift the parts upward before thorough shaving is possible. The disinfection is completed by rinsing the parts with the mercuric chloride solution.



FIG. 102—Position of Incision in Tibial Neurotomy. (Bayer.)

Third Step.—Making the Incision.—The incision is made one and a half inches long at the point indicated, first through the skin with the scalpel and then through the fascia with the probe-pointed bistoury, cutting upward and outward in order to avoid wounding the posterior tibial vein, which lies directly under the fascia, slightly anterior to the line of the incision, but sometimes immediately under it. As in median neurotomy, the probe-pointed bistoury is indispensable. Otherwise, the vein, sometimes full and bulging, will frequently be wounded and yield a troublesome hæmor-

rhage, which will have to be arrested before the operator can proceed.

Fourth Step.—Dissecting the Nerve.—The tibial nerve is always masked. It never promptly appears upon the foreground when the fascia is divided, even when the division is made directly over it. This nerve is encircled with a covering of adipose tissue which forms a perfect mask, and this immediately perplexes the unsuspecting operator. Although this nerve is large and superficial and the parts are easy to dissect, the new operator is certain to become confused if this special feature of the region is not known.

The method of procedure after the fascia has been di-





FIGS. 103 AND 104—Forms of "Break-Down" after Tibial Neurotomy.

vided along the entire length of the dermal incision is to first dispose of all of the blood and bleeding, and then pick up and divide the underlying tissues here and there along the course of the incision until a part of the glistening surface of the nerve is encountered. Deep digging is to be avoided, as the nerve is not far from the fascia. When the posterior vein appears in the incision it will serve as a certain landmark. The nerve lies immediately beneath and slightly posterior to it. These two structures, vein and nerve, are never widely separated. They are related to each other always. When once located by this dissection it is loosened from its embedded position at a certain point, and then lifted from

the wound with the nerve elevator. Oftimes the posterior tibial vein sends one or more branches backward, which may easily be wounded while releasing the nerve from its encasement along the course of the incision.

Fifth Step.—Resecting the Nerve.—The elevated nerve is stretched by means of an elevator, and then quickly snipped off superiorly with the probe-pointed bistoury, after which the stump is picked up with the artery or dissecting forceps and divided inferiorly. About two inches of the trunk should be resected.

Sixth Step.—Closing the Wound.—The wound is closed with interrupted sutures, special care being taken to bring the edges of the skin into perfect apposition throughout. The edges of this wound are very liable to fold inward unless special care is taken to arrange them properly. Drainage is not necessary.

AFTER-CARE.—The wound of tibial neurotomy should be protected with a plastic dressing, either collodion or calcareous clay, which is not disturbed until the edges have united, six or seven days later, at which time the stitches are removed. The patient is kept in the standing position at all hazards, in order to protect the edges of the wound against the friction and tension produced by curving the leg beneath the body, and by getting np and down. After twenty days the patient may be returned to work, but a longer rest at pasture is advisable. The hoof must henceforth be protected against nail pricks, treads, etc., and the pasterns and fetlock against scratches and interfering wounds. But above all the patient's occupation must not be arduous. Hard or fast work will sooner or later cause dissolution of the hoof or fetlock.

PERONEAL NEUROTOMY.

SYNONYMS.—Anterior tibial neurotomy; deep peroneal neurotomy.

DEFINITION.—Peroneal neurotomy is the resection of a part of the anterior tibial nerve in the middle third of the tibial region.

DISTRIBUTION OF THE ANTERIOR TIBIAL NERVE.—The anterior tibial or deep peroneal nerve is a radicle of the femoro-popliteal branch of the sciatic. It leaves the parent trunk at the upper third of the tibia after the latter has passed diagonally across the external surface of the tibia. On its course down the leg it occupies the space between the bellies of the extensor pedis and peroneus

muscles, about three-quarters of an inch from the surface of the skin, and but a short distance from the anterior tibial artery. Approaching the hock it directs its course internally until it gains the antero-internal part of the tarsus, where it sends ramuscules into the midst of the tarsal bones. One of its branches accompanies the perforating pedal artery into the depth of the articulations, the other, the terminal branch, continues down the anterior aspect of the leg to be lost cutaneously along the metatarsus. This nerve has a pronounced influence on the sensory innervation of the seat of spavin, but is not alone in supplying sensation to the hock. It is largely concerned in distributing sensation to the cuneiform bones.

INDICATIONS.—Peroneal neurotomy has heretofore been applied in conjunction with tibial neurotomy for the relief of spavin lameness. It has never been recommended alone for this or another purpose. Recently, however, in numerous trials, we have applied it with phenomenal success in circumscribed spavin located in the usual position, after repeated blisters, firing,—feather and puncture,—and cunean tendinotomy had failed to afford relief. In fact, this is its real indication. It should be used alone, for circumscribed spavin after the inflammatory stage has been made to yield more or less to the old lines of treatment.

A spavin has been fired, probably, twice, it has been blistered, cunean tendinotomy has been performed and the lameness persists. At this time, the disease being local peroneal neurotomy alone may be safely recommended as a positive cure for the lameness. It seldom fails. When the inflammation is new, spreading, encroaching, active, the same benefits are not obtained. When the spavin is diffused over a wide region, implicating nearly all of the tarsal bones, even if the condition is old and the lameness trivial, very little benefit is derived. In fact, in such cases there is no perceptible change in the lameness after the operation has been performed. In these diffused cases tibial neurotomy must be performed in addition to the peroneal operation, and even then relief is not certain, particularly if the tibio-astragular articulation is implicated. A spavin involving the major part of the tarsus is not affected by peroneal neurotomy, and is not always cured when both operations are performed. When the true hock joint is involved no relief seems possible, from any neurotomy.

The **double or tibio-peroneal operation** has, therefore, a limited sphere of usefulness, if the above presents are re-

spected. It can only be defended as a last-resort operation. A spavined horse may lame for one or two years and then finally become useful during the remainder of a long life. If this double operation is performed the complications which are certain to follow sooner or later will shorten this period of usefulness, because the sensibility of the foot and fetlock is sacrificed to the ultimate detriment of the unnerved subject. It is at least an operation that the veterinary practitioner can not well afford to recommend too highly.

RESTRAINT.—Peroneal neurotomy is performed in the lateral recumbent position with the affected leg uppermost. The leg should be extended from the body rather than flexed at the hock for the important purpose of bringing the anatomical structures separated in the operation into the same relations they occupy when the patient is in the standing position. If the operation is performed with the leg in a cramped, unnatural position, it will be found that the sutured wound will be crimped and distorted when the patient assumes the standing posture. The difficulty of healing the wound of peroneal neurotomy, which is referred to below, is guarded against at this, the first step of the operation, by so arranging the leg that the structures will be separated in their normal respective positions.

The **operating table** is by far the best apparatus for the operation, because a normal extension of the leg is maintained by simply fixing the foot to the table, and then fastening both legs together with a "figure eight" below the hocks. Subcutaneous cocainization, in addition to these fastenings, is sufficient restraint on the operating table. When the **casting harnesses** are used, general anæsthesia is advisable to assure the perfect immobilization of the region that is essential to the execution of the rather difficult technique. Local anæsthesia is hardly sufficient because at the crucial part of the operation,—the elevation of the nerve,—a struggle will often so change the relations of the muscles as to hide the nerve that was previously visible in the depths of the wound. The **English hopples** are fairly satisfactory. With the aid of general anæsthesia the operation can be performed without even releasing the leg from the hopples.

Whichever apparatus is used the one point to respect is the fixation of the leg in the extended position.

EQUIPMENT.—Scalpel, probe-pointed bistoury, dissecting forceps, three or four artery forceps, two tenacula for wound retractors, a special nerve elevator (Fig. 105), needles and thread, cocaine solution, antiseptic solutions,

razor and clippers, constitute the necessary equipment. As the infection of the wound of peroneal neurotomy is a serious matter, special effort at sterilization of the instruments must not be neglected.

TECHNIQUE.—Locating the Seat of Incision.—The incision is located in the middle third of the tibial region



FIG. 105—Special Nerve Elevator for Peroneal Neurotomy.

externally, at the most prominent part of the anterior tibial muscles; that is at the apex of the muscular protuberance formed by this group of muscles. (Fig. 106.) By passing the finger tips along these muscles, a groove is felt between the bellies of the extensor pedis and the peroneus muscles. It is over this groove that the incision is made. Often a plexus

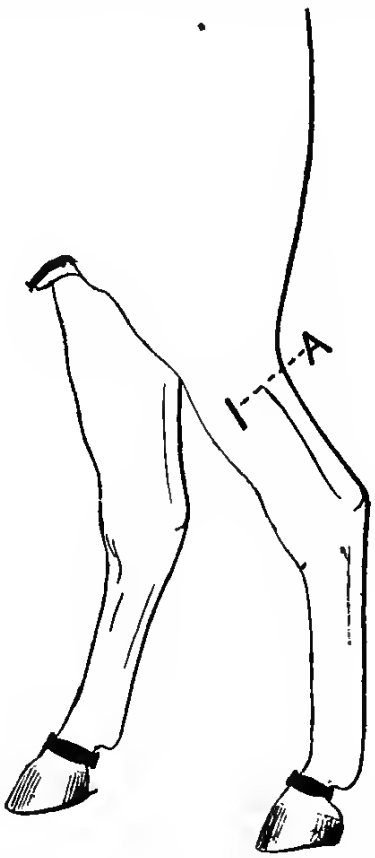


FIG. 106—Position of Incision in Peroneal Neurotomy.

of superficial veins occupies the seat, but this should not be regarded as sufficient reason to change the line of incision.

Second Step.—Disinfecting the Field.—Special effort is made to thoroughly cleanse the field preparatory to an aseptic operation. The hair is clipped and shaved, and the skin submitted to a cleansing, first with soap and water, then

with mercuric chloride solution 1-500, and then finally with alcohol. In order to still further combat sepsis, the field thus cleansed may be sprinkled and rubbed with boric acid and iodoform, portions of which are allowed to remain in the recesses of the shaved integument.

Third Step.—Incising the Skin and Fascia.—An incision is made two inches long along the line decided upon, regardless of the veins which are often seen to traverse the seat in different directions. These veins are subcutaneous. They should be exposed without cutting them in making the incision through the skin, and then picked up and twisted with the forcep to prevent blood from saturating the wound. When these vessels are disposed of, the underlying tibial fascia is incised with the probe-pointed bistoury, an entrance point for which is made at the distal end of the wound. These two incisions, which expose brownish-red muscles beneath, should be rendered perfectly bloodless before proceeding to the next step; otherwise the search for the nerve will be greatly impeded by the constant flow of blood into the depth of the wound.

Fourth Step.—Separating the Exterior Pedis from the Peroneus Muscles and Searching for the Nerve.—After the tibial fascia is divided, a second fascia is encountered. This one surrounds the anterior tibial group of muscles. Before it is divided, the division between the muscles cannot be found, but when incised with the probe-pointed bistoury, the handle of the scalpel can easily be carried between them, as they are attached to each other with only a loose areolar tissue. The two tenacula are now hooked into the muscles on either side of the wound, as the handle of the scalpel gently breaks down the areolar tissue connecting them. This breaking down process with the handle of the scalpel is carried about three-quarters of an inch deep. Then as the tenacula widen the space, the muscles are pressed first to one side and then to the other, with the handle of the scalpel, while the eye searches the depth of the wound for a slender, whitish cord lying flush against the anterior wall of the wound. This cord,—the peroneal nerve,—is no larger than the size of a small straw, but it is easily seen against the brownish-red back-ground, if there is no blood to mask the surface. When it is not promptly seen, the incision is not immediately deepened. Instead, the muscles are pressed to and fro with the handle of the scalpel, until the part related to the nerve is rolled into view. Sometimes the dissection of the muscles is accidently carried between the extensor pedis and flexor

metatarsi, in the anterior direction where, of course, no nerve will be found. This diversion in the wrong direction is recognized by the absence of the nerve when the incision is three-quarters of an inch deep. In this step special effort is made not to cut directly into the muscles; these are only separated with a blunt implement.

Fifth Step.—Elevating the Nerve.—A Special instrument facilitates this step. The elevator best adapted for the purpose (Fig. 105) is a long, slender tenaculum with a short, pointed hook. The usual nerve elevator, adapted for shallow wounds, is difficult to pass beneath the nerve, because of the depth and narrowness of the wound.

The nerve is hooked up with this long tenaculum and then brought to the surface by passing it beneath.

Sixth Step.—Resecting the Nerve.—Little dissecting is required to free the nerve from its attachments. The tension caused by elevating it from the depths of the wound loosens it from its delicate areolar surroundings. When brought to the surface it is at once found to be perfectly free and ready for resection.

The resection is carried out as in all neurotomies, with the exception that an artery forcep should first be fixed upon it below the tenaculum, which holds it out of the wound, in order to prevent the distal stump from falling back into the deep wound after it has been divided superiorly. The nerve is slender; it may be even more slender than usual from stretching; if the distal stump is lost in the depths of the narrow wound, some difficulty may be encountered in locating it amid the blood-soaked areolar tissue, and thus the completion of the operation may be unnecessarily delayed.

Seventh Step.—Closing the Wound.—The wound of peroneal neurotomy is a difficult one to heal. By dividing the tibial fascia, the subjacent muscles lose their chief support, their chief incarceration, and that at the most prominent part of their bellies. With this support lost, they tend to bulge through the breach and produces a **real muscle hernia,** whose formation is still further favored by their contractions with every movement of the limb. Sepsis and bursting of the sutures are certain to terminate in the formation of this unfortunate sequel, acting in conjunction with these inimical conditions.

The closure of the wound is therefore a matter of much importance. It must be effected with special effort to accomplish a primary union of both the fascia and skin. Delayed cicatrization will always result in formation of miser-

able, protruding, slow healing, granulations, which leave an indelible blemish at this conspicuous part of the economy. Sometimes several months will elapse before cicatrization is complete.

The first step in closing the wound is to carefully adjust a row of small interrupted cat-gut sutures in the fascia. It is needless to state that these should be sterilized and inserted with precautions to prevent septic contamination of the buried structures.

The second step consists of the insertion of two or three mattress sutures of braided silk in the skin, about one-half inch from the edges of the wound. These are for the purpose of immobilizing the edges; to protect against friction. They are not drawn taut. When tied, the wound should gap a little, about a quarter of an inch.

The third step is the insertion of a row of small interrupted silk sutures along the edges of the skin wound to complete the closure. The loops should be small and a quarter of an inch apart.

The fourth step consists of the application of a plastic dressing over the whole region to still further immobilize the skin, as well as to prevent infection from without. This step is postponed until the subject has regained the standing posture, and all of the bleeding sometimes caused by suturing has ceased. Antiphlogistine or any other clay dressing, is best adapted for this purpose. It is applied sparingly, with alternate layers of absorbent cotton, until a thick dressing is built over the region. In twenty-four hours this dressing will harden and then act as an adhesive plaster. Drainage is not necessary.

AFTER-CARE.—The subject is kept in the standing position for no less than eight days and at all hazards. Lying down for a single moment will demoralize the whole affair. The sutures will burst and the desired primary union will be defeated. At the end of seven to eight days, the dressing is carefully soaked off and the stitches removed. The skin should have healed. If, however, there is any doubt as to the integrity of the union, the mattress sutures may be left in place for two or three days and another dressing applied.

When a union has not been effected, the stitches are removed, the patient kept in the standing position for another week and astringent lotions applied frequently and freely.

The large muscle hernia, which sometimes follows peroneal neurotomy, should be treated from the beginning by keeping the patient quiet, and by the application of strong

astringents. Caustic and actual cautery are even necessary to control the protruding granulation, but these should not be resorted to until the acute inflammation has subsided, after the third or fourth week.

ACCIDENTS AND SEQUELÆ.—Peroneal neurotomy is not a dangerous operation. There is some slight danger of cutting the anterior tibial artery, which lies about one-half an inch beneath the nerve (operating position.) There is little danger, however, if the distance of the peroneal nerve from the surface is known to the operator. The anterior tibial artery has been mistaken for the nerve, but only by operators who have no previous knowledge of their relative dimensions. The nerve is a mere shred, while the artery is a large, cylindrical structure, the size of a small lead pencil.

The only formidable sequel is the muscle hernia, described above, that occurs in different degrees of severity, according to the cleanliness of the operation, and the skill displayed in preventing bursting of the sutures. Breaking down of the unnerved parts never follows. From this standpoint, peroneal neurotomy is harmless.

Ulnar Neurotomy.

DEFINITION.—Ulnar neurotomy is the surgical division of the ulnar nerve in the middle third of the fore-arm.

HISTORY.—Ulnar neurotomy really has no history, at least little is ever heard of the operation. It is sometimes mentioned in connection with median neurotomy. When the latter has failed to entirely cure the lameness, the ulnar operation is sometimes referred to as a method of turning failure into success. But the number of such operations performed have been few, and the success met by them is still unknown to the veterinary profession. It is by no means a standard operation today; the veterinary practitioners are little acquainted with its worth or the method of performance.

INDICATIONS.—The ulnar or cubital cutaneous nerve, a radicle of the brachial plexus, is closely related to the median or cubito-plantar, in the region of the arm. In the fore-arm it occupies a rather superficial position between the middle and external flexors of the carpus. Near the trapezium it joins a branch of the median to form the external plantar, and also sends a branch over the anterior surface of the knee. Its influence over the sensibility of the knee is, however, limited to the superficial structures. To the ten-

dons, fetlock and foot, it furnishes only a part of the sensibility, being fused with the median, whose influence predominates. Ulnar neurotomy alone is, therefore, of no service whatever. It can only be utilized to dispatch the sensibility that remains in certain structures after the median has been divided, in which instance the two operations combined become about equivalent to high plantar neurotomy, with the exception that the fetlock and part of the tendons are completely unnerved, while in plantar this articulation and the tendons are not affected. We have tried the operation for the cure of lameness, due to an osteophyte, located on the supero-external part of the os suffraginus with negative results; but finally cured the lameness by adding median neurotomy.

For tendinitis, navicular arthritis, sesamoiditis, or a combination of these, the combined operations have a decidedly marked influence. The patient is at once better. The results are pronounced, immediate, flattering, but the danger of disaster to the diseased parts is sensibly greater than in any other of the nerve operations. In fact, the patients seldom survive long. The hoof sheds, the ligaments loosen or the leg swells, and becomes the seat of an extensive dissolution. In the face of these unfavorable comments, we are forced to record several very flattering cures from these combined operations, wherein the subjects were permanently benefited; and although several years have elapsed, no serious accident has yet occurred to any of them. The great majority, however, do not survive the ordeal for more than two or three months, sometimes much less.

It is very evident from the brief experience and the few data here and there, that ulnar neurotomy as an adjunct to median, is to be cautiously judged, pending further investigations, and that at present its performance is only advisable as a last resort in the otherwise useless subject.

RESTRAINT.—Ulnar neurotomy is performed in the recumbent position, with the affected leg uppermost, and brought out at a right angle with the long axis of the body. Either the operating table or harness will answer. The leg is fixed in the usual manner, and the seat of operation is anæsthetized subcutaneously with a five per cent solution of cocaine. General anæsthesia is unnecessary.

TECHNIQUE.—The technique is as follows:

First Step.—Locating the Seat of the Operation.—The ulnar nerve, although quite superficial, cannot be felt on palpation, on account of its hidden position beneath the anti-

brachial fascia. It occupies the well-marked groove between the external and middle flexors, which can be felt by pressing the finger tips along the postero-external aspect of the forearm. The nerve is best reached in the middle third of the forearm, although it can be easily found as far down as the trapezium. The location to select in the above-mentioned groove, is a point midway between the olecranon and the trapezium, determined by measurement.

Second Step.—Disinfection of the Seat and Anæsthesia.—The region is shaved, washed, immersed in mercuric chloride

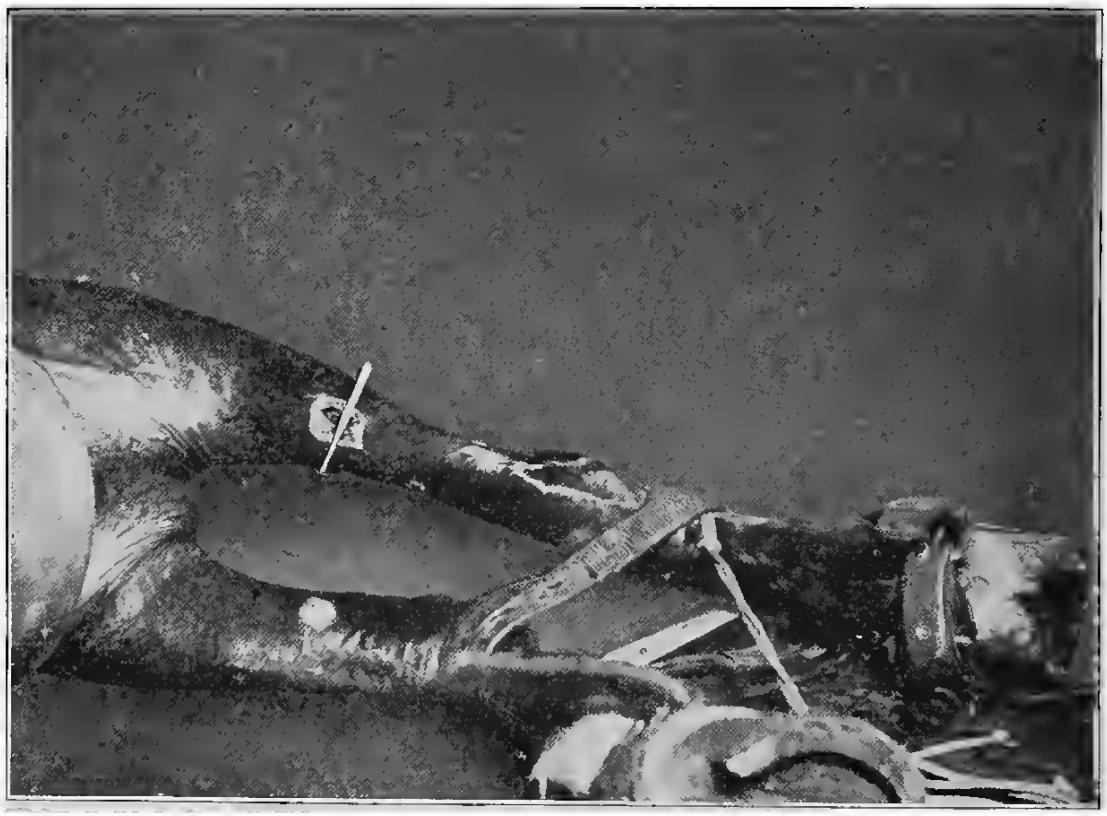


FIG. 107—Position of Incision in Ulnar Neurotomy.

solution 1-500, and then anæsthetized subcutaneously with cocaine hydrochlorate five per cent.

Third Step.—Dissection.—An incision is made through the skin, one and a half inches long, which will expose the thick underlying antibrachial fascia. Retractors are applied to the wound, and the fascia incised along its whole course with a probe-pointed bistoury, cutting upward and outward. At this point, search is made for the external radial vein, which should now lie along the course of the incision. If this vein is not visible, the antibrachial fascia just divided is dissected away along both edges, until it is brought into the foreground. Once found, it is utilized as the land-mark in the search for the nerve, which is always closely related to

it. The ulnar nerve lies beneath and slightly anterior to the vein. It is never deeply imbedded. Just beneath it is the small tendon of the ulnaris accessoris, which might at first be mistaken for it, but which is soon seen to be too large. The ulnar nerve at this point is the size of a wheat straw, and it is generally found by pushing aside the vein with the dissecting forceps, or by carefully separating the vein from its surrounding structure with the forceps and scalpel.

Fourth Step.—Elevation of the Nerve.—The nerve is elevated with the elevator, loosened along the course of the wound, and then resected in the usual manner.

Fifth Step.—Closing the Wound.—The wound of ulnar neurotomy is closed with two sets of sutures. Two mattress

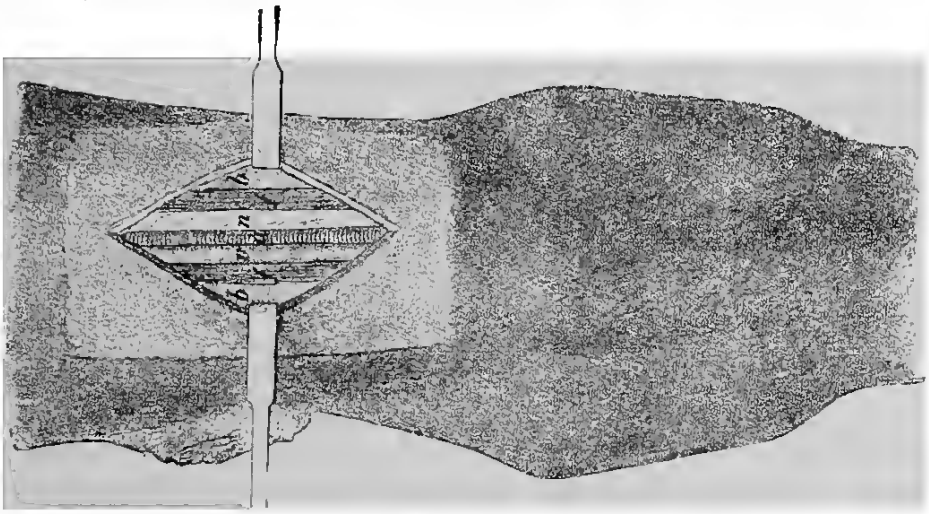


FIG. 108—Relations of the Ulnar Nerve.
a—Artery. *b*, *b*—Skin. *n*—Nerve. *v*—Vein. *f*, *f*—Fascia.

sutures are first adjusted some distance from the edges of the wound, and then several interrupted stitches are placed along the edges to keep them in perfect apposition. In this manner there is no friction of the edges, as the horse moves about, and the union is primary. It is essential to heal this wound promptly, to prevent a muscle hernia. If the skin edges gap, the underlying muscles (no longer supported by the antibrachial fascia) protrude, delay cicatrization, and finally leave an indelible blemish.

AFTER-CARE.—The patient is kept in the standing position for ten days, or until the wound is safely united. The lying posture would disturb the sutures and prevent their union.

CHAPTER III.

TENOTOMY AND MYOTOMY.

DEFINITION.—Tenotomy is the surgical division of a tendon to correct a deformity or inequality, or to relieve tension produced by encroaching pathological conditions.

INDICATIONS.—Although tenotomies are very frequently resorted to in domestic animal surgery for one condition or other, it is worth noting that they are never curative. **Tenotomies in veterinary surgery correct the effects, but do not modify the cause.** Shortened tendons are secondary conditions, due to pathological conditions of articulations or synovial apparatuses, in which they themselves do not share. The tendons themselves are free from disease; they simply contract to accommodate themselves to changes in the skeletal angles. Osteites, synovites and tendo-synovites are the primary lesions. Thus an inflammation in the region of the carpus, by causing the knee to be held in constant flexion, brings about a shortening of the metacarpal flexors; and inflammation about the fetlock, pastern or coffin joint in the same way shortens the flexors of the phalanges, and so forth, throughout all of the articulation having tendinous relations.

The object of the tenotomy is therefore that of correcting deformities, due to certain diseases which must in addition, be submitted to appropriate treatment. The condition known as "knee sprung" is an example of this compensatory contraction of tendons. The carpal bones or the neighboring synovials, when attacked with painful inflammations, cause the knee to be kept in constant flexion, and thus bring a relaxation of the normal tension of the three flexors of the articulation, which then gradually shorten in length to accommodate themselves to the new angle. At the same time, structural changes occur in the diseased organs (bones, ligaments, and synovials) which will sooner or later prevent the readjustment of the angle, even though the tendons have been surgically divided. In order that tenotomies be successful it is, therefore, essential that the operation precede the devolpment of permanent deformities at the seat of disease. Otherwise the relief is partial or nil. Again it is

essential that the causative inflammatory condition be submitted to abortive treatment as soon as the tenotomy is performed, in order to prevent an early return of the abnormal flexion of the articulation, and contraction of the tendons.

It is very evident, therefore, that tenotomies have a limited sphere of usefulness, and that frequently they only temporarily correct the deformity for which they are performed. Generally the primary lesion is a serious, deforming, incurable defect, often in an old animal of little value, which circumstance again circumscribes the usefulness of the operation.

Here and there, however, conditions are encountered in which the operation gives fairly satisfactory results. If the primary disease aborts without leaving any serious obstruction to the reposition of the articulation to its normal angle, a tenotomy may permanently correct the deformity, but these favorable indications are, unfortunately, rare. Generally there are exostoses, contracted binding ligaments, or chronic inflammations to prevent a satisfactory and lasting effect.

The different tenotomies in veterinary surgery are not, however, all performed for this same purpose of correcting articular deformities. Cunean tenotomy and peroneal tenotomy are performed with entirely different objects in view. These will be considered separately as regards their indications. Furthermore, tendons are now often divided in the treatment of acute traumatic inflammations of bursae and sheaths, examples of which are the division of the plantar aponeurosis for tendo-synovitis of the plantar bursa, and division of the perforans for thecal abscess at the sesamoids (see page 461).

TECHNIQUE.—Each tenotomy has its special technique which is described below under the separate heads. In a general way it may, however, be mentioned that the tenotomies for correcting deformities are all rather simple operations, consisting of a subcutaneous division of the contracted organ with a curved bistoury, followed by a forcible reposition of the deformed articulation to its normal angle. If the adhesions are not too formidable, only a little force may be required, but in almost every case some difficulty is encountered in breaking them down. In every case, as soon as the divided tendon no longer lends to the deformity, traction is applied from a point of advantage until the adhesions give way. The manipulation necessary to effect this breaking down process varies according to the location of

the deformity and strength of the adhesions. Special apparatuses have been improvised for this particular purpose, but these are not absolutely necessary. Traction upon ropes advantageously adjusted to the deformed leg is generally effectual. When the deformity has been thus corrected, a retention bandage is necessary to retain the articulation in the normal position. It may return to the old position, or else break down entirely in the opposite direction. A bandage is necessary to support the parts for some days after large supporting tendons have been divided. Another feature of these operations is the necessary attention to the hoof, which has grown too long at the heels to allow the joints to fall into their normal positions. This aggravated hoof growth should be trimmed before the operation is performed; that is, the hoof should be pared to its normal shape.

Carpal Tenotomy.

DEFINITION.—Carpal tenotomy is the name we apply to the subcutaneous division of the tendons of the flexor metacarpi medius and flexor metacarpi externus, a short distance above the trapezium, for the purpose of correcting the articular deformity of the horse known as "knee-sprung."

INDICATIONS.—In a normal leg the line formed by the radius, carpus and metacarpus, is a straight one. When this straight line is interrupted at the carpus by chronic flexion, the horse is said to be "knee-sprung," or, in still more vulgar parlance, "cut out at the knees." This common condition is sometimes congenital, sometimes acquired. The new-born frequently presents the deformity in an aggravated form, but it gradually improves as the skeletal and muscular systems develop toward maturity. It sometimes happens that the improvement is not perfected, and the subject is left with a permanent deformity. The carpus or both carpi, are thrown forward; they are "shaky." The horse is said to be "cut out" or "shaky" at the knees. There is no definite lesion. The structures comprising the articulation and the muscles attached to it are free from disease, but they are anatomically deformed. The flexor tendons are too short, and the bones have developed in shape to accommodate themselves to the position they are thus forced to occupy. If the tendons are divided, it may be found that the binding ligaments and the osseous apophyses will prevent the perfect reposition of the articulation. The deformity may be only partially corrected and the shape of

the bones will favor an early recurrence of the trouble. The operation of tenotomy is, therefore, not highly recommended for **"congenital knee-sprung."**

The principal indication is **"acquired knee-sprung,"** a deformity due to inflammation of some part of the carpal articulation. It may be an osteitis, synovitis or tendo-synovitis. The former, by producing obstructing, encroaching exostoses, is the most common causative disease. The latter, that is inflammation of the extensive synovial apparatus behind the carpus (the carpal sheath), is, however, very frequently the seat of the responsible lesion. These painful inflammations cause the knee to be held flexed, and thus relax the flexor muscles, which in turn shorten to compensate for the changed relations. The change in the muscle is a shortening without a morbid entity. The whole structure is too short, not the tendon alone. It is, indeed, quite probable that it is the fleshy parts of the muscles that shorten, owing to their natural tendency to maintain a certain state of tension.

This condition affects chiefly the aged and the hard-worked horse. It accentuates with hard, arduous work, and improves somewhat with rest and palliative treatments, but the deformity is never entirely cured, except by tenotomy. The young horse that has had only nominal work may sometimes become badly knee-sprung, when predisposed to the deformity by the congenital form. That is to say, a horse thus deformed from birth, when worked even judiciously, and in the absence of any serious carpal disease, may develop an accentuated variety of the deformity.

The ideal indication for the operation is the "knee-sprung" case that is accompanied with no appreciable structural obstruction, such as exostoses, contracted binding ligaments, etc., but is deformed because of a sub-acute inflammation that causes the joint to be held forward. Under such favorable circumstances the divisions of the flexor tendons, blisters, firing and rest will very often bring a highly flattering result. The permanency of the cure will depend upon the success in curing the causative inflammation. When this is not cured, the deformity will recur, but if aborted, the cure is permanent.

An inimical circumstance in many cases is the low value of the horse, due to its age and general state of decrepitude. Very frequently the knee-sprung horse is an old subject, probably suffering from other locomotory defects and general senile debility. This low value, together with the long

period of post-operative convalescence, markedly limits the number of suitable surgical subjects.

EQUIPMENT.—Division of the tendons is best effected with a **special bistoury,** (Fig. 5) curved slightly, probe-pointed, with a cutting edge extending to the very end. This knife is identical to the ordinary probe-pointed, curved bistoury, with the exception that the rounded protuberances at each side of the end of the blade are absent. The essentials are those required for any surgical operation; i. e., antiseptics, scalpel, razor, clippers, soap and bandages. Special pains is taken to sterilize the scalpel and bistoury.

RESTRAINT.—The operation is performed in the lateral recumbent position, with the deformed leg uppermost, and brought out at a right angle with the long axis of the body. The **operating table and casting harness** are both suitable methods. The leg is fixed with a strap or rope extending from the lower part of the middle third of the radius to a stationary point posteriorly,—the hopple of a hind leg or the frame of the table, and a second rope looped around the pastern and brought forward around the heel of the foot. This second rope is given into the hands of one or two strong assistants, who are instructed to pull with their might while the tendons are being divided. This tension facilitates the cutting. The only appropriate anæsthesia is general anæsthesia, but as the operation is a brief one, attended with no torturing pain, this precaution may well be omitted. Local anæsthesia is ineffectual, on account of the impossibility of bringing the solution in contact with all of the tissues to be incised. Mere subcutaneous cocainization is of no service whatever during the crucial part of the operation, the cutting of the tendons. It is much better to restrain the leg by force, omitting all anæsthesia.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The point of entrance for the bistoury is located about one inch above the trapezium in the grooved depression that can be felt with the finger tips between the tendons of the external and middle flexors. The groove is not a distinct one, except on firm pressure, when the skin is found to push inward slightly between the tendons. Distinct palpation of each tendon is prevented by the firmness of the antibrachial fascia.

Second Step.—Disinfecting the Field.—The hair is clipped, shaved, and the skin well washed with mercuric chloride solution 1-500, over a liberal surface around the point selected. It is important to execute this step well, with

the view of preventing abscess. The space between the cut ends of the tendons fills with blood clot and leaves a favorable field for the growth of micro-organisms, which might be accidentally carried into these recesses from a dirty skin. Furthermore, purulent products will burrow between neighboring structures and cause serious complications. Absolute cleanliness is therefore specially essential.

Third Step.—Making a Point of Entrance for the Bistoury.—The point of the scalpel is plunged firmly through the skin and subjacent fascia. The knife is held firmly between the fingers, and the hand is pressed flush against the leg, so that a sudden jerk will not slash a large opening in the skin. The point of entrance is made just large enough to admit the bistoury, and no larger. With a gaping wound at this location, subsequent infection of the deeper recesses could hardly be prevented.

Fourth Step.—Dividing the Tendons.—The probe-pointed bistoury is now passed through this small incision, between the two tendons, until its point is on a level with their deepest part. Its cutting edge is turned against the external tendon and the handle is then grasped firmly, the other hand acting as a guard externally. The assistants who are holding the leg pull with their might to stretch the tendon, as a deliberate sweep of the bistoury snaps it off. Then, without removing the bistoury, its cutting edge is turned against the medius, which is divided in exactly the same manner. The only special precaution to take in this step is that of not passing the bistoury too deep. The posterior radial artery, and the superior cul-de-sac of the carpal sheath, may thus be unnecessarily wounded.

Fifth Step.—Bandaging.—A thin layer of cotton soaked in an antiseptic is placed over the wound and a firm muslin bandage wound over the region, including the upper third of the metacarpus and the lower third of the radius.

AFTER-CARE.—The patient is kept in the standing position for several days. The bandage is changed daily to prevent discomfort from pressure. At the end of the week the patient is turned into a loose box, paddock or pasture, and allowed at least six weeks of rest.

SEQUELÆ AND ACCIDENTS.—Septic inflammation of the surgical wound, which may spread into the adjacent synovials, is the most serious consequence of the operation. If guarded against by cleanly methods of operating, it will seldom occur. The radial artery may be accidentally cut by passing the bistoury too deep between the tendons, but the

accident is easily avoided by exercising a little care in passing the bistoury around the medius. There is no danger while dividing the external tendon. The hæmorrhage resulting from this accident is controlled promptly by applying a taut compressing bandage over the whole lower half of the forearm.

One of the unfortunate results is the failure to relieve the deformity. Although the tendons are well divided and the carpus can be straightened, it sometimes happens that the patient will persist in keeping it flexed, except when it is retained on a straight line by force. In this event it will be necessary to apply a hard retention bandage (plaster of Paris) to prevent flexion for several weeks, at which time the condition will be found to be at least partially ameliorated.

METACARPAL TENOTOMY.

SYNONYM.—Tenotomy of the perforans and perforatus tendons.

DEFINITION.—Metacarpal tenotomy is the name we apply to the subcutaneous division of the flexors of the phalanges, at the middle third of the metacarpus, for the purpose of correcting the deformity known as volar or palmar flexion.

INDICATIONS.—Chronic volar flexion is a deformity of solipeds, consisting of a contraction of the flexors of the phalanges, due to a definite lesion in the digital region. On account of a painful morbid process, located at some point along the "palmar surface," the phalangeal articulations are thrown into a constant state of excessive flexion, which relaxes muscles controlling that action, and thus induces them to shorten in obedience to the distance they cover. Once contracted, the flexed state, commonly known by the phrase "volar flexion," persists until the tendons are again lengthened by tenotomy or other treatments. This definite lesion is generally a tendo-synovitis of the navicular bursa, but may also be located in the bones, tendons or synovials, at any point between the fetlock and the semilunar ridge. Exostoses, severe strains of the tendons or ligaments, severe inflammations of the synovials, and sometimes chronic laminitis, are the usual primary abnormalities which cause the muscles (and their tendons) to become shorter and shorter as the articulations become more and more flexed by the animal's efforts to place the articulations in the most comfortable position.

It thus occurs that acquired volar flexion of solipeds is a complex entity, consisting of a serious lesion as a **cause,** and contracted tendons as an ultimate **effect.**

Aggravated volar flexions of congenital origin are sometimes encountered in the new-born in the absence of any perceptible lesion, but these usually improve with the development of the skeletal and muscular systems, like all other similar deformities of the young. These require surgical treatment, when the deformity is serious. In the most exaggerated form they cause the patient to walk upon the dorsal surface of the phalanges.



FIG. 109—Volar Flexion of Pedal Origin.



FIG. 110—Bilateral Volar Flexion due to Sesamoiditis.

Contractions of tendons from lesions in the tendons themselves seldom ever occur. The flexor tendons of the horse may be sprained, ruptured or "bowed," and in the siege of a painful, obstinate inflammation, without ever contracting therefrom to any appreciable extent. A slight volar flexion may result from such lesions, but it is never of the accentuated type seen from lesions in the palmar aspect of the digital region. The sprained tendon is, therefore, in the metacarpal region, not an indication for tenotomy. It does not cause a pronounced volar flexion.

Similar deformities also occur in the pelvic limb, but not with the same frequency as in the pectoral. The knuckling

deformity of the hind leg is generally due to the sesamoiditis, but as in the fore limb, it may sometimes be due to lesions along the plantar aspect of the digital region. Spavin and exostoses about the head of the great suspensory ligament are also occasionally causative (Fig. 111).

In the selection of a suitable case for tenotomy, the character of the primary lesion deserves first consideration. It may be impossible to correct the deformity, even after the tendons are cut, or the great force required may inflict serious injury to the diseased structures. Before operating,

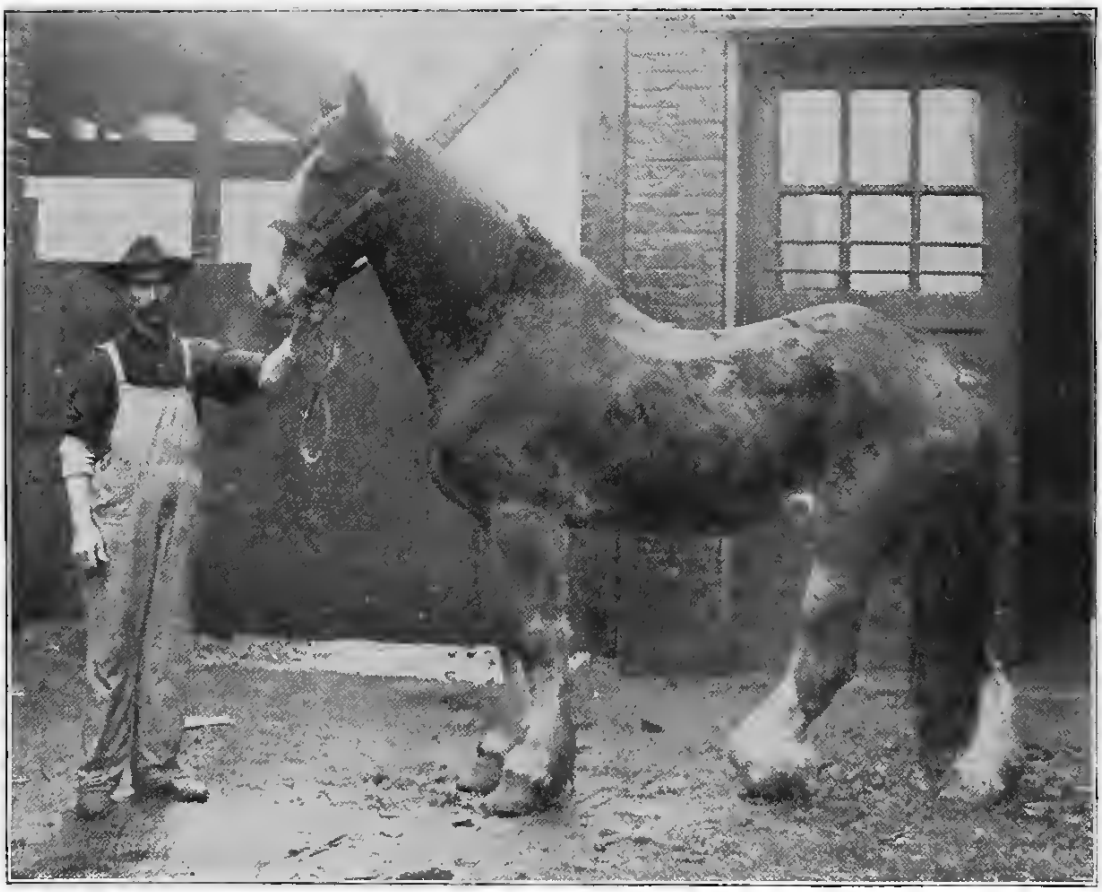


FIG. 111—An Extreme Case of Chronic Plantar Flexion from Goneitis.

there must always be some certainty that reposition of the deformed articulation will not be prevented by confirmed ankylosis or adhesions.

When the initial lesion is in the navicular bursa, division of both the perforans and perforatus tendons may always be depended upon to correct the deformed fetlock. Sometimes division of the perforans alone is sufficient. But there is no assurance that the cure will be permanent, because the pain at the seat of the initial lesion may cause a recurrence of the contraction, after the tendons have again reunited. The operation to correct the deformity must, there-

fore, be followed by treatment that will tend to benefit the original disease to which it was due. Firing, blistering, appropriate shoeing, and long rest or easy work are often helpful in bringing about a satisfactory termination of the operative treatment.

In the ox and dog similar deformities are rare; the deformity is seen chiefly in solipeds, because these animals alone are constantly submitted to the arduous work, and are exposed to the kind of injuries that are capable of causing the particular lesions from which contracted tendons emanate. However, in the absence of any evidence to the contrary, it is reasonable to theorize that nail pricks, thecal abscesses, fractures, etc., may sometimes cause the deformity in these domestic species.

EQUIPMENT.—The division of the tendons is effected with the same special bistoury described under the head of carpal tenotomy (Fig. 5). A common tenetome, pricking knife, sharp-pointed curved bistoury may, however, be substituted in the absence of this special bistoury. The other requirements are: Scalpel, clippers, razor, hoof-knife, hoof-nippers, hoof-chisel, bandages in abundance, antiseptic solutions.

RESTRAINT.—The operation is performed in the recumbent position with the affected leg undermost and stretched out at a right angle from the body. General anæsthesia is helpful, and is especially demanded, when there are firm adhesions to break down after the tendons are divided. The division of the tendons alone is not very painful, but the breaking-down process inflicts a torturing pain that deserves consideration. Local anæsthesia is of no service whatever.

The leg itself is secured with two ropes, one passing from the knee backward to some fixed point, and a second one looped around the pastern and brought forward around the heel of the foot. The first is a stay rope to prevent the leg from pulling forward, while traction is applied to the other one to break down the deformity.

The operating table and casting harness are both suitable apparatuses to restrain the subject, but the former is somewhat more convenient.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The division of the tendons is effected **exactly at the middle of the metacarpus,** a point devoid of synovials. At the lower third is the superior cul-de-sac of the sesamoidean synovial, while at the upper third is the inferior exten-

sion of the carpal sheath. These two important sheaths must be avoided. The internal aspect of the leg is selected for the purpose of avoiding the great metacarpal artery. If a tenetome is passed between the perforans tendon and the

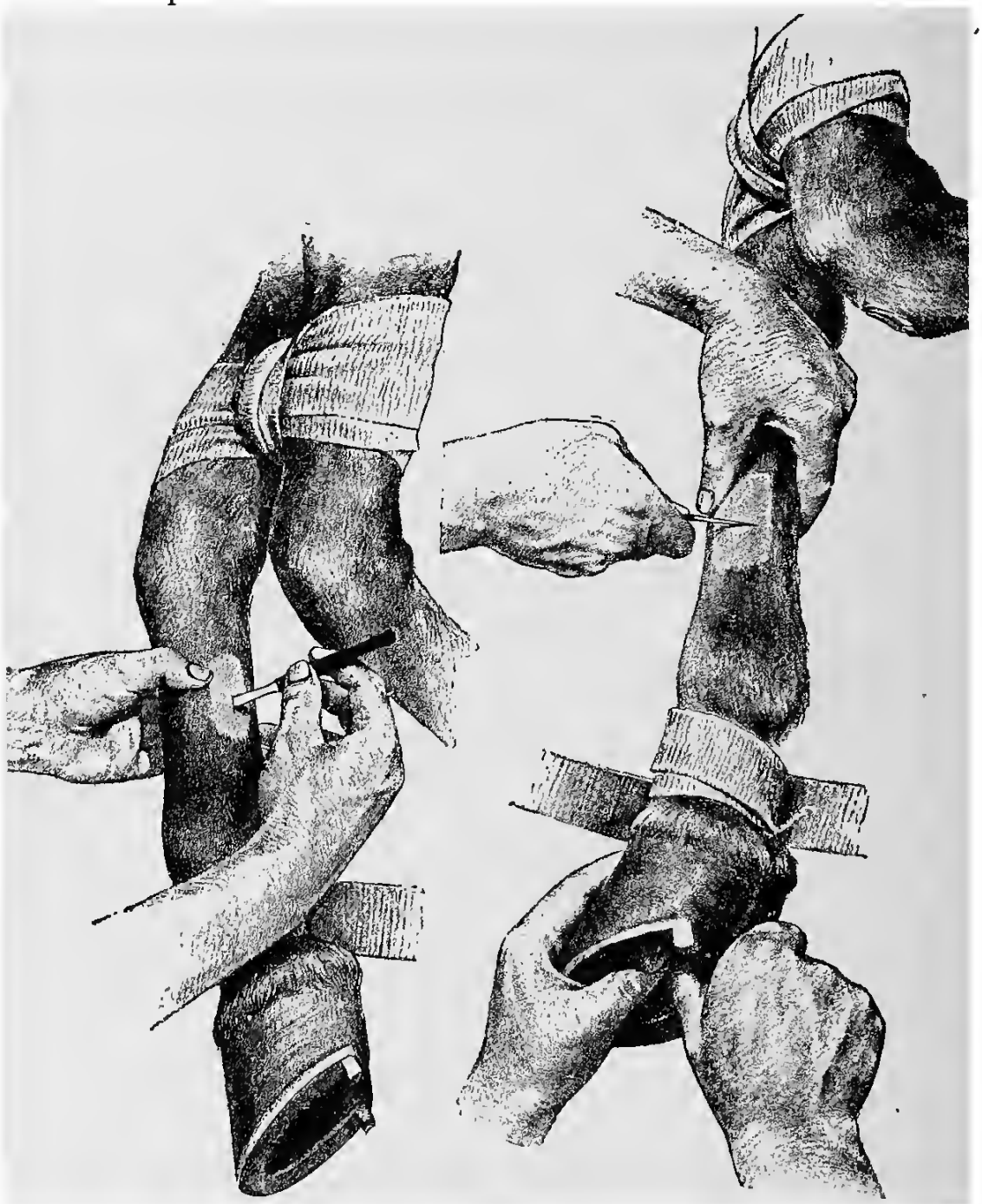


FIG. 112—Position of Incision and Correct Direction of Tenetome in Metacarpal Tenotomy.

FIG. 113—Fourth Step of Metacarpal Tenotomy. (Moller.)

great suspensory ligament, from the external side of the leg, it can hardly be made to sweep around the tendons without cutting this large blood vessel, while on the other hand if the point of entrance is the internal side, the blade can easily

be slipped beneath this vessel, which occupies a rather superficial location along the internal surface of the region.

Second Step.—Disinfecting the Field.—The whole middle third of the metacarpal region is clipped, shaved and disinfected with mercuric chloride solution 1-500, and then rinsed in alcohol. It may in addition be submitted to a friction with boric acid and iodoform. It is important that no infectious matter be carried into the recesses of this sheltered wound.

Third Step.—Incising the Skin as a Point of Entrance.—A small point of entrance for the bistoury is first made with the point of the scalpel in the groove, between the perforans tendon and great suspensory ligament. The exact location of this **point of entrance** is important. It is made at the posterior edge of the groove, not in its depths, so that the bistoury can be passed downward and forward under the great metacarpal artery, and internal metacarpal vein. If the entrance point is made in the depths of the groove these two vessels can hardly be avoided.

Fourth Step.—Dividing the Tendons.—This step is effected with the special bistoury previously described. The bistoury is passed through the entrance incision, antero-externally; that is to say, forward and downward, so as to glide under the great metacarpal artery, the internal metacarpal vein and internal plantar nerve. The blade is placed flatwise against the tendon on its downward course. When the blade is buried beyond its cutting portion it is first directed straight through to the opposite side, until its point is felt beneath the skin, and then turned, cutting edge against the tendon. At the same moment the assistant holding the rope is instructed to pull with his might to bring tension upon the tendons as the bistoury divides them. It is advisable to first divide only the perforans and then endeavor to break down the deformity by force. If the adhesions do not yield to the traction, the perforatus is then severed.

Fifth Step.—Breaking Down the Adhesions.—Old deformities require the application of considerable force to readjust them. If they do not yield to ordinary traction the rope looped around the pastern is taken in both hands and one foot is placed against the front of the fetlock. A steady and forcible forward traction with the hands and a firm backward pressure with the foot will usually bring the fetlock to its normal angle without much ceremony. The reposition is attended with a crunching sound caused by the tearing of the adhesions. It sometimes happens that the

adhesions will stubbornly resist any ordinary force that can be applied. Under such circumstances additional help is enlisted. The full strength of two, of ever three, strong men may be required, each one pulling upon the rope with one foot against the dorsal surface of the leg. No matter how much force is required the volar flexion must be straightened. To simply sever the tendons without effecting this reposition is useless.

Sixth Step.—Applying the Supporting Bandage.—The amount of support required to prevent the fetlock from breaking down altogether into an exaggerated dorsal flexion and the turning up of the toe, will vary greatly in each case. It sometimes happens that no bandage supporting is necessary. The remaining adhesions may be sufficient to retain the fetlock at the proper angle. Frequently the deformity is only partially corrected by the traction and the weight of the body gradually forces the phalanges to the proper inclination. This is particularly the case when only the perforans is severed.

Usually, however, it is necessary to support the articulations with a substantial bandage. A thick wrap of firm muslin bandages extending from the carpus to the foot partially covering the latter is an appropriate support for the first week.

Seventh Step.—Shaping the Hoof.—This part of the operation, which may be executed before or immediately after the preceding steps, is demanded, because of the excessive growth of the heels in all cases of chronic volar flexion. The heels of the hoof, not being in wear, elongate in proportion to the degree and the duration of the deformity. They are sometimes four or even six inches long.

It is probably advisable to shape the hoof with the hoof-chisel, hoof-nippers and hoof-knife as a preliminary step before the patient is placed in the recumbent position. Once cast, these instruments cannot be as conveniently used. Another method, however, is to reduce the hoof to its proper dimensions with a saw while in the recumbent position, after the other steps have been completed.

AFTER-CARE.—The patient is given the preference of standing or lying at will in an ordinary loose box. The muslin bandage is not disturbed for six or seven days unless swelling or pain supervenes, which circumstance would necessitate readjustment. At the end of the first week the muslin bandage is replaced by a hard retention bandage of insulation tape (see p. 497), which is removed at end of third week.

At this time the tendons will have reinforced themselves sufficiently to perform their weight-carrying function unaided. A blister or firing with the feather-edge iron, and finally a rest at pasture or in a paddock for one or two months, completes the procedure.

ACCIDENTS AND SEQUELÆ.—In dividing the flexors of the phalanges special care is taken to prevent **pyogenic infection.** An accumulation of pus between the divided ends of the tendons may spread into the neighboring synovials and terminate in a serious complication. The prevention is found in performing the operation with sterilized instruments after having thoroughly cleansed the field.

An **exaggerated dorsal flexion** may result from failure to apply an adequate supporting bandage. The fetlock descends almost to the floor and the toe turns upward at every step.

Induration of the tendons at the seat of operation is an inevitable and unavoidable sequel. The operation always leaves an indelible hard tumefaction at and around the seat of operation. This sequel is not important in view of the much greater deformity which preceded it. The firing and blistering limits the size of the indurated tumefaction somewhat, but no form of treatment will entirely eliminate it.

During the operation there is always some danger of **severing the great metacarpal artery and vein.** This accident is certain to be followed by a very troublesome œdema of the leg. Prevention is found in operating on the internal side of the leg and by passing the bistoury safely beneath the vessels.

Recurrence of the Deformity.—Volar flexions straightened by tenotomy do not always remain permanently cured. In view of the fact that they are caused by primary lesions that are not benefited by the operation, a recurrence of the deformity may be often expected. The cure is permanent only when the causative lesion is no longer active. The supposition that tendons shorten again on account of the contraction of the cicatricial tissue that fills up the space between the divided ends is not true. **It is the initial lesion that governs their future behavior.** If this lesion is cured the tenotomy will be a pronounced success, otherwise recurrence of the deformity may occur to a greater or lesser degree, dependent upon the amount of pain accompanying the lesion.

METATARSAL TENOTOMY.

Metatarsal tenotomy is performed for analogous deformities in the pelvic limb, according to the same special recommendations governing metacarpal tenotomy. Plantar flexions (knuckling) grave enough to warrant its application are, however, much more liable to recur than the volar flexions of the pectoral limb. This is particularly the case when the causative lesion is connected with the tarsus.

PERONEAL TENOTOMY.

DEFINITION.—Peroneal tenotomy is the name applied to the surgical division of the tendon of the peroneus muscle at or near to its insertion to the extensor pedis tendon, for the cure of stringhalt.

HISTORY.—Peroneal tenotomy is a modern operation, first recommended by Bassi only a few years ago. It has been performed in America only during the past twelve or fifteen years, but was known to European veterinarians for some years prior to that time. At the present time it is very frequently performed by American veterinary practitioners. In fact, few stringhalt horses escape the operation where there chances to be a veterinarian to perform it. It seems to be performed by nearly all of the country practitioners. Horses coming into the markets very often show evidence of having been thus treated. It is a very common occurrence to find that the stringhalt horses submitted at the large clinics have been operated upon before having been brought from the country districts. Although a common procedure of the veterinary surgeon it is now generally known to be rather unreliable. Some are cured, some are benefited, but many are not even improved by the operation, and it seems absolutely impossible to predict the results. Its unreliability is, however, regarded as being counter-balanced by its simplicity and harmlessness, which fact will doubtless serve to retain its same nominal popularity until a better treatment for this mysterious abnormality of locomotion is found.

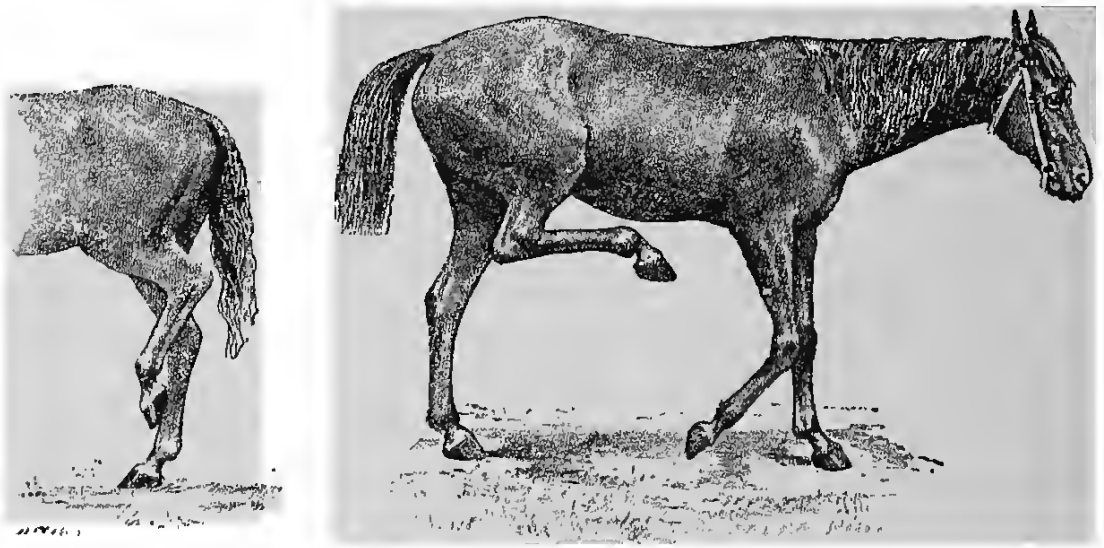
INDICATIONS AND CONTRA-INDICATIONS.—The operation of peroneal tenotomy is performed only for **stringhalt.** It is intended to cure or modify the excessive flexion of the hock, by which the disease is manifested. Stringhalt is the symptom of an obscure lesion, whose pathology is still a mystery. The various explanations and

speculations by pathologists give the reader no positive information, and the closest observation on innumerable affected subjects gives no clew to the nature or location of the causative lesion. It is true that stringhalt often co-exists with definite abnormalities about the hock, foot, stifle or hip, but the existence of similar abnormalities without this involuntary excessive flexion, must, for the present at least, leave some doubt as to whether they are the causative factors or not. The improvement of the symptom so often following the division of the peroneus tendon would indicate that the seat of the lesion is not far from the hock or tibial region, but the fact that peroneal tenotomy often fails and that desmotomy of the internal patellar ligament is sometimes successful, shows beyond reasonable doubt that the trouble is at times if not always, located above these regions.

The disease is interpreted differently by each investigator. Bassi recognizes two forms, **true** and **false** stringhalt. The former he attributes to some abnormality about the patella, and the latter to some definite lesion in the tarsal bones, fascia of the leg or extensor muscles. Contraction of fascia at any point from the hip to the metatarsus, he supposes, is the most likely lesion responsible for the faulty gait. Moller differentiates between two forms also, but calls them **idiopathic** and **symptomatic** stringhalt; the latter when due to a perceptible cause, and the former when the cause is obscure. Hughes divides stringhalt into **true stringhalt** and **chorea.** He applies the former designation to those cases in which the flexion is constant, that is, more or less pronounced at every step; and the latter to those which only show the symptom when first backed out of the stall, or when first started up after a moment of rest. The theories of different veterinarians might be repeated ad infinitum without finding two of them similar, which fact clearly exemplifies the mysteriousness of the condition.

It is, however, probable that stringhalt very often is a symptom of some lesion of, or is closely related to, the great fascia that envelope the pelvic limb. Speculations on the nature of disease, varying from neuroses of the spinal cord to definite lesions in the foot, do not harmonize very well with the striking uniformity of the manifestation. The symptom, stringhalt, is characteristic and manifestly uniform in every case. The variation in different cases is one of degree only. It is not very likely that this same sign,—excessive flexion of the hock,—is caused by so many dissimilar lesions. **The sensible decision is that stringhalt is**

due to a causative lesion as uniform as the symptom itself, were it only known. To claim that one case is due to chorea, —a brain lesion,—another to some defect in the spinal cord, another to some abnormality of a peripheral nerve, another to injury to the stifle, another to spavin, another to sidebone, another to injury to the extensor tendons, and another to contraction of the tibial fascia, seems very illogical when the uniformity of the symptom is taken into consideration. At the present time stringhalt is not undestood. It is a mysterious manifestation of some unknown lesion. Its treatment is empirical. It is sometimes cured by dividing the peroneus tendon, but the mechanism by which the cure is accomplished is quite as mysterious as the primary lesion itself. The peroneus is an accessory extensor; it has no



FIGS. 114 AND 115—Two Distinct Forms of Operable Stringhalt.

marked action upon the hock, and its chief mission is to assist the extensor pedis to extend the phalangeal articulations. If divided accidentally or surgically its loss produces no perceptible change in locomotion, which fact shows conclusively that the cure from tenotomy is not due to any direct modification of muscular activity. The same fact proves also that stringhalt is not of nervous origin. The cure of some cases by peroneal tenotomy points to a lesion somewhere near the peroneus muscle, at its origin, its belly or its tendon. That the lesion is sometimes located near its origin is suggested by the cures which follow division of the internal patellar ligament. These two operations may sooner or later solve the perplexing problem; and in view of all facts connected therewith it will not be surprising if the cause is found somewhere in the neighborhood of the stifle,

especially around the superior extremities of the tibia and fibula.

Another very reasonable theory places the fault on the loss of equilibrium in the action of that great mechanism that automatically flexes the hock and the stifle simultaneously. When one of these articulations flexes the other one also flexes automatically. Flexion of one is physically impossible without flexion of the other. The gastrocnemius posteriorly extending from the femur to the calcaneum, and the tendinous portion of the flexor matatarsi anteriorly extending from the femur to the metatarsus, complete a mechanism operating these great articulations with the aid of two groups of muscles, one group anteriorly and one posteriorly. Normal action of these two articulations depends upon an equilibrium between these two groups. If this equilibrium is disturbed by a decreased activity in the posterior group excessive flexion of the hock and stifle results. This theory places the **lesion in the region of the gastrocnemius,** and it is fortified by the fact that exaggerated stringhalt always follows either accidental or experimental division of this muscle. It also explains much about the effect of peroneal tenotomy. By dividing the peroneus (one of the anterior group) the disturbed equilibrium is again balanced. The loss of this muscle by surgical division of its tendon, equals the loss of mysterious origin posteriorly, and thus re-establishes the lost equilibrium. Sometimes the defect posteriorly is too great to be corrected by the division of so trivial a muscle as the peroneus, hence the frequent failures. The cures effected by partial or complete division of the flexor metatarsi still further fortifies the hypothesis.

That stringhalt is due to a definite lesion as uniform as the symptom itself is the only reasonable hypothesis upon which to base future investigation.

EQUIPMENT.—The small curved bistoury recommended for tenotomy of the metacarpal flexors is the only special instrument required, and it may be supplanted with any ordinary curved bistoury, either probe or sharp pointed. A scalpel, local anæsthetic outfit, and antiseptics, complete the equipment. If it is desired to resect a portion of the tendon, as is often the case with some practitioners, a dissecting forcep and an elevator are added.

RESTRAINT.—The operation can be performed in the **standing position** with the aid of twitch, single side line to lift the opposite leg and local anæsthesia. **Recumbent restraint** becomes necessary only in restive horses whose na-

tural tendency to resent restraint threatens interference with the successful execution of the technique. As most stringhalt horses are well broken, and as the disease is not so frequent in unbroken, unworked animals, the operation is usually very easily performed in the standing posture.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The antero-external aspect of the leg at the superior part of the upper third of the metatarsus is the surgical field. In this area the tendon of the peroneus can be plainly felt extending in an oblique direction upward and slightly backward from the point of its insertion to the extensor pedis. It rolls under the fingers tips, when pressed against the bone beneath. Its caliber is that of a small lead pencil, but it is slightly flattened from side to side. When traced upward by palpation it is gradually lost as it surmounts the tarsal bones. The division of the tendon, or its partial resection, is effected at any point between its insertion to the tendon of the extensor pedis and the point above where it is lost in the tarsal fascia. It is advisable to divide it as near the insertion as possible, or as far from it as possible, in order to leave either a very short distal stump or else one long enough to preserve the sheath in which it plays. A distal stump of an inch, by moving up and down with each contraction of the extensor pedis, will sometimes develop a pronounced tumefaction below the seat of operation. These presents are particularly important when a part of the tendon is resected, and much less important when the tendon is simply divided subcutaneously.

Second Step.—Disinfecting and Anæsthetizing the Field.—The field is clipped, shaved, washed with mercuric chloride solution, 1-500, and then anæsthetized by subcutaneous injections of cocaine solution 5%. The anæsthetic solution is distributed under the tendon as well as subcutaneously, in order to anæsthetize every part touched with the knife.

Third Step.—Dividing or Resecting the Tendon.—Some veterinarians prefer simple subcutaneous division of the tendon, while others claim better results when a portion is resected (tenectomy). The former procedure is very simple. As soon as the cocaine solution has effectually anæsthetized the parts a small point of entrance is made in the skin with the point of the scalpel, along the anterior border of the tendon, that is in the space between it and the tendon of the extensor pedis. The point of entrance is made deep. The point of the scalpel should touch the bone, so as to complete the channel for the probe-pointed bistoury, as

far as possible. If only a cutaneous incision is made the probe-pointed bistoury will be blocked by the underlying connective tissue, in its downward passage. The bistoury is passed flatwise beneath the tendon and then turned against it. The division is then effected by pressing the tendon against the sharp edge with the thumb.

To resect a part of the tendon a cutaneous incision is made, one-half inch long, along the course of the tendon at its most conspicuous part. The tendon is then brought out with a nerve elevator or tenaculum, stretched as tight



FIG. 116—Side-Line Restraint and Position of Operator in Peroneal Neurotomy.

as possible and then divided, first superiorly and then inferiorly. An inch is easily resected in this manner.

A third method, somewhat more complicated than the preceding, consists of first elevating the tendon through a half-inch incision made as low as possible and then dividing it subcutaneously an inch higher, so that a long piece of the tendon can be pulled out of the incision. After the tendon has been elevated through the lower incision, the bistoury is passed under it an inch or so higher up and as its blade is turned against it, traction is applied to the elevator to facilitate its division by increasing the tension. When the division is effected a firm pull will bring the

whole distal stump out of the incision. Division distally then completes the resection.

There is no intention here to claim any special merit for any one of these methods over the others. Each one has its failures as well as its victories. The latter, however, has given us the highest percentage of cures, but the number of cases specially observed for differentiation has not been sufficient to warrant a final decision in its favor.

Fourth Step.—If but a subcutaneous division of the tendon has been made the operation is completed by simply covering the small incision with collodion or clay dressing. A dab of iodoform is also sufficient if renewed daily for a few days. When either of the other methods is used a stitch to the incision will be required to prevent a scar.

AFTER-CARE.—The stitch is removed at the usual time. In the meantime the horse is turned into the loose box for a week and then given slight exercise for another week. At the end of the second week he may be returned to his usual work without harm or without danger of distracting from the final results. Some time always elapses before any benefit is observed. There is often a marked amelioration as late as six weeks after the operation has been performed, and it is seldom that any perceptible modification of the flexion occurs sooner than two weeks. Sometimes the cure is not permanent. The symptom may subside markedly during the first and second months and then return in a more exaggerated form than ever.

ACCIDENTS AND SEQUELÆ.—Septic complications extending into the tarsal articulations is the only serious sequelæ, and this is of rare occurrence. If the operation is carefully performed with regard to surgical cleanliness it will be indeed very rare. Sometimes a pronounced tumefaction at or immediately below the seat of operation develops after some weeks. This sequel is due both to a septic wound and to the irritation caused by friction of the distal stump. As stated above, the stump should be very short, (one-half an inch) or long (one and one-half inches or longer).

The only accident we have ever known to occur is the accidental division of the extensor pedis tendon, resulting from a sudden jerk of the leg as the knife,—a scalpel,—was being passed under the tendon from behind forward. The prevention is found in passing the bistoury in the opposite direction as previously recommended. When the operation was first introduced a certain veterinarian deliberately di-

vided the extensor pedis tendon of each leg, mistaking them for the tendons of the peroneus muscles; but this accident is little likely to occur to a more intelligent practitioner.

CUNEAN TENOTOMY.

DEFINITION.—Cunean tenotomy is the resection of a portion of the cunean branch of the flexor metatarsi where it winds diagonally over the internal aspect of the tarsus, for the purpose of curing or modifying the lameness of spavin.

HISTORY.—Cunean tenotomy is the artifice of Peters and Deicherhoff, although others before them suggested and attempted similar operations to cure spavin lameness by different procedures directed towards this tendinous structure. The peculiar relations of the cunean tendon to the exostosis of spavin, led many veterinarians during the past decade toward this interesting anatomical structure in their vain endeavors to ameliorate this refractory lameness. When the operation was first introduced into America about fifteen years ago, too much was claimed for it. Its first victories were heralded with the satisfaction wrought only by great discoveries. It was fabulously claimed by some that a real panacea for this stubborn limp was now at hand, that spavin was now divested of its terror to the veterinary practitioner. It was, however, judged differently as soon as it was more generally performed at the different clinics. Today, after sufficient time has elapsed to gather data on its real effects, the operation has lost some of its prestige. Some experienced practitioners have abandoned it entirely, while others, more correctly, still defend it as a satisfactory operation under certain circumstances. It is not now regarded as **the** cure for spavin lameness; firing, blistering and rest, having by far the most adherents among the best practitioners. The tendency today is toward the application of the operation after these usual expedients have failed, which is no doubt the proper interpretation of its worth.

INDICATIONS AND CONTRA INDICATIONS.—Cunean tenotomy has but a single indication—**the lameness of spavin.** Its proper place in veterinary surgery today is that of **a second resort** in the treatment of **circumscribed spavin.** A prominent exostosis, limited in extent, implicating only the lower part of the tarsus, is the preferable indication.

Adams claims that one of the benefits derived from cunean tenotomy is the detachment of the tendon from the cuneiform parvum. The claim is based on the logical reasoning that the tendon, as the hock flexes, pulls against the diseased parvum and thus causes at least a part of the lameness. Severed, this much of the lameness is dispatched. If this reasoning is correct, a backward extension of the exostosis, a common occurrence, should be a favorable rather than an unfavorable condition for the operation. Cunean tenotomy is also defended on the grounds that it provokes a deep seated inflammation, deeper than puncture firing, and thus hastens resolution of the osteitis. One of the first contentions held, was that tension against the tendon caused lameness, and that its division by removing the tension palliated the limp. This theory is probably ill-founded, as the tendon is never found in a state of tension. On the contrary, it is always imbedded in a deep, well carpeted groove. The exostosis builds up around the tendon but never presses it into a state of tension.

Cunean tenotomy performed at the very beginning of spavin lameness seldom ever affords the desired relief. It is probably as effectual as any of the other treatments, but as some time must always elapse between the beginning and the termination of every real spavin lameness, the operation, like all other treatments, is generally found to have given little or no benefit after the usual period of post-operative convalescence is over. Firing and blistering might then be recommended as a second resort, but the tenotomy being regarded as the radical treatment it is preferable that the former precede it.

Besides those serious, diffused, incurable spavins which encroach farther and farther over the articulation until the entire tarsus is implicated, almost all spavins will eventually recover in from three to six months of treatment. Treatment tending to hasten this cure must consist of keeping the seat of disease in a constant state of irritation. Cunean tenotomy maintains such a state for some weeks, and is therefore a defensible procedure.

EQUIPMENT.—No special equipment is required to perform the operation. The usual operating outfit containing the essential instruments,—scalpel, curved, probe-pointed bistoury, small curved scissors, dissecting forcep, razor, clipper, hypodermic syringe, 5% solution of cocaine, antiseptics, needles and thread, constitutes the necessary instruments.

RESTRAINT.—Cunean tenotomy can be performed in both the **standing** and the **recumbent positions.** The former is ample restraint if the patient is not restive and if the seat of operation is well cocainized subcutaneously. The **twitch** for the nose, the **single side line** to lift the opposite leg from the floor, and the liberal use of the **cocaine solution** along the line of incision, will effectually restrain the ordinary

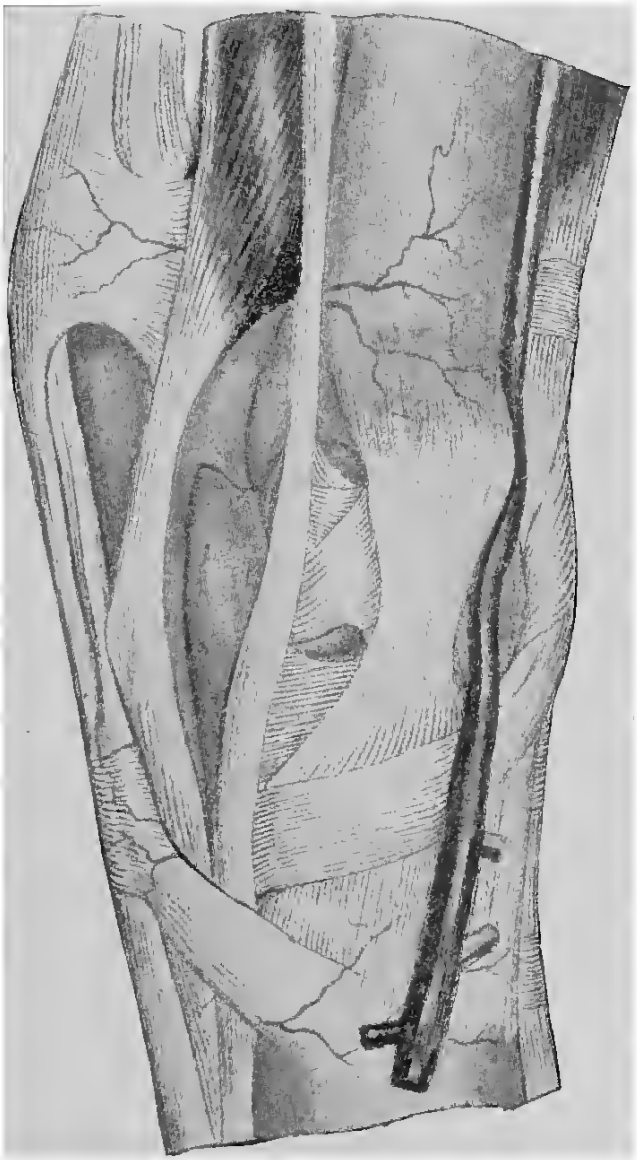


FIG. 117—Surgical Anatomy of the Internal Aspect of the Tarsus.

horse for cunean tenotomy. If for any reason the recumbent position is found necessary, the operating table will be found most suitable. It is much more difficult to secure and retain the legs in a convenient position when the patient is cast with the harness, and harness restraint is always more or less dangerous in spavined horses; if aged, fracture of the lumbar vertebræ is not an unlikely accident.

TECHNIQUE.—First Step.—Locating the Line of In-

cision.—The incision is along a vertical line at the very middle of the hock internally, and is about two inches long. The cunean tendon can not be felt on palpation. It is flat and hidden in a groove which is quite deep if the exostosis is a large one. It traverses the inner side of the hock in an oblique direction from above downward and backward between the quadrification of the flexor metatarsi in front of the astragalus to the cuneiform parvum. A line drawn from the anterior face of the astragalus to the head of the internal splint bone about follows its course. These two points are selected because of their prominence. A vertical incision in the middle of the internal surface of the hock crosses the



FIG. 118—Restraint and Position of Operator in Cunean Tenotomy.

tendon at the safest and most conspicuous place. Some practitioners make a diagonal incision following the oblique course of the tendon, but besides giving no advantage it is much more difficult to heal than the vertical one.

The line of incision is determined by mental calculation; there are no land-marks to follow. The incision is two inches long, the lower end coming downward to the level of the large metatarsus. If the incision is kept in the middle of the hock no important structures will be encountered. Anteriorly the field is traversed by the internal saphenic vein, but this vessel is visible and easily avoided. If carried too high there is danger of entering the capsular ligament of the

tibio-astragular articulation. (Fig. 119.) By keeping in the middle of the hock and cutting two inches upward from the head of the large metatarsus, a free, bold, deep incision can be made with impunity.

Second Step.—Disinfecting and Anæsthetizing the Field.—Having previously applied the twitch and side-line, the whole inner surface of the hock is clipped, shaved and rinsed with mercuric chloride solution, after which a liberal amount of cocaine solution 5% is injected subcutaneously along the line of incision. A few moments may now elapse before proceeding, to allow the cocaine solution to disseminate and produce its effects.

Third Step.—Making the Cutaneous Incision.—The operator stands parallel to the affected leg, facing its ex-

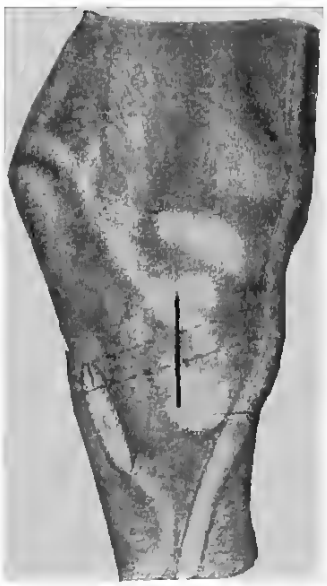


FIG. 119—Location of Incision in Cunean Tenotomy. Dotted Lines Show Course of the Tendon.

ternal surface, leans over the hock and makes an upward incision through the skin at one deliberate stroke, beginning at the head of the large metatarsus and ending two inches higher. The edges of the wound are separated to either side with the dissecting forceps and as the assistant bails out the blood the tarsus fascia is seen in the depths of the wound. Sometimes one or even two cutaneous vessels will bleed quite profusely. These are managed with the artery forceps which are left hanging for a few moments, or even until the operation is completed. If they are allowed to bleed search for the tendon will be more difficult. (Fig. 118.)

Fourth Step.—Searching for the Tendon.—When the skin is divided the tendon still remains covered by the tarsal fascia, a rather thick but somewhat indistinct structure

which is now divided by a second upward stroke of the scalpel. This fascia is adherent to its subjacent structures and cannot be separated as easily as the skin. It is, however, advisable to push it apart in both directions so as to expose the tendon better. The tendon is then searched for by palpation with a blunt instrument,—the closed dissecting forcep or the handle of the scalpel. The tendon will be found to move under the pressure of a blunt instrument, and is thus accurately located and outlined. Its very edges can be thus found. All of the surrounding structures are immovable and are easily differentiated from the tendon itself.

Fifth Step.—Elevating and Resecting the Tendon.—The inferior edge of the tendon is sought and slightly dissected free from its attachments, so as to give a point of entrance for the elevator. The best elevator is the curved scissors, which are now passed under the tendon from below upwards until they are safely lodged and held by the pressure. The probe-pointed bistoury is then passed under the tendon in front of the scissors. The scissors are lifted up so as to bring out as much tendon as possible as the bistoury divides it. This leaves the distal stump protruding from the incision, while the proximal stump sinks out of view by the contraction of the muscle. The distal stump is now grasped with the dissecting forcep and as much of it as possible is resected with the scalpel.

Sixth Step.—Suturing the Incision.—The wound is closed with interrupted sutures, with the exception of a small orifice inferiorly for drainage. The edges are carefully approximated and all of the hæmorrhage should have been previously arrested.

Seventh Step.—Applying a Protective Dressing.—It is important to guard the wound against infection from without by applying an impervious coating of collodion over the sutured portion. A thick layer or two should be smeared over the entire field with the exception of the drainage orifice at the inferior commissure of the incision.

AFTER-CARE.—The subject is kept in the standing position for five or six days, largely for the purpose of keeping the wound intact and to prevent its contamination with the dirty floor or litter. On the sixth or seventh day the protective dressing is dissolved with ether and the stitches removed. If the union of the edges is firm little additional treatment will be required, besides that of keeping the parts clean with weak antiseptic or astringent lotions. If the union is not perfect, as is often the case, the wound must be

cleansed, matted with idoform and then recoated with collodion or a clay dressing. If the wound becomes infected soon after the operation, a circumstance that should not be permitted to occur, the drainage orifice is widened by the application of a pledget of wadding, and the wound frequently irrigated with hydrogen peroxide. The stitches are not disturbed unless the infection is virulent and threatening, in which case the whole wound is laid bare and treated as an open one.

At least six weeks of rest should be allowed after cunean tenotomy, if any benefit is to be derived. An immediate return to work after the cutaneous incision has healed will deprive the operation of whatever benefit might have been otherwise derived.

ACCIDENTS AND SEQUELÆ.—The only accidents liable to occur during the operation are **wounding of the vena saphena** by making the incision too far forward, or **wounding the capsular ligament** if made too high. These, however, could result only from gross carelessness.

The most serious sequel is **infective inflammation of the surroundings or abscess,** manifested by the appearance of swelling and acute lameness before the wound has healed. Ordinarily this complication is not dangerous, but may cause considerable anxiety for one or two weeks by threatening to implicate the articulation.

A second sequel is the **enlargement of the exostosis.** Cunean tenotomy enlarges the spavin but never decreases its size. It transforms the circumscribed exostosis into a wider one. The exostosis seems to grow upward into the space previously occupied by the excised tendon. For a long time after the operation, two, three or four months, the whole internal face of the hock is tumefied, seemingly with permanent new tissue, but this finally reduces until only the exostosis remains.

PATELLAR DESMOTOMY.

SYNONYMS.—Patellar syndesmotony; radical operation for the cure of habitual luxation of the patella.

DEFINITION.—Patellar desmotomy is the surgical division of the internal straight ligament for the purpose of curing the congenital abnormality of colts, usually described under the name of "habital luxation of the patella."

HISTORY.—The operation is the artifice of Bassi, and is one that has only recently been introduced into this coun-

try. Although performed and somewhat freely discussed by continental veterinarians for some few years past, it has only been performed a few times in America. It cannot be claimed that the operation is in general use among American practitioners. Although some publicity has been given to it by Schumacher in the **American Veterinary Review,** and later by the writer in the **Quarterly Bulletin** of the Chicago Veterinary College, little has been heard of its adoption by the country practitioner, who alone meets the appropriate subjects in sufficient numbers to give it the thorough trial upon which definite conclusions must be based. Schumacher reports two cures which were prompt and permanent. Our experience is limited to one case which was promptly and permanently benefited. Simpson reports a case in a full grown horse that was promptly benefited after the operation, but the permanent effects have not been reported. These few cases are the only ones known to have been submitted to the operation since its introduction in this country, in spite of the facts that the disease is very common in breeding districts, and that the operation is manifestly effectual. The difficulty of its technique and the apparent danger of injuring the synovials of the stifle seem thus far to have induced dissuasive arguments against it. The few cases reported in this country, although all were favorable, do not seem to have been sufficient to prompt its general adoption against the warning of its dangerousness by such well known writers as Moller, and others, who emphasize the great liability of transgressing upon dangerous ground while attempting to locate and isolate the ligament whose outlines are none too well marked. In our experience no such complications have ever followed in the many experimental operations performed (on normal stifles) during the past six years, when the technique was carried out according to certain specified directions. In the case previously referred to it was found much easier to find the ligament then in normal stifles, because the ligament, having been constantly submitted to stretching as the patella slipped in and out, became isolated and separated from the adjacent structures. Its isolation and division was a very simple matter. These deductions are identical with those of Schumacher and Simpson, both of whom found the operation easy enough to perform without endangering the underlying capsular ligament, and without the trouble in isolating the ligament that is so constantly heralded.

Bassi and others have recommended the operation for

the cure of stringhalt after having successfully applied it for this defect of locomotion, but up to the present time little is known of its real worth in this connection on account of the dearth of data.

INDICATIONS.—Patellar desmotomy has, therefore, two indications, namely; **Habitual luxation of the patella of young animals,** and **stringhalt** of the mature horses. For the former it is a radical cure as well as a scientific operation, while for the latter its application is empirical because the method by which it effects the cure is not known.

Habitual luxation of the patella is a congenital weakness, a relaxation, of the mechanism holding the patella to the femoral trochlea. The ligaments laterally and inferiorly, and the muscles superiorly are too lax to prevent the bone from slipping from its groove, and as the external wall of the groove (the external lip of the trochlea) is relatively small, the luxation is outward. In exaggerated cases the relaxation will let the bone slip freely across the whole trochlea. When the condition prevails until the patient grows to maturity the trochlea may be worn into a perfectly flat surface; as a trochlea it becomes obliterated. The desease is seen in **foals, calves,** and **pups,** especially in weak rickety subjects. Its tendency is toward improvement as an improved diet, and medical treatment of the young and its mother, promotes the general strength. If the relaxation is pronounced the patella slips in and out at every step without preventing locomotion, but if a less degree of relaxation exists the patella slips over the external lip of the trochlea and locks the motion of the stifle so effectually as to prevent extension of the leg. If bilateral, locomotion is impossible except when the patella is accidentally or manually restored to its proper position. Generally the luxation will promptly recur and thus perpetuate a pitiful state of decrepitude. The **operation is indicated only when the patella locks itself over the trochlea.** If the relaxation is so pronounced as to permit the bone to slip freely to any position without locking, the operation can do no good, because **its only service is that of preventing the patella from remaining in the state of luxation.** The cure of the relaxation will depend upon gain in general strength as well as local strength of the relaxed structures.

Certain treatments, local and general, should precede the operation in hope of curing the defect by easier means. It is only when the condition persists that the operation should be performed, but it should never be delayed until the slip-

ping of the patella over the edges of the trochlea has deformed it beyond relief.

EQUIPMENT.—The operation will demand the following equipment: Scalpel, dissecting forceps, artery forceps, two wound retractors, curved probe pointed bistoury, needles and silk thread for three to five stitches, needle holder, razor, soap and water, mercuric chloride solution 1-500, mercuric chloride 1-2000 in sterilized water, chloroform and anæsthetic apparatus.

RESTRAINT.—The operation is performed in the lateral recumbent position with the affected leg undermost, and under general anæsthesia. Local anæsthesia is hardly sufficient, as a sudden jerk of the leg at the critical moment might plunge the knife into the articulation, and besides the relations of the underlying structures to the cutaneous incision change with every different position of the leg. The ligament lying parallel to the incision may be found some distance away when the leg takes another position.

The operating table, or any ordinary casting harness or ropes will answer. Under profound anæsthesia the leg can be released and brought out to the desired position and effectually held by an assistant. The affected leg is slightly flexed at the stifle so as to bring the ligament into a wider field and to make it more conspicuous on palpation. The operation can not very well be performed if the leg is stretched, because in the extended stifle the ligament is hidden among its relations. On the operating table the uppermost leg is hoisted ceilingward, at the same time rolling the patient slightly toward the dorsal posture, and the affected leg is fixed to the table after being drawn slightly backward and well flexed at the stifle. A certain definite position markedly facilitates the operation. It is obtained by bringing the femur as far backward as possible and then folding (flexing) the tibia upon it. This brings the field some distance from the body. If the stifle is left to hug the abdomen the work is hindered. In the casting ropes or harness the uppermost leg is well flexed upon the pelvis and spread outward as if to expose the inguinal region. The patient is rolled toward the dorsal posture and the affected leg is drawn to the proper position with a rope fastened to the lower third of the tibia and pulled backward by an assistant.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—The ligament is located in the field representing the internal aspect of the flexed stifle. It is easily felt by firm pressure with the finger, extending from the patella, in

an oblique direction, toward the supero-internal part of the tibia. The middle straight ligament is found extending vertically from the middle of the patella to the tibial crest. It stands out prominently, much more so than the internal. By palpating inwardly from the middle straight a V-shaped depression dividing it from the internal straight easily determines the anterior edge of the latter, which exists in the form of a firm flat body about one inch in width in the mature normal horse, proportionately smaller in the colt, and more or less rounded in a patient affected with habitual luxation. The direction of the ligament varies somewhat with the position of the stifle. Flexion increases its obliquity; extension straightens it. It is essential in this step to determine



FIG. 120—Patellar Desmotomy.

its outlines by cautious palpation, so that the line of incision can be made directly along its long axis and as near as possible to the middle of its breadth.

Second Step.—Making the Cutaneous Incision.—Having determined the exact location of the ligament, an incision is made through the skin from the superior part of its middle third downward to and slightly beyond its insertion to the tibia, in all about two and a half inches long. Although the region is not very vascular, the cutaneous incision gives a little hæmorrhage that must first be controlled perfectly before proceeding, in order that the subsequent dissection is not hindered by masking blood.

Third Step.—Searching for the Lateral Edges of the Lig-

ament.—The wound is widened with the retractors, and as soon as the bleeding no longer hinders, the edges of the ligament near its tibial insertion are searched out by cautiously dissecting the areolar tissue and fascia. The fascia is thick and closely blended with the ligament itself; in fact they are inseparable. It is impossible to lift the fascia from the ligament so as to expose it. They must be managed as a single structure. The edges are sought directly through the fascia, where by palpation it is found to be thin and devoid of the thick underlying fibrous tissue—(the ligament itself). The search for these two lateral edges is limited to the inferior part of the wound, where a thick pad of adipose tissue interposed between the ligament and the capsular ligament acts as a perfect protection against wounding the latter. Higher up the capsular ligament is so closely related to the ligament as to render their separation quite hazardous.

Fourth Step.—Dividing the Ligament.—When the edges have been thus exposed the probe-pointed bistoury is passed flatwise under the ligament from before backward, keeping its blunt point against the ligament rather than plunging it inward. When its point appears at the opposite edge of the ligament the blade is turned upward and the ligament cut off at a single stroke. If the cut ends do not at once separate at least a quarter of an inch it is evident that some of the fibers of the ligament on one side or the other have not been divided and will require subsequent attention. These few fibers are divided by carefully passing the bistoury under them first on one side and then another until the breach between the cut ends widens sufficiently to indicate complete solution of continuity of every part of the ligament.

Fifth Step.—Closing the Wound.—The wound is closed with three to five interrupted stitches so adjusted as to assure perfect apposition of the wound from end to end. Drainage is not indicated except when found necessary to deal with an accidental septic state a few days later. The sutures are closed with an impervious dressing of collodion or calcareous clay. If there is any blood flowing or oozing from the incision the dressing is postponed until the standing position is regained and all of the flow has ceased.

AFTER-CARE.—The wound is given the usual treatment for wounds requiring no drainage, i. e., renewal or repair of the dressing as required and the removal of the stitches at the end of six or seven days. Except in the case of a suckling it is advisable to keep the patient standing until

the stitches have been removed in order to preserve the apposition of the edges of the wound.

When there is evidence of sepsis on the second, third or fourth day the lower stitch is removed to facilitate the escape of the wound secretions. In addition to the removal of the stitch the wound at that point may be carefully widened with a blunt instrument and submitted to a daily injection of a limited amount of hydrogen peroxide, more for the purpose of preserving the orifice than to disinfect the whole area. Forcible irrigations are contraindicated.

The cure is instantaneous. Patients which have never been able to walk before are now able to move freely about unincumbered. It is, however, advisable to first heal the wound before any exercise is allowed, except in the case of a suckling, in which such control is impossible.

ACCIDENTS AND SEQUELÆ.—During the operation there is always danger of wounding the capsular ligament, but this danger has been greatly magnified. If the division is effected at the inferior end of the ligament as above recommended, the danger of this accident is practically nil. When the accident does occur its gravity cannot be overestimated. It may prove fatal. Although the wound may, at the time of the operation, be perfectly aseptic, the subsequent flow of synovia into it will surely promote a septic state in spite of all preventive efforts.

Septic arthritis may ensue even in the absence of the above accident by the spread of an infective inflammation from the surgical wound into the articulation. This accident is rare after clean operations.

CAUDAL MYOTOMY.

SYNONYMS.—Pricking; nicking.

DEFINITION.—Caudal myotomy is a subcutaneous division of one or more of the coccygeal group of muscles for the purpose of correcting defects in the carriage of the tail.

INDICATIONS.—The principal indication for caudal myotomy is **habitual deflection** of the tail of the horse. While driving, or when trotted to the halter, the tail is deflected to one side of the vertebral axis to the decided detriment of the horse's appearance. The defect is regarded as a serious deformity by fanciers of good horses, either saddle horses or harness horses, and its amelioration is always anxiously sought.

In the past, when docking was extensively practiced

among coach horses, caudal myotomy found its principal indication in "setting up" the tails before they were amputated, and for this purpose the operation was chiefly known as "nicking" or "pricking." Its object is that of producing a higher carriage of the amputated stump. By dividing the depressor muscles and then preventing them from reuniting, the elevators, with their antagonist out of commission, are free to raise the tail to a higher level. Today, however, this use of caudal myotomy is as unlawful as docking itself, although it can be employed lawfully if intended solely to improve the carriage of the entire tail. Every horse of quality must carry a "good" tail to earn favorable consideration and as an otherwise splendid individual may hug the tail into the perineum or let it flop listlessly about, the operation in such indications is justifiable corrective surgery.

RESTRAINT.—The operation is best performed in the standing position with the aid of the twitch applied to the nose, and the side-line to elevate one hind leg. Cocainization of the seat of operation is sometimes practiced, but it does not help matters much on account of the impracticability of depositing the solution into every part of the substance of the muscle where the section is to be made. While a more or less effectual anæsthesia can be produced by injecting the solution subcutaneously at different points around the depressor muscle of each side, into the space between the muscle and bone, and then directly into the substance of the muscle, the process of administration is difficult, and the numerous needle pricks necessary to complete it provoke as much resistance as the operation itself performed without anæsthesia.

The extremely restive horse should be secured on the table or with harness, but this emergency is seldom required.

ANTISEPSIS.—Caudal myotomy is an extremely dangerous procedure if performed without adequate antiseptic precautions, especially in regards to the tenetome, which should be made absolutely aseptic. Caudal myotomies performed with an aseptic tenetome (pricking knife) heal up without visible reaction, but if done with an unclean knife or one only partially disinfected, inflammation, abscess, septicæmia and sometimes sloughing off of the tail, may supervene. In short, the disinfection preparatory to the operation must be thorough, absolute, perfect.

To this end, the first step is to submit the tenetome to a boiling of no less than ten minutes, or in lieu of this, to an immersion in pure phenol for no less than twenty minutes.

The seat of operation is washed with mercuric chloride 1-500, after the inferior surface of the tail, the surrounding portion of the buttocks and the pudendum have been cleansed with soap and water. Braiding the tail hairs, while not absolutely necessary, is helpful.

Special attention to the hands is not necessary because they do not contact the wound.

If the sterilized tenetome, after having been used upon one side of the tail, becomes accidentally soiled by touching septic objects, the procedure should be delayed for a few minutes, pending its re-disinfection. As regards the bandage, it will be sufficient to immerse it in the mercuric chloride solution from the time the preparatory step begins until needed at the end of the operation.

INSTRUMENTS, ETC.—The **pricking knife,** which is nothing more than an ordinary narrow bladed tenetome, is the only instrument required. This and a muslin bandage three yards long completes the equipment, unless it is intended to "pulley the tail;" then a sash cord about twenty feet long, two small pulleys and two six-pound weights must



FIG. 121—Myotomy (Pricking) Knife.

be provided and arranged on the stall beforehand, ready to receive the patient as soon as the operation is over.

If the operation is performed for lateral incurvation, then a short piece of cord and a girth will be needed to tie the tail to the opposite side.

TECHNIQUE FOR BILATERAL CAUDAL MYOTOMY.—First Step.—Surgical Position.—The horse having been properly restrained as above recommended, the tail disinfected and the sterilized tenetome placed within reach upon a tray held by an assistant, the first step is to take a good hold of the tail about twelve inches from the root and push it firmly over the back with the left hand, in which position it should be held until the whole operation is complete. An assistant standing opposite the stifle can lend useful help in maintaining this position by pulling forward upon the tail hairs.

Second Step.—Myotomy.—The division of the depressor muscles is made subcutaneously; the only external wound is the small entrance point for the knife. The same wound will answer to divide both sides. The location to select in order to obtain the best results should be no more than one inch

from the root of the tail and in the median line. The tenetome is passed through the skin, immediately deflected to one side to avoid puncturing the middle coccygeal artery, passed obliquely upward between the bone and the muscle until its point reaches the level of its uppermost part. The section is effected by turning the edge of the tenetome outward and then pressing the muscle against it with the thumb as the knife blade is made to execute a circular sweep corresponding to the contour of the tail. As the most painful part of the procedure is that produced by cutting off the muscle, resistance must be provided against as soon as the cutting begins, by pushing the head upward and giving the twitch an extra turn. If the patient takes a step or two forward

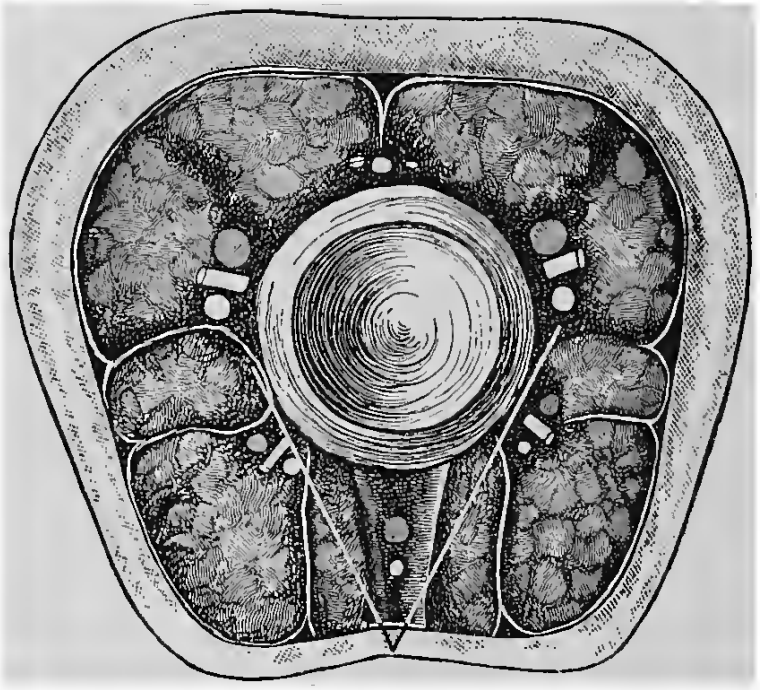


FIG. 122—Section of the Tail Showing Muscles. Straight White Lines Show Direction of Knife.

it is important to follow the movement without releasing the hold on the tail and to continue the cutting as if no molestation had occurred. Otherwise, if the tail is suddenly released and the tenetome not as suddenly withdrawn there is always danger of breaking its slender blade within the substance of the muscle. If the edge is keen-cutting and the tail pushed taut over the back the muscle snaps off almost instantly with little opposition, while on the other hand if the cutting is delayed by a dull knife or a relaxed state of the muscle, the duration of the pain will provoke annoying opposition that may necessitate withdrawal of the tenetome several times before all of the muscle is finally divided.

The opposite side is managed in the same manner

through the same perforation and releasing the tail from its position over the back.

Third Step.—Hæmostasis.—The bleeding, unless its arrest is immediately provided for, is always copious. The operation can, however, be made perfectly bloodless by keeping the tail stretched over the back (in which position the wound will not bleed) until the bandage is applied, and in the interest of neat surgery this should always be the aim, in distinction to allowing blood to gush out over the buttocks and hind extremities while preparation is being made to apply the hæmostatic bandage. The safe bandaging of the tail at this point, where its diminishing diameter favors slipping, is effected by twisting the end of the bandage into a loose cord and passing it around the tail once or twice at the seat of section, where it will imbed itself between the divided ends of the muscles and thus effectually lock itself against slipping downwards. The bandage is wrapped tight but is removed two hours afterward on account of the danger of inflicting injury.

When it has been decided to "pulley" the tail the bandage is superfluous, as the stretching of the tail upwards will control the bleeding sufficiently, if not absolutely. If after the tail has been thus elevated the bleeding seems rather copious or persistent, the addition of more weight to the pulley-cords for an hour or two will generally control the situation satisfactorily. When the cutaneous incision has been accidentally made rather large and thus operates to favor bleeding, the edges may be closed with a short pin held in place with a thread, figure eight fashion.

AFTER-CARE.—The after-care of the patient is of capital importance, in that the success of the operation depends entirely upon preventing reunion of the divided muscles. The continuity must be permanently destroyed to assure permanent results. If no provision is made to prevent reunion a cicatrix is promptly interposed between the cut ends and the function of the muscle is soon fully restored. To prevent reunion the following methods are recommended

1. Daily, beginning the day following the operation, the tail is carefully but firmly pushed over the back and the thumb is pressed forcibly into the space between the cut ends, forcing the contents of the cavity out through the small cutaneous wound. Thus on the first day the cavity is rid of its coagulum which would have aided in the construction of the connective union, and during the subsequent twelve days the repeated pressing out of the secretions and

forcing apart the cut ends with the thumbs soon leaves them hopelessly separated—active regenerative efforts having ceased. Among the various expedients to prevent reunion of caudal myotomies none is as humane nor as universally effectual as this simple manipulation. At first, on account of recollections of the operation on the previous day, the patient may rebel slightly, but if executed as gently as the necessary thoroughness warrants, there will be little opposition to the manipulations after the first two or three days.

2. **"Pulleying,"** as it has been done extensively in past epochs, is barbarous, and its discontinuance is a credit to the modern practitioner. But as there are situations in which good results cannot be otherwise obtained, the method may sometimes be excused, if sensibly applied. This method of preventing reunion of the divided muscles requires pulleys, rope and weights. The pulleys are fastened to the ceiling on each side of the stall opposite, to the stall pillars and on a level with the patient's hocks when standing in a comfortable position to feed from the manger. The rope is passed through each pulley so that each end hangs down to receive the weights and the center is pulled downward and looped to the tail hairs. About six pounds is attached to each side. Immediately after the operation, to arrest the bleeding, ten to twelve pounds may be hung at each end for several hours.

The practice of keeping horses' tails thus weighted for two to three weeks, day and night, is no longer practiced in America, on account of the cruelty inflicted, and because it has been found sufficient to weight them ten to twelve hours during each twenty-four for a period of about ten days.

Care must be taken to place the pulleys so that the tail will not be pulled too perpendicularly or forward over the back, as in these positions the circulation may be so hindered as to cause gangrene; and again, excessive weight must be avoided in certain patients having weak tails, or in patients that abandon themselves to the weights without offering any resistance to them.

3. **Cruppers.**—For horses already docked, a crupper of special design is used to hold the tail stump upward. The crupper has a trough-like extension to receive the tail and a back strap that passes forward to a girth. Such appliances are worn continuously, day and night, for a period of ten days; they are removed only when deemed necessary to inspect the condition of the wound.

4. **Tying the tail over the back to the girth,** is a relic of

bygone days, and on account of its cruelty, should be discountenanced.

UNILATERAL CAUDAL MYOTOMY FOR LATERAL INCURVATION. — Technique. —The depressor muscle on the side toward which the tail is deflected is divided as in the bilateral operation. It is important here to pass the tenetome far enough upward to include every shred of the muscle, otherwise permanent results will not be obtained. The elevator muscle on the same side is then divided by passing the tenetome beneath it from the **median line of the superior surface,** or from the middle of the lateral surface. To assure against immediate reunion the tail is then tied around to the opposite side for a period of ten to fourteen days.

The secrets of successful intervention are to divide every particle of the muscles, and to operate as near to the root of the tail as possible.

Note.—The incurvation is sometimes located some distance from the root of the tail, and not infrequently it transcribes a double curve the shape of an S. Such abnormalities are more difficulty to correct, and may require two or three operations before a straight carriage is obtained. The first operation should always be performed at the root of the tail, and after the healing process is complete, the location of subsequent sections of the muscles is decided upon by the location of the remaining incurvation. Sometimes the section is made eight, twelve, fifteen or even eighteen inches from the root, and in the case of double incurvation it may be found necessary to operate also upon the opposite side, after the first one has healed.

SEQUELÆ AND ACCIDENTS.—(1.) **Hæmorrhage.** —Caudal myotomy sacrifices the lateral coccygeal arteries, which yield a copious bleeding if provision to control the flow is not immediately executed. When the cutaneous puncture has been accidentally made too large to hold the coagulum, stretching the tail in the pulleys may not immediately arrest the flow, and if the addition of more weight to the ropes proves unsuccessful, a temporary bandage may be required, but in no case must the bandage be left on more than two or three hours.

(2) **Secondary hæmorrhage** is the most common sequel of the operation. It occurs after the bandage has been removed, and as the bandage may be reapplied to arrest it, strangulation of the circulation terminating in gangrene, multiple abscesses, diffuse alopecia, or even death, may en-

sue. The proper management of secondary hæmorrhage consists of suturing the puncture with a pin held in place with a figure eight suture. The reapplication of a bandage should be avoided; it is a dangerous practice. Suturing is by far the safest practice, although sometimes the blood may find its way into the peri-rectal space, and if infection ensues as a subsequent complication serious results may supervene. It is when the middle coccygeal artery has been accidentally severed that this sequel is most likely to occur.

(3) **Gangrene of the tail** ensues when there has been a too radical interference with the caudal circulation, either from having cut too many of its nutrient arteries, from prolonged bandage compression, or from the improper use of the pulleys and weights, and especially when these faults are added to unclean methods of operating or unclean after-care. Microbes find a mighty favorable field in the partially strangulated tail, or before collateral circulation has been sufficiently established. The prevention consists of (1) avoiding the severing of the middle coccygeal artery, (2) avoiding the use of too heavy weights, (3) placing the weights so as to pull backward rather than forward, (4) removing the bandage in two to three hours and then never re-applying it to control secondary hæmorrhage, and (5) operating under strict aseptic conditions.

The treatment of threatened gangrene consists of free evacuation of accumulated secretions and the application of hot antiseptic baths. When well established, amputation of the dead portion should not be delayed.

(3) **Wound Infection.**—The infection of the wound of caudal myotomy varies in seriousness from a trivial infective inflammation ending in harmless suppuration, to grave and even fatal **septicæmia.** The blood clot within the wound may also extend into the peri-rectal space, and if it becomes the seat of an active microbian growth, especially when the integrity of the caudal circulation has been seriously impaired, threatening local and general symptoms may follow. Fatal septicæmia, **tetanus,** and **malignant œdema** have been occasionally noticed as sequelæ of improperly executed caudal myotomies. The **prevention** is found in the use of a perfectly sterilized tenetome and thorough cleansing of the seat of puncture. With these precautions fully respected the wound will heal without perceptible reaction, even when other errors in management are made. When sepsis is noticed the **treatment** must begin at once. The wound is opened, and pus squeezed out and hydrogen peroxide in

small quantities is injected several times daily until all danger of serious consequences has passed, and as long as the morbid process is threatening all violent attempts to prevent reunion must be abandoned.

(4) **Paralysis of the tail,** although a rare result, has been observed once by the author, following prolonged pulleying with heavy weights. The paralysis, at first complete, gradually improved to complete recovery in four months.

CHAPTER IV.

CASTRATION AND SPAYING.

CASTRATION.

SYNONYMS.—Emasculation; gelding; caponizing (in cocks).

DEFINITION.—Castration is the ablation of the testicles.

INDICATIONS.—The operation is practiced extensively, in fact almost universally, on domestic animals; only the highest types of individuals intended for breeding purposes, escape the operation.

Castration of young animals, before they have arrived at puberty, by intercepting the development of the sexual nisus, creates an individuality that combines the effeminate excellency of the female temperament to the strength, vigor and endurance of the male physique. By nullifying the baser passions it invites the evolution of the finer instincts, and although the highest mental development is somewhat forestalled, the docility, tractability and general good behavior gained thereby more than compensate for the trivial loss in a function (the mental) that is of so little importance compared with the improvement of the physical elements for every economic utilization. The slight stunting of the mental faculties is in fact more desirable than objectionable.

In the mature and the aged animal, castration produces almost immediate impotence, but the impelling impulses for sexual intercourse are retained for a long while, waning gradually during the succeeding months. In individuals that have never been used for breeding purposes and which have never developed strong impulses by cohabitation with the opposite sex, the sexual desires fade more rapidly than in studs.

While one of the chief objects of animal castration is the improvement of breeds by preventing procreation from undesirable individuals, there are special reasons found for the operation in the different species, each differing from the other. In the **equine species,** the tractability is decidedly improved; cohabitation of the sexes is rendered safe; and the body escapes the exaggerated development of certain regions which distinguishes the fineness of the gelding from

the characteristic coarseness of the stallion. In the **ruminating, meat-producing species** the operation is performed not only to forestall the sexual impulse that renders unprofitable the cohabitation of males and females, but especially to improve the excellency of their meat products; and by facilitating fattening it yields a handsome salvage in the cost of feeding for the market. In the **porcine species** the additional object is chiefly to prevent the harmful molestation and wholesale impregnation of the young sows. In the **canine and feline species,** the principal reason for castration is to forestall the inclination to roam about in search of consenting females, which habit, besides exposing them to serious contagions, renders them undesirable for household companions. The castrated pet grows large and fat, caressant, docile and obedient, and although somewhat more indolent, it is never involved in obscene manœuvers.

In cocks caponizing is practiced solely to increase the profits of the chicken industry. The caponized rooster grows fat and large, and yields meat of exceptional excellence that is salable at a much higher price than that of the entire cock. But on account of the small economic importance of each individual operation, the caponizing of cocks is destined to be practiced more extensively by the fancier than by the veterinary practitioner.

The testicles must sometimes be sacrificed on account of disease. **Tumors and hernias** are the commonest abnormalities of this category. A tumor of the scrotum whose ablation would expose the testicle is best managed by removing the latter instead of attempting the futile step of reconstructing the scrotum over it, and when tumors or any other serious pathologic process (tuberculosis, glanders, etc.) attacks the testicles themselves their sacrifice is always advisable, as it is never profitable to conserve diseased testicles in animals. In the surgical treatment of **bubonoceles** and **oscheoceles,** castration is generally one of the steps of the technique, as the radical kelotomies with conservation of the testicles can indeed very seldom ever be successfully carried out in the larger species.

In **orchitis** of aged animals with prevailing impotence castration may often be performed to the benefit of the general health, and in **habitual onanism,** so rampant amongst race horses, where the vitality is threatened or has waned under the influence of frequent ejaculations, the operation is often urgently required to retain or to restore a vigorous constitution.

INSTRUMENTS, ETC.—The complete outfit required to perform the operation and to meet every untoward exigency should include

1. A special castrating scalpel.
2. An emasculator.
3. An ecraseur.
4. A pair of wooden clamps.
5. Strong braided silk.
6. Needle.
7. Antiseptics.

The castrating scalpel (Fig. 123) has a markedly convex blade to facilitate the cutting through of the thick integu-

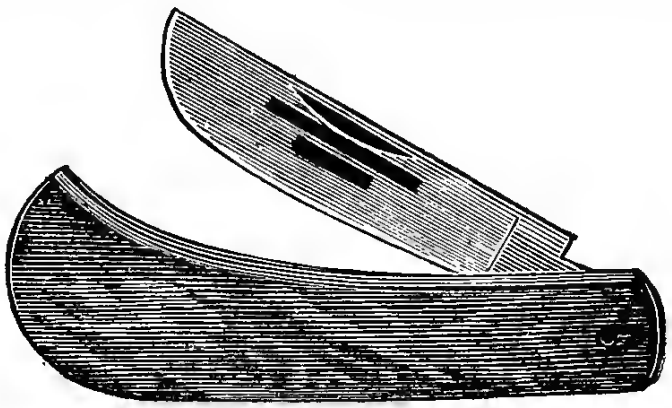


FIG. 123



FIG. 124

FIGS. 123 AND 124—Castrating Knives.

ments covering the testicle at one deliberate stroke. The **emasculator** (Fig. 21) is the most adaptable instrument with which to divide the cord. It crushes and cuts off the spermatic cord at one pang and as satisfactorily manages the bleeding as any of the various methods of ablation. It, however, has the fault of cutting rather poorly when the tough tunica vaginalis of full growns is caught between its jaws. When the ablation is effected below the lower attachment of the tunica vaginalis the emasculator cuts the cord off very easily, but when a higher level is selected as the point of ablation it will be found sorely unequal to the task of effecting a division without the employment of considerable force.

Any emasculator that will satisfactorily cut off the cord with the tunic included is too sharp to effectually prevent hæmorrhage, and any one that will always prevent hæmorrhage, is too blunt to divide this tough fibrous membrane, except by the employment of more than the ordinary strength of one or even both hands.

The **ecraseur** is much the best ablating instrument for recumbent castrations in horses, bulls, bucks and goats, especially where it is desired to effect the division of the cord high up in the inguinal canal. It is much less convenient and inflicts a more lasting pain than the emasculator, as with it more time is required to crush through the spermatic cord. For standing castration it is much too slow; the subject often becomes uncontrollable before the ordeal is over.

The **wooden clamps,** once a standard and very popular method of managing the hæmorrhage, are now used only in

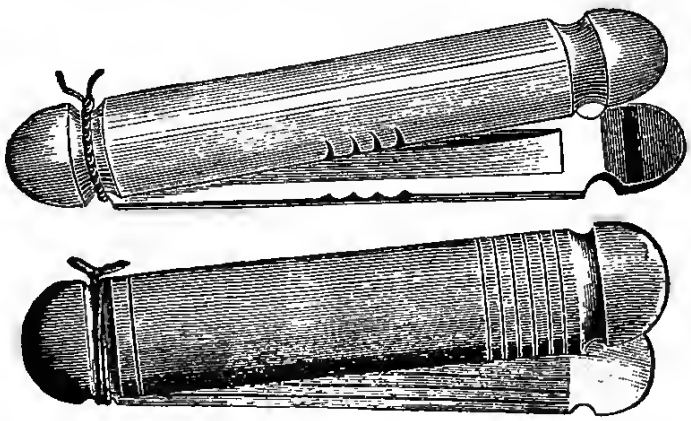


FIG. 125—Wooden Clamp for Castration and for the Clamping of Hernias.

emergencies. The ecraseur chain may break unexpectedly, the emasculator may be unequal to the task on account of an unexpected anomaly, or a hernia not previously noticed may present itself at a critical moment. The clamps are included in the equipment to meet such emergencies, if not also sometimes to satisfy a caprice against the more modern instruments. The **braided silk** is sometimes required to control hæmorrhage from the spermatic artery and occasionally to perform an operation against hernia. (See Van Law's operation.)

RESTRAINT.—Any of the domestic animals can be castrated in the **standing position.** In the **horse,** however, the **recumbent position** is generally desirable on account of the personal danger to the operator, or because the testicles may be too high up in the scrotum to be pulled down easily. The standing position may be safely adopted in the **well-broken**

adult and in the two or the three-year-old, which on account of having been handled, groomed, etc., will not object to manipulation of the scrotum. A colt or adult that will tolerate scrotal manipulations is generally a safe subject for standing castration, but the ticklish animal, whether colt or adult, is seldom ever a good subject for this method of restraint. Mules, bronchos, vicious horses, unbroken colts and horses, yearlings and ponies should be cast; the standing restraint is reserved more for the full-grown, well-broken and fairly tractable horse.

Standing Position.—Standing castrations are performed with no other restraint than the twitch, but a single side-line to lift a hind leg should be available in case the horse unexpectedly becomes unmanageable before the operation is



FIG. 126—Restraint and Position of Operator in Standing Castration.

completed, or in case some unusual abnormality (hernia, adhesions, etc.) is encountered. The twitch is always previously inspected as to the strength and security of its cord; a good grip is taken on the nose; and the holding is entrusted only to a fearless, unflinching attendant who is instructed to push the head upward as the operation begins. The operating place should be an open space, preferably a grass plot where a sudden fall would be harmless to the patient, and to the operator. In a box stall, a small room, or corner of a paddock or corral the castrator is always exposed to the danger of being caught by a plunging or falling patient, and while such manœuvers are exceptional they are too consequential when they do occur to be so flagrantly ignored as to attempt the operation in a confined space.

Recumbent Position.—The best apparatus for securing horses in the recumbent position for castration is the Farmer Miles side-lines or any of the many harnesses of like construction. The author prefers the Knowles harness, because of its cheapness, adaptability for all kinds of operations and relative simplicity. There are some harnesses, notably the Freeport harness, with which horses can be cast by two men, and instantly tied securely enough for a castration. Compared with harnesses requiring the assistance of three or four men these patterns commend them-



Fig. 127—Correct Mode of Securing Horse for Castration in Recumbent Position.

selves for simple castration, but lack essential features when utilized for other operations, and besides these rapid ties by not flexing the hind legs sufficiently are often productive of fractures of the femur or tibia in colts affected with unsuspected rarified conditions of the skeleton. Although castration is a relatively brief operation, performable by almost any kind of restraint, every interest is best served by insisting upon a perfect, methodical and standard restraint in which the hind legs are well flexed upon the pelvis by ropes which protect the spine against injury and at the same time spread the legs apart so as to give free access to the

inguinal region. These desiderata are found in the Miles or the Knowles harnesses properly adjusted.

The operating tables, unless the subject is anæsthetized have nothing to recommend them above the harnessess, because the parting of the hind legs by lifting the uppermost one toward the ceiling is unsafe to both the patient and the operator, and if the exposure of the scrotum is effected by simply drawing the uppermost leg forward the accessibility of the region is found insufficient. Whenever horses are to be castrated upon the operating table chloroform anæsthesia should be included in the restraint.

TECHNIQUE OF STANDING CASTRATION—First Step.—Disinfection of the Field.—Good cleansing of the scrotum must not be omitted, although the systematic disinfection by washing is more difficult to carry out than when the parts are exposed by casting and tying. In order to facilitate matters in this connection a stronger antiseptic solution is used and the washing is restricted to the outlines of the dependent parts of the scrotum. Mercuric chloride, 1-200, briskly rubbed into the stretched skin with pledgets of cotton which are cast off as they are soiled is the most effectual rapid disinfection. Washing of the whole region with soap and water previous to the application of the antiseptic solution is advisable only in exceptionally tractable horses accustomed to such baths, in which there is no danger of provoking a suspicion that anything unusual is about to occur. In short, disinfection, important as it is, must not materially delay the proceedings nor provoke rebellion at the very onset.

Second Step.—Position of the Operator.—The surgeon stands on the near side, a safe distance anterior to the stifle, at extreme arm's length from the scrotum, and far enough outward to avoid touching the horse's body with the shoulder, arm, elbow or forearm. No part of the surgeon's body should touch the horse except the hand, and that should touch only the scrotum. If any part of the operator's body presses against the horse's abdomen or flank as the operation proceeds, he will tend to lean over and even fall suddenly during some painful step of the operation. This particular position must be adopted as an absolute law, not only to prevent the tendency to lean over and to fall, but also to escape personal injury from a kick. The kick of a horse at a castrator attempting to operate in the standing position is a forward one, deflected outward about six inches from a straight line connecting the patella

to the olecranon. A position six inches from this line may therefore be considered a reasonably safe one.

Third Step.—Pulling Down the Testicle.—The testicles are not always hanging pendulant; on the contrary they are generally drawn upward by the full force of the cremaster muscles. In young animals with short cords they may even be hidden in the inguinal canal. To bring them down sufficiently to incise the scrotum from this rather disadvantageous, arm's length position is often no small part of the operation. In an exceptionally tractable subject the rule to not touch the body may be disregarded and one hand passed between the legs from behind and the other from in front, both of them meeting at the scrotum. With the two hands engaged on the scrotum the testicle is easily surrounded above with the left one and brought down into operating position. When the two hands can not thus be utilized on account of intractability of the subject it is preferable to wait a few seconds until the incessant pain of the twitch causes the cremasters to relax and drop the testicles into the scrotum, at which moment by gently passing the hand around the cord of the nearest and gathering up the scrotum tightly in the grip, it can be firmly retained in an exposed position for the incision. It is, however, essential to inspect the skin covering the testicle to locate the median raphe so that the incision may be made parallel to it, and sometimes to accomplish this object the position of the hand must be changed.

Fourth Step.—The Oscheotomy.—The incision of the scrotum is made at one bold backward slash, a veritable blow that may even bisect the testicle as well as neatly divide all of its enveloping integuments. The incision must never be slowly made nor be so incomplete as to fail to drop the testicle. At the moment the knife strikes the scrotum the assistant, previously instructed, gives the twitch an extra turn to divert the horse's attention from the short pang of pain that might otherwise provoke a vicious kick.

Fifth Step.—The Ablation.—The knife is now set aside and the emasculator taken up leisurely to allow the testicle to drop some little distance out of the incision. Generally it is drawn upward for some moments after the incision is made, but the contraction of the cremaster is soon relaxed and the testicle comes down to the desirable position for ablation in a few moments. A few extra turns of the twitch will usually hurry matters somewhat. The forefinger of the

left hand is then passed very gently around the exposed cord as high up as possible and the jaws of the emasculator adjusted between it and the testicle. After taking especial pains to note that the point of the emasculator is not engaging any of the integuments, the handles are taken in one or both hands and given a quick, deliberate squeeze that will safely effect a perfect division without delay. If the emasculator fails to divide the cord in this one squeeze, or if the pinching is protracted, any kind of rebellious act from the subject may be expected. Leaning over into a position that prevents further handling of the instrument, falling down, kicking with one or both legs, or lunging desperately forward are among the unfortunate manœuvers to be expected when there is any delay. On this account it is of capital importance to avoid hooking the skin or any part of the tunica vaginalis with the emasculator.

The ecraseur, on account of its slowness, is, therefore, seldom as satisfactory, and the clamps, although successfully employed for years by Jay, are objectionable for the same reason in standing castrations.

Sixth Step.—Repetition of the Same Steps on the Opposite Side.—In removing the opposite testicle the operator continues to occupy the near side of the horse; to take advantage of a much safer position and because a right-handed man would be at a disadvantage on the off side. The removal of the farthest testicle is much the safest as well as the easiest. There is no danger from kicks and the hand is in a much better position to grasp the testicle. Further, there is no difference to relate.

SPECIAL HINTS—1. Select the subjects with due regard to age and tractability. 2. Make a special examination of the region for abnormalities, hernia, adhesions, etc. 3. Disinfect the scrotum, hands and instruments in exceptionally strong antiseptics. 4. Make a bold, deliberate incision and instruct holder of the twitch to give it a good turn as the knife strikes. 5. Adjust the emasculator carefully and use enough pressure to cut off the cord promptly. 6. Operate upon the near-side testicle first, because the second incision may provoke a kick; it is preferable that the kick should occur on the opposite side.

TECHNIQUE OF RECUMBENT CASTRATION.—First Step.—Disinfection of the Field.—The cleansing of the field of operation should be limited to the outlines of the scrotum itself, but here it should be done in no perfunctory manner. The rugæ of the scrotal skin should be stretched

out and submitted to a good washing of soap and water and then rubbed well with a strong solution of mercuric chloride no weaker than 1-500. In view of the small field thus disinfected, even a stronger solution may be employed to advantage. It is not advisable to attempt to cleanse the whole inguinal region, because of the impossibility of cleaning and disinfecting it well in a short time, and if only washed, the supposed cleansing process is more apt to "dig up" and distribute infection than to destroy it. The internal surface of the sheath, which is always filthy, should likewise not be disturbed by a washing process that would distribute rather than adequately destroy filth. It is much better to limit the cleansing to the skin of the scrotum itself and then simply sponge or sprinkle the legs, thighs and buttocks with a little water to prevent loosened hairs from flying into the wound when the animal struggles.

Second Step.—Oscheotomy.—The undermost testicle is gathered up with the left hand so that the skin is stretched tightly over it, and then the incision made four inches long through all of the scrotal integuments. The cutting should be done quickly, and yet deliberately enough to assure a uniform depth along the whole length of the incision. It is not sufficient that the skin should be incised four inches and the tunica vaginalis only two inches. The incision must be a through-and-through one, four inches long and parallel to the raphe. When the testicle is too high up on the inguinal canal to be pulled down into the scrotum, the incision of the skin is made by simply stretching it between the thumb and finger, the inguinal canal is opened by forcing two fingers upward beneath the skin until the testicle can be grasped and pulled down by them, and then the tunica vaginalis is incised to expose it for final ablation. Such testicles are usually called **"high flankers."** (See castration of cryptorchids, page 259).

The length of the incision is important in castration. If the operation were strictly aseptic and exposed structures, (cord, inguinal canal, scrotum, etc.,) were not subsequently infected, the smallest possible incision would be preferable; but when there is some doubt as to the asepsis of the procedure, and a still greater certainty that the exposed parts will suppurate before the healing process is complete, the long incision, by facilitating drainage, is advisable.

Third Step.—Ablation.—In ablating the testicle especial pains is taken not to touch the hands to any part of the

testicle and cord that will not be removed. It is unnecessary to touch the cord above the point of ablation, and to do so with the hands that only a few moments previously were engaged in handling dirty ropes and the still dirtier patient, invites avoidable trouble from septic infection. The testicle is pulled up with the hand without touching anything else, while the chain of the ecraseur or jaws of the emasculator is passed around the cord. The cutting off process should be done as promptly as possible; there is nothing gained by crushing the cord slowly, and promptness shortens the pain to a trivial pang. The division of the cord as high up in the inguinal canal as possible is advisable because a long, hanging cord not only invites ordinary pyogenesis, but also creates a favorable condition for funiculitis and scirrhous cord.

Fifth Step.—Repetition of the Same Steps on the Uppermost Testicle.—The uppermost testicle is removed last because if the reverse order were followed blood would flow over the scrotum to the annoyance of the operator.

Sixth Step.—Ridding the Scrotum of Blood.—While the uppermost testicle is being removed the scrotum of the undermost one may fill with blood, generally from vessels of the tunica vaginalis, and as this accumulation is a favorable soil for microbes, its removal is of capital importance. The blood thus gathered in the scrotum is squeezed out by pressing the hands along the inguinal canals just before the patient is rolled to the lateral position preparatory to releasing the ropes. Once in the standing position the blood will flow outward.

AFTER-CARE.—The care of a castrated horse consists of nothing more than daily exercise, either at the halter, in harness or at pasture. The latter in nice weather, and especially if there are other horses to encourage the patient to move about, is preferable to the other. In cities and in all instances where the patient shows a stubborn inclination to stand around instead of moving about, halter exercise or hitching must be insisted upon. Exercise prevents oedema of the sheath, causes the serous secretions to drain from the scrotum, prevents stiffness, and encourages good health. Washing of the scrotum, opening the incisions with the fingers, and irrigation of the canal by attendants in charge of the patient are always more harmful than beneficial. It is only when there are unmistakable signs of sepsis that such treatments are advisable, and then they should, if possible, be given by the experienced nurse

or by the surgeon himself. As long as there is no elevation of the temperature, there is no occasion to molest the scrotum with any local treatment or manipulation. Œdema in the absence of fever is not a sufficient reason to open up the incision with the fingers, and such a procedure is always certain to transform a harmless serous exudation into a much more serious purulent discharge by making a portal of entrance for microbes. The appearance of fever, however, must be met by prompt evacuation of the contents of the scrotum, followed by irrigations of the inguinal canals with antiseptic solutions, and the maintenance of proper drainage thereafter.

SEQUELÆ AND ACCIDENTS.—Septic Peritonitis.—Septic peritonitis is the most formidable sequel of castration; it is the usual cause of death when the operation results fatally. It is caused by filthy surgical methods or by improper after-care. The **septic emasculator or ecraseur,** handling of the spermatic cord with the **hands** and **digital explorations** of the incisions during convalescence are the most common causes of the disease. When no infectious matter is deposited in the scrotum, in the canal or upon the cord during the operation, and no unnecessary fingering of the incision is done afterwards, there will be indeed few cases of serious infection from castration. Contamination of the scrotum from the litter or ground of the pasture, especially if blood clots were allowed to remain in the scrotum, may sometimes cause the disease, but by far the most common etiologic implements are the **hands and the instruments,** which sow the seeds of mischief at the time of the operation. There are also **certain predisposing causes** in the form of ill health from **bad nourishment, privation, exposure, febrile disease, approaching febrile diseases, convalescence from diseases** and all forms of **general systemic debility,** which, in addition to dirty methods of operating, are very prolific in causing fatal consequences.

The symptoms begin about the fourth day with a slight indisposition. The patient stands continually, seems fixed to the floor and will only move about when urged; the appetite gradually fails, the temperature rises to 103° to 105° Fahr.; the flanks are tucked; the coat is staring; the urine scanty; the bowels are constipated and defecation is avoided on account of the pain produced in straining to perform the act; the scrotum and sheath may be either slightly or enormously swollen; the inguinal region on palpation of the cords is found exceptionally painful; and

the wounds when evacuated of their contents are found to contain a sero-purulent secretion which becomes more purulent as the disease advances. Later, as the peritoneum becomes more extensively implicated, colics and diarrhea complicate matters and death soon follows. In some cases the disease takes a more subacute form from the beginning or from the acute stage, and only ends fatally after three to four weeks of illness. Rare cases terminate in the formation of abscesses which may point favorably, and after discharging their contents leave behind an enfeebled patient which slowly recovers its health, during the succeeding months.

To be successful the **treatment** must be prompt; the disease must be recognized early, before the infective inflammation has made any headway into the peritoneum. Otherwise, the most energetic therapy is futile. As the disease at the beginning is only an extra-abdominal inflammation that is limited to the scrotum, cord and tunica vaginalis, it is really a trivial one until the inflammation advances upward beyond the confines of the inguinal canal; then it becomes a very formidable affliction because it is no longer accessible for local treatment. The treatment should, in fact, begin before any peritonitis exists, while the disease is still a local funiculitis.

The important remedial measure consists of the establishment of free drainage by breaking open the incisions and forcing the fingers upward along the cord so as to assure evacuation of all of the secretions that have accumulated at different parts of the inflamed inguinal canal. The cord must be entirely loosened from the wall of the canal where it is found adhered, so that no part of the canal is capable of harboring secretions, and in order to allow the local treatment to reach every point of the inflamed surfaces. When the canal has been thus drained it is submitted to thorough irrigations with solutions of hydrogen peroxide and mercuric chloride consecutively, and these are repeated every three or four hours until the temperature indicates that the hot-bed of the disease has been destroyed. Internally, large doses of quinine are helpful.

Funiculitis, or inflammation of the spermatic cord, of course supervenes all castrations, but when there is no sepsis to accentuate its gravity, resolution is complete in a few days. If, however, the funiculitis is infective the seriousness varies. It may end in a tumefaction which, after undergoing the process of sclerogenesis, becomes the

precursor of a scirrhous cord; it may act as the initial seat of a grave septic peritonitis; or it may terminate in the formation of a hot abscess that produces all of the symptoms of septic peritonitis from which it is differentiated by the prompt abortion of the fever when the abscess is drained by opening the incisions in the scrotum. Funiculitis is but a local inflamation of the cord and canal that is only serious when the virulence of the infection or the meager autogenic resistance of the patient cause it to spread into the peritoneum.

Simple cases of funiculitis require no special treatment until general symptoms (fever, etc.) indicate the existence of sepsis. As long as there is no fever, no matter how badly the cords are swollen, it is prudent to trust solely to exercise for the cure; but on the first appearance of a rise of the temperature the canals must be drained and irrigated to prevent graver consequences, and when the tumefaction becomes chronic, lasting for several months (scirrhous cord), operative intervention will be necessary. (See scirrhous cord).

Œdema of the Sheath.—Œdema or swelling of the sheath is a very common result of castration. This loose, pendulant structure is a favorable harbor for serous infiltrations. It requires little provocation to produce swelling of the sheath in any event, and the wound of castration, even in the absence of any signs of sepsis, is sufficient to cause it in a very threatening if not serious form. The swelling of the sheath following castration is a trivial matter unless it occurs as the reflection of a sepsis at the seat of operation, or becomes voluminous enough to cause paraphimosis. It follows aseptic as well as septic operations, long as well as short incisions of the scrotum, and any of the various methods of ablation or any of the systems of after-care. Its prevention seems impossible. The swelling usually begins on the third or fourth day after the operation and it increases gradually until the tenth or twelfth day when it begins to diminish by gradual stages.

The treatment of œdema of the sheath must vary according to the cause. If there is fever to indicate that the cause is infection of the seat of operation, the scrotum must be drained by promptly opening the incision with the well cleaned fingers; then irrigate the canals to assure thorough cleansing of the infected area. On the other hand, if the œdema is not accompanied by any systemic derangement, exercise alone may safely be depended upon unless the

swelling becomes very large or threatens to so affect the capacity of the sheath as to produce paraphimosis, in which event moderate scarification may be practiced to good advantage. The operation of scarification is preceded by a good washing of the parts to be punctured with a strong antiseptic solution; then, with a lancet or scalpel guarded with the thumb and finger to only penetrate a short distance, a number of stabs are made here and there, chiefly about the anterior part of the sheath. The effect is the dripping of considerable serosity for some hours. The

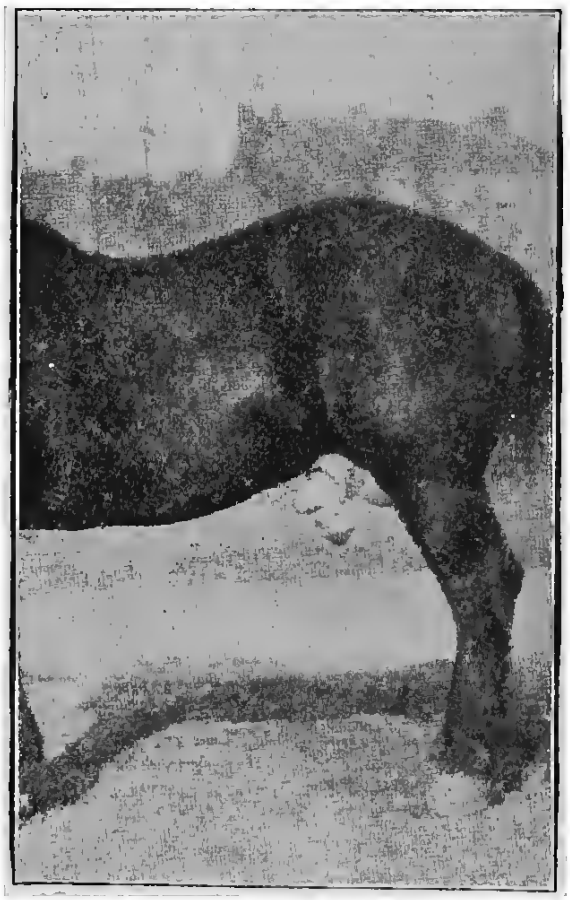


FIG. 128—Paraphimosis Following Castration.

wounds thus made are then submitted to frequent baths of antiseptics to prevent them being transformed into purulent tracts by becoming infected. When the œdema accentuates instead of diminishing, the operation may be repeated every second or third day, but the reiteration need not be practiced after there is any evidence of a decrease in the volume of the swellings.

Paraphimosis.—Prolapse of the penis results from two distinct initial causes. The first and most common one is œdema of the sheath and prepuce, in which instance the

swelling encroaches upon the sheath cavity and thus actually forces the penis out, where it remains until the œdema diminishes sufficiently to re-admit it to its normal position. The second is paraphimosis from funiculitis. The cords become swollen and painful, and the penis is protruded to accommodate them. Generally the protrusion does not persist for more than two or three days, but in some instances the prepuce becomes so œdematous in this pendulous position that reduction becomes impossible until the swelling disappears.

The treatment of prolapse of the penis must begin promptly, and must continue incessantly until a cure is effected, in order to intercept serious consequences. The œdematous swelling of the sheath and of the prepuce may become so large as to obstruct the nutrient vessels and cause gangrene, or to press upon the urethra and prevent micturition. The first evidence of paraphimosis is met by first bathing the swollen parts with hot water and then wrapping the protruding organ with muslin bandages soaked with astringents (ten per cent tannic acid). The bandaged penis, especially if the prolapse is long and the swelling large, may then be supported against the abdomen by body bandages passing over the loins. A sling made of heavy leather, rubber belting, thick canvas, or linoleum, supported by appropriately adjusted body bands, may be improvised and used to good advantage. The object is to support the now heavy organ whose weight aggravates the condition, and whose position subjects it to exposure and injury.

Scirrhous Cord is a progressive sclerosis of the part of the spermatic cord that remains in the inguinal canal. Pathologically, it may be correctly classed as a cold abscess due to microbes that gain access to the exposed field at the time of castration or during convalescence from the operation, and there implant themselves as the seeds of the future growth which then evolves rapidly or slowly. Although it generally presents itself to the practitioner a short time after the operation in the form of a castration wound that is refusing to behave in the usual manner by healing up promptly, there are numerous instances where the evolution is so slow that nothing abnormal is noticed for years, when rather suddenly an œdema of the sheath accompanied with manifestations of pain in the inguinal region announces the existence of a previously unsuspected tumefaction of the scrotum. This is a scirrhous cord; the real entity. The

acute sclerogenesis of the cord following immediately in the wake of castration is not always a true specimen of this morbid condition, for it may disappear spontaneously, even after sojourning for six weeks to more than two months. True scirrhous cord never diminishes in volume, but grows gradually larger and larger, presenting clinical signs analogous to those of true tumors with which, however, it must not be classified. The acute varieties occurring immediately after castration, although they present themselves in the form of very hard and sometimes quite voluminous tumefactions of the cord, should be called "funiculitis," and



FIG. 129—A Large Scirrhous Cord.

the phrase "scirrhous cord" should be reserved for the chronic, encroaching variety.

The pyogenesis of scirrhous cord may be streptococcic, botryomycotic, or actimomycotic, the latter being rare. The formation of abscesses which are all destined to point at the surface of the scrotum sooner or later is accompanied with the formation of abundance of fibrous tissue around them. The abscesses may be small, large, single or multiple; the pointing and cicatrization of one is followed by the evolution of others, leaving the mass more or less riddled with excavations and tracts. Sometimes a single excavation (abscess cavity), a single tract and the surround-

ing fibrous tissue constitutes the entire tumefaction; and and sometimes the size of the cavity is so large as compared with the amount of fibrous tissue surrounding it that the condition is more like a cyst then a body.,

The cause of scirrhous cord may always be safely attributed to badly executed castrations. The cords were left too long, protuding into the scrotal incision where they were exposed to infection, the instruments were dirty, or the hands needlessly deposited infectious matter upon the cords. The prevention is found in clean methods of performance and sensible after-care. The use of clamps to arrest the hæmorrhage yielded many scirrhous cords that are now prevented by the ecraseur and the emasculator, but the use of these instruments is universally preventive only when aseptic technique is respected as well.

In size scirrhous cords vary greatly. They may be no larger than the thumb or they may reach the enormous weight of fifteen pounds. They may be confined to the end of the cord or may extend upward along it to the internal abdominal ring and even into the abdominal cavity. A tumefaction about the size of a cocoanut attached to a peduncle about the size of the wrist gradually diminishing in diameter towards the internal abdominal ring, is, however, the average volume. The diseased tissue is always firmly fused with the surrounding tissues, from which it can be separated only with the greatest difficulty.

The subject affected with scirrhous cord is always unthrifty from the constant drain and discomfort and sometimes suffers from attacks of pyrexia while the abscesses are forming. Colics, peritonitis, chronic septicæmia, emaciation, eventually terminate life when operative intervention is postponed too long.

The treatment of scirrhous cord once well established is total ablation, (see page 305) but in the recent case this radical intervention should be postponed in expectation of spontaneous disappearance of the tumefaction. Six weeks to three months should always elapse between the castration and the passing of final judgment as to the permanency of enlarged cords. In the interval potassium iodide may be given to advantage. The author's experience with this drug in old as well as in recent cases leaves no doubt that it exerts some "arresting influence" upon the progress of the growth, similar to that observed in actinomycosis, spontaneity considered.

Sloughing with caustics, especially by packing copper

sulphate into the tracts, can not be entirely discarded, but as this treatment affects only the smaller ones and as the patient must first be placed in the recumbent position to properly apply it, ablation suggests itself as the most sensible remedy.

Post-Operative Hæmorrhage.—There are two kinds of bleeding after castration by the modern methods above recommended: 1. **primary hæmorrhage** from the vessels of the scrotum and, 2. **secondary hæmorrhage** from the spermatic artery.

The first, although never serious, is sometimes the cause of considerable anxiety until its source is definitely determined. This variety of bleeding originates from the vessels of the scrotal integuments, especially from the tunica vaginalis, which in full grown adults and aged horses are by no means small ones. As division of the vessels is made with a sharp knife and as no provision is made to arrest the bleeding from them, a copious hæmorrhage from this source may occasionally be expected. It is generally noticed soon after the horse has been returned to the stall, running in a stream the size of a straw or even larger, and when the patient moves about the blood accumulating in the scrotum may gush out en masse in the most threatening manner imaginable as if coming from the spermatic artery instead of from small insignificant vessels. The differentiation is soon made, however, by the gradual diminution of the flow. At first the stream reaches the ground unbroken, then it begins to break into drops some distance from the floor and finally drips drop by drop until it ceases entirely. There is no occasion to make any effort to arrest this hæmorrhage as its spontaneous arrest may always be depended upon.

The second, that is, secondary hæmorrhage from the spermatic artery, on the contrary, is a serious hæmorrhage that may terminate fatally if not controlled. It may occur at any time from twenty minutes to three hours after castration. Hæmorrhages occurring later than three hours are rare. The cause of spermatic hæmorrhage is inadequate crushing of the artery with an instrument that was too sharp, hæmophilia, or disease of the coats of the artery. For a time the crushing holds the blood current but the fortification being insufficient the barrier breaks down and the bleeding begins, and since the spermatic artery is a large one,proceeding directly from the posterior aorta where the blood pressure is high, a very copious flow generally results.

This hæmorrhage is easily recognized from the former by the size of the stream and when there is any doubt, by passing the finger into the incision the synchronism of the spurts with heart beats is easily recognized.

When hæmorrhage is recognized as coming from the spermatic artery, it should be arrested without delay as its spontaneous arrest is not likely to occur until a harmful amount of blood has been lost. The loss of blood from castration leaves the patient at the mercy of the septic sequelæ even when it does not itself cause death. In fact, few patients that have bled profusely do well for some time after the operation. They swell badly, fever generally supervenes and the clotted blood in the scrotum usually furnishes a field for an active sepsis. The mortality amongst patients that have bled profusely is higher than among those operated upon bloodlessly.

There are various methods employed to control spermatic hæmorrhage. In tractable subjects it is sometimes possible to pinch the artery between the thumb and finger for a few minutes with successful results, or to snap an artery forcep upon it. By applying a twitch and lifting a hind leg with the sideline these simple efforts are indeed very frequently successfully carried out. When the cord has been cut very short and the patient is restive packing the scrotum with an antiseptic wadding held in place with a few stitches across the incision, may be tried, but by far the safest and the most effectual method is to place the patient in the recumbent position and ligate the artery with a catgut or a silk ligature, and then submit the interior of the canal and scrotum to a good irrigation to rid it of blood clots and to cope with the infection that may have occurred during the execution of these steps.

Prolapsus of the Intestines is a rare accident of castration when the operation has been preceded by a careful examination for hernia, but when through carelessness no effort was made to determine the existence of hernia or when the patient was too fractious to approach near enough to do so, there is always danger of prolapsus some minutes after the operation is completed. In the recumbent position hernia may escape notice by the contents falling back into the abdominal cavity as the patient is rolled upon its back, and occasionally hernia, especially epiploceles, are not conspicuous enough to attract attention even when a careful examination is made.

Prolapsus of the intestines is always fatal unless prompt-

ly treated. As soon as the hernial sac has been destroyed by the incision of the scrotum and the ablation of the testicle, the intestines rapidly gravitate downward until an enormous amount protrude and if not supported immediately they will soon trail to the ground to be trampled upon by the feet. The situation is therefore always an urgent one. There must be no delay, or treatment will be futile. The first appearance of intestines at or through the incision in the scrotum must be met by immediately preventing their further prolapse. A twitch is placed on the nose, a sideline applied to a hind leg and then a few stitches are sewed across the incision close enough to safely assure against further protrusion. These emergencies having been completed no time is then lost in casting, anæsthetizing, and placing the patient in the dorsal position. The region is then rinsed with abundance of antiseptic solution and as soon as the anæsthesia is profound the emergency stitches are removed and attempt begun to replace the intestines. If filled with gas they are punctured with a small trocar and canula and if still irreducible kelotomy must be performed. Once reduced safely in the abdominal cavity the tunica vaginalis is drawn up and ligated according to Van Law's method (see page 360). Thorough rinsing of the cavity completes the operation.

Prolapsus of the Omentum is less serious but not entirely without danger. It is generally safe to simply cut off the protruding portion, at the level of the incision, with the emasculator or ecraseur, but never with a sharp knife on account of the large size of the vessels it contains. If left alone its weight will drag down more and more and finally bring out loops of intestines. A patient treated by simple ablation of the protruding portion must be carefully watched for several hours in order that a possible prolapsus of the intestines may be discovered early enough for successful intervention.

A much safer method of dealing with prolapsus of the omentum is to place the patient in the recumbent position, cut off the protruding end, replace the remainder and then apply a clamp upon the cord including the tunica vaginalis.

Adhesion of the Testicles to the Tunica Vaginalis is a condition that often complicates castration. It is one of the banes of the standing operation, because the adhesions are sometimes too firm to be broken down with the fingers from the disadvantageous position the operator finds himself in, and the certain resistance the patient will offer. This

abnormality should if possible be determined in the pre-operative examination and when discovered the patient should be cast and the testicles, tunica vaginalis and all should be removed with the ecraseur.

CRYPTORCHIDECTOMY.

SYNONYM.—Ridgling castration.

DEFINITION.—Cryptorchidectomy is the operation of ablating hidden testicles—testicles that have not descended into the scrotal sac.

INDICATIONS.—It may be said that the operation is always indicated, in every domestic animal, where cryptorchidism exists, as the individual so affected is always a degenerate, and never a good specimen from which to breed. The operation is, however, not very frequently demanded in city work-horses because the hard-worked ridgling, although sometimes somewhat troublesome, is by no means as intolerable a creature as the young, growing farm ridgling, whose impelling impulses render him absolutely unsafe in the pasture. It is in the springtime when it is desired to turn the two- or the three-year old into the pasture with other horses that the economic importance of castration presents itself to the owner of a ridgling. If the young ridgling could be economically reared to maturity it is very doubtful whether many of these subjects would ever be presented to the practitioner for operation.

Cryptorchidism results from some obscure perversion of fœtal evolution. It is frequently hereditary. Mares bred to cryptorchid horses give birth to a remarkably large per cent of colts similarly affected. It is much more common in grade animals than in well bred ones. In the latter it is usually traceable to inbreeding or defective nutrition in utero. The condition is physiological during the first few months after birth in some mammals, but in most species the testicles should descend into the scrotum during the fœtal life. The hidden testicle of youth is known as **pseudo-cryptorchid.** It is this tendency of growth and development that is evidently responsible for the hidden testicle of mature subjects. The exact cause of the retarded or arrested descent cannot be satisfactorily explained, and is a subject belonging more to the domain of embryology or teratology than surgery. It is, however, only reasonable to expect that the effort of nature to guide the testicle from the lumbar region to the scrotum during the fœtal life should occasionally mis-

carry. A rational supposition in this connection is that the small weight of an undeveloped testicle delays its descent until the internal inguinal ring has closed, and in the case of the "high flanker" variety, until the tunica vaginalis is too firmly developed to respond to the weight of the testicle. Debilitating diseases, exposure, overwork and poor quality of food during the period of gestation are prolific in the production of cryptorchid young.

The testicles of cryptorchids are found floating within the abdominal cavity (intra-abdominal cryptorchid), within



FIG. 130—Intra-Abdominal Cryptorchidism (Farmer Miles' No. 3). (Bayer.)

the inguinal canal (extra- abdominal cryptorchid), or caught trap-like by the epididymis in the internal inguinal ring (intra-inguinal cryptorchid).

1. Intra-adbominal cryptorchidism may be unilateral or bilateral, usually the former. The testicle is small, undeveloped, and its secretion is sterile. It will develop to the normal size, or even larger, after the opposing testicle is removed by castration, but its secretion remains sterile through life. It is only on the rarest occasions that the bilateral ridgling or the half-castrated proves able to procreate.

In the process of growth and an effort to perform the

function of both organs after one is removed, the single organ within the abdominal cavity frequently undergoes cystic degeneration and develops into a large fluctuating body. (Farmer Miles designated this condition "internal hydrocele"). In other cases they undergo fibrous degeneration and become hard, indurated masses; and furthermore the abdominal testicle, owing to its abnormal life, is very susceptible to strongylus, tuberculosis, glanders, and suppurative processes. The latter condition frequently coexists with the cystic degeneration. The testicle is not covered with peritoneum. The tunica vaginalis is wanting; except in rare cases it is found collapsed and protruding down the inguinal canal several inches.

2. Extra-abdominal cryptorchidism, like the foregoing, may be unilateral or bilateral. It is a normal anatomical condition with some mammals during the brief period after birth. In most animals, however, it is pathological. In both instances there is a strong tendency toward descent of the testicle into the scrotum as the subject grows older. When the opposing testicle is removed by castration their descent is more certain.

This variety is again subdivided into **supra-scrotal** and **intra-inguinal** cryptorchidism. The supra-scrotal testicle is common in young animals, and may descend into the scrotum as the animal develops. If the opposing testicle is removed its descent is certain. The testicle is covered with the tunica vaginalis and is better developed than any of the other varieties. In the inter-inguinal (high-flanker) variety the testicle is found just below the internal inguinal ring within the inguinal canal, appropriately clothed with the tunica vaginalis containing more than the usual amount of serous fluid. The testicle is smaller than the supra-scrotal, and is less inclined to descend when the opposing testicle is removed. It is frequently very small and easily "overlooked" in palpating the region before operating.

The intra-inguinal cryptorchid is one of the interesting freaks of cryptorchidism in horses. The testicle is found strangled by the epididymis in the inguinal ring, the major portion of the testicle remaining within the abdominal cavity. The epididymis is covered with a tunica vaginalis and is distended with fluid. (See modifications page 271).

Farmer Miles classified ridglings into Nos. 1, 2, 3, 4, and 5. The first three refer to the location, and the remaining two to pathological conditions of the testicles:

No. 1.—The testicle is located above the scrotum in the

inguinal canal, covered with a tunica vaginalis and can be felt on palpation with the patient in the standing or recumbent position.

No. 2.—The testicle is small and about five or six inches from the external inguinal ring, just below the internal ring. It is covered with the tunica vaginalis and can not be felt on palpation in either standing or recumbent position.

No. 3.—The testicle is in the abdominal cavity, without a peritoneal covering. The testicle is small in the young animal or entire horse, but large in the mature horse that

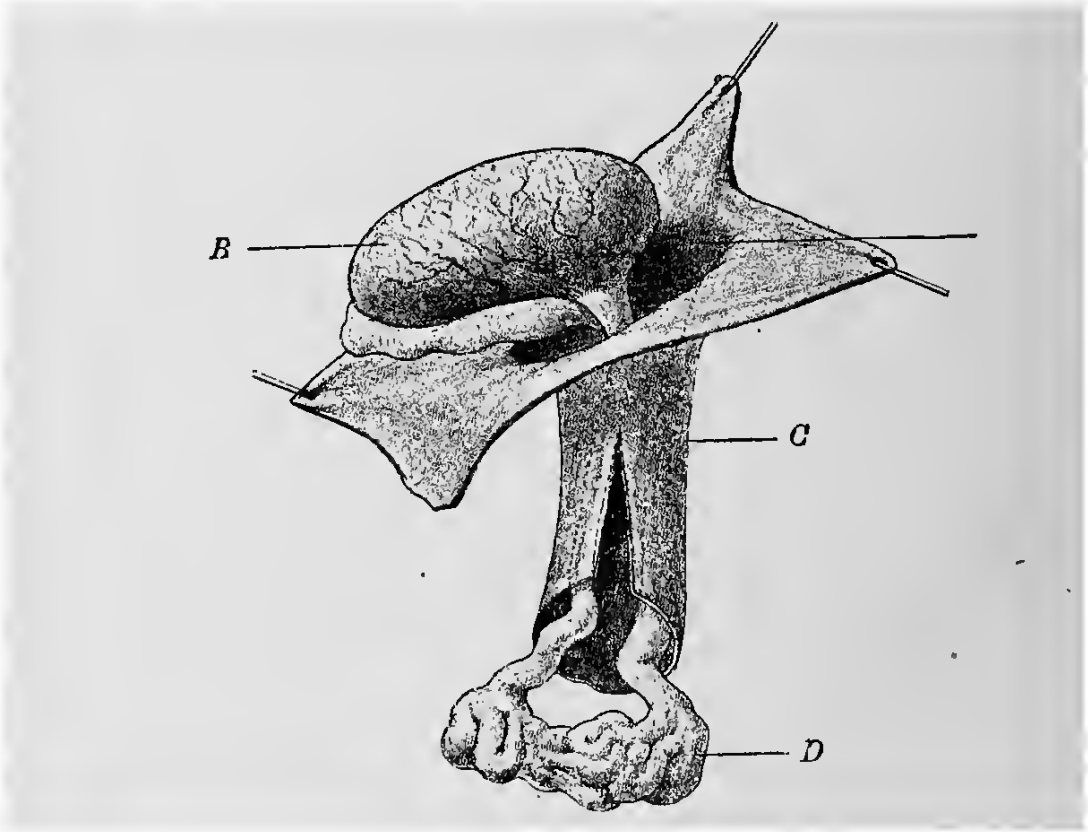


FIG. 131—Intra-Inguinal Cryptorchidism. The Epididymis Extends Downward Into the Inguinal Canal, Covered with the Tunica Vaginalis. (Bayer.)

was castrated on the opposite side in youth. This variety is the most common of all ridglings.

No. 4.—The testicle is partly through the internal ring and is covered over its protruding portion with peritoneum (tunica vaginalis) filled with serous fluid. The testicle itself remains within the cavity.

No. 5.—The testicle is enlarged from disease, within the abdominal cavity.

It will be observed that this classification includes supra-scrotal, inter-scrotal, intra-abdominal, intra-inguinal, and the intra-abdominal pathological testicle, respectively, and

is made with the purpose of distinguishing five separate operative requirements.

SURGICAL ANATOMY OF THE INGUINAL REGION.—The inguinal region includes the space on each side of a raphe extending from the perineum to the umbilicus. Superficially it presents the sheath and scrotum; the prepubian tendon extends forward from the brim of the pubes forming the internal boundary of the external inguinal ring; an aponeurotic portion of the tendon extending from the femoral fascia forms the antero-external boundary of the external inguinal rings, and Poupart's ligament forms the posterior boundary. The external ring is a large opening, and can be located by external manipulation. The in-



FIG. 132—Correct Position for Cryptorchid Castration.

guinal canal is funnel shaped, and extends from the external ring, upward and outward to the internal inguinal ring, which is but a small slit in the abdominal wall. The length of the canal is from six to nine inches, according to the size of the horse.

The large arteries of the region are the external pubic and the subcutaneous abdominal, a branch of the former located along the line of the sheath.

DIAGNOSIS.—In the entire animal the condition is readily recognized by the absence of one or both testicles from the scrotum. When there is no history to confirm the diagnosis, suspicion is aroused by the amorous nature of the animal and the willful and impelling disposition character-

istic of stallions. The neck is large, but not as well developed as in the normal stallion, but the muscular system, especially the buttocks, fall far below the average in contour.

The chief source of confusion in the diagnosis of cryptorchidism is the location of the affected side. In the suprascrotal ridgling the testicle is felt on palpation of the inguinal canal, but in all the other varieties the diagnosis can only be made in the recumbent position, by the examination for the scar remaining from the castration of the normal side, and by the palpation of the inguinal canal for the remains of the spermatic cord of the previous operation. The fact that two-thirds of all cryptorchid testicles are located on the left side will materially assist in this connection. If the region is not marked with fat the cord is easily felt, and in most instances the scar is visible. The greatest confusion arises when scars exist upon both sides, one from the original castration and one from previous attempts to find the hidden testicle. In this circumstance an attempt must be made to locate the old spermatic cord on the castrated side, and if results are negative the only recourse is to operate first on the left side, and then upon the right. Rectal explorations are deceptive and very seldom fruitful.



FIG. 133—Technique of Cryptorchidectomy with Miles' Harness.

PREPARATION.—It is advisable, when possible, to administer an oleaginous cathartic three days in advance of the operation and follow the purge with a limited diet. During the last twelve hours no food or water should be allowed.

EQUIPMENT.—Castrating knife, ecraseur and antiseptics.

RESTRAINT.—A special form of restraint is an indispensable feature of the operation, the object being to flex the hind legs upon the pelvis and part them as wide as possible to expose the inguinal region and to prevent any

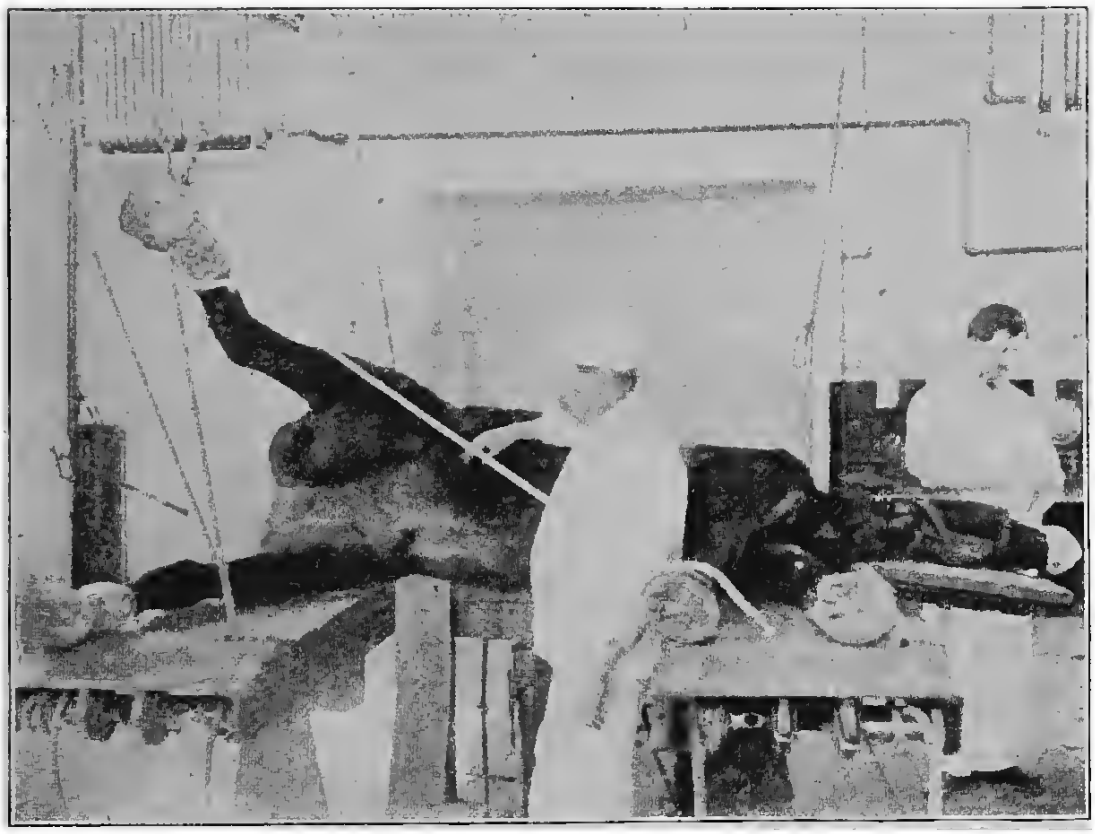


FIG. 134—Restraint with Operating Table. (Courtesy of Prof. W. L. Williams.)

interference with the free passage of the hand down the inguinal canal.

The appropriate throwing harness is the double sideline, consisting of about sixty feet of ¾ inch rope, with a loop in the center for a collar, two hopples for the hind legs, and small sash cords or straps for the fore legs. The loop is placed around the neck and the two ropes passed between the fore legs to each hopple and then upward to the rings in the neck loop. One rope is held by an assistant behind the horse and the other by a second person in front. The foreleg on the side on which the horse is intended to fall is tied

up with a sash cord or strap. The third man then takes the horse by the head and directs the assistants at the ropes to pull in opposite directions until the horse falls. The rope of the uppermost leg is now "double-half-hitched" over the foot, passed around the loins, and "double-half-hitched" to the opposite foot. The horse is then rolled over to the opposite side and the other foot fastened in the same manner. The legs may be parted still further by the use of a spreader passing between the feet, but if the ropes passing around the loin are drawn taut the spreader will not be necessary. The forelegs are secured in the flexed position with small cords or straps.

The appropriate posture for operation is the dorsal lateral attitude with the affected side uppermost. The operator takes either a sitting or a kneeling attitude posteriorly. Farmer Miles recommended sitting flat upon the tail.

General anæsthesia is advisable, although not essential nor customary amongst American veterinarians. The administration of one ounce of chloral hydrate one hour before operating is beneficial, and advisable when general anæsthesia is not expedient.

On the operating table ridgling castration can not be safely performed without profound anæsthesia, and the table must be so constructed as to admit the operator into the space between the fore legs and the hind ones. With such a table and with the patient under the influence of chloroform the uppermost leg can be pulled upward with a rope so as to appropriately expose the region for operation.

ANTISEPSIS.—There is no other veterinary operation in which careful, painstaking antiseptic precautions are more essential then in the castration of a ridgling. The first step in this direction is the sterilization of the knife and **emasculator,** especially the latter, as this instrument must under no circumstances deposit microbes when it crushes the cord. It is here that the mischief, ending fatally, often occurs, and to forestall **every** chance of infection from this source, only **perfect** sterilization of the instrument will answer. For this purpose, when operating without a steam sterilizer, the author uses mercuric chloride solution no weaker than 1 to 300. The harmful effect of this solution upon the metal is easily compensated by the greater certainty of the disinfection as compared with that obtained from the other antiseptics. An emasculator or ecraseur, previously cleaned or boiled and carried about wrapped in a clean cloth, that is immersed for ten to twenty minutes in such a solution while

the preparatory steps are being executed, and only removed therefrom when required to ablate the testicle, has never in the author's experience infected the seat of ablation. The **knife** being used only to perform a very small part of the operation is a much less important infection carrier. If kept reasonably clean, and if the blade is placed in phenol for a few minutes, there will be little danger from this source. The **hands,** on the contrary, are of capital importance. Contaminated with dirt while tying the patient, they must in a few minutes be passed into the peritoneal cavity. The best system of dealing with the whole matter of antisepsis for ridgling castration is as follows:

1st. Submit the hands to a good washing with soap and water, after cleaning and trimming the nails, then rinse them for a few minutes in a solution of mercuric chloride 1-500.

2nd. Place the emasculator in a basin containing a solution of mercuric chloride 1-300, and the knife blade in phenol.

3rd. Wear gloves while casting, tying and placing the patient in proper position.

4th. Remove the gloves and rinse the hands in the mercuric chloride solution, just before the operation proper begins, and thereafter do not touch any septic objects.

5th. Wash the region well with soap and water and then with mercuric chloride, and moisten the thighs, buttocks, and abdomen to prevent hairs from flying.

6th. Do not allow the fingers to touch the dirty rugæ of the sheath while making the incision.

7th. Rinse the hand after the incision is made, just before passing it upward through the inguinal canal.

8th. When the testicle has been found, take the emasculator directly from the basin to effect the ablation.

While this routine does not constitute absolute asepsis, it takes advantage of all reasonable precautions without delaying any part of the procedure.

It has been observed that certain of the old ridgling castrators entirely ignored cleanliness in their operations and yet were very successful, in fact more so than the practitioners who make strong pretenses toward the observance of antiseptic technique. An explanation of these results, which at first might seem to reverse the teachings of aseptic surgery, is easily found by observation to be due to the greater skill of the former and the misconception of the latter as to what actually constitutes effectual antisepsis.

First Step.—Oscheotomy.—The incision of the scrotum is made about four to five inches long, according to the size

of the operator's hand. As there is no objection to a long incision, it is well not to handicap the hand in a tight place. The incision is made parallel to and one to one and a half inches from the median raphe over the external inguinal ring; in other words, across the undeveloped scrotal sac. The exact position is easily determined by comparison with the opposite side, where there is either a testicle or scar from which to locate the middle of the incision. The skin of the scrotum is stretched between the thumb and finger of the left hand and the knife is drawn backward carefully so as not to cut too deep where there is some danger of cutting underlying vessels, the bleeding of which would be annoying and harmful. It is the practice of some operators to stretch the scrotum by grabbing the end of the sheath with the left hand, but as the sheath is always dirty this can only be

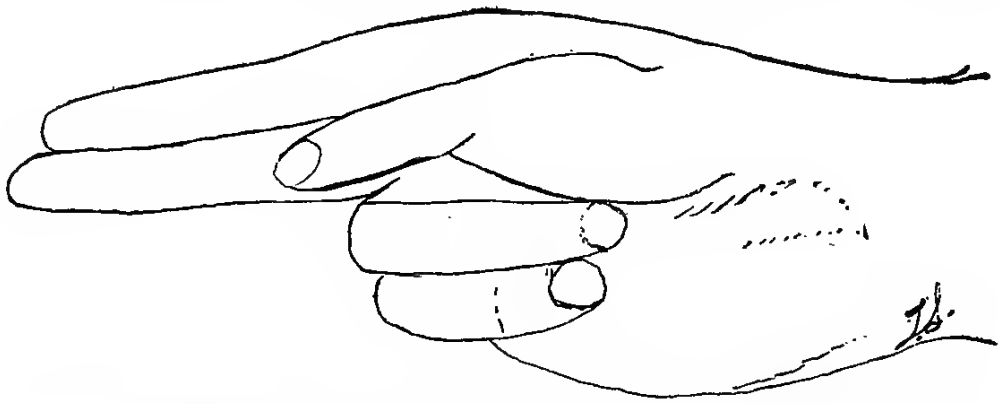


FIG. 135—Position of Fingers While Opening the Inguinal Canal and Perforating the Peritoneal Cavity.

recommended when done by an assistant. The incision includes the skin and the dartos.

Second Step.—Opening the Inguinal Canal.—The four fingers of each hand, placed back to back, are pushed into the incision about one inch in depth and then with considerable force the edge of the canal is torn open for passage of one hand into it. The course of the hand is now downward and forward toward the flank just beneath the skin, to the depth of six to nine inches, according to the size of the horse. The fingers are closed cone-shaped and the penetration is effected by rotation and gentle forward pressure until the desired depth is reached. The hand is in the proper position for the next step of the operation when it is buried six to nine inches and the fingers can be felt under the skin about one-half inch from the surface of the body. Most of the failures are due to pushing the hand downward directly into the abdominal cavity instead of directing it beneath the

skin toward the internal abdominal ring. While this step of the operation is being executed the canal is palpated for the testicle which might be found in the canal covered with the tunica vaginalis.

The opening of the vaginal canal is facilitated somewhat by oiling the hand. But when oiling is practiced care should be taken to use only a perfectly sterilized lubricant. Recently boiled linseed oil with three to five per cent phenol, kept in a well stoppered sterilized bottle answers the purpose.

Third Step.—Perforating the Peritoneum.—When the hand has been thus placed palpation with the index finger here and there soon discloses a thin spot, where the finger can be pushed through by pressing about half a pound. First the index finger alone is pushed through; then, if the cord cannot be found at once by "wiping" around in different directions, the second finger is also passed through the perforation. Failure to find the cord or the testicle with the two fingers may necessitate passing the entire hand into the abdominal cavity, but as this is an exceptionally hazardous procedure, and is only required in anomalies of great rarity, the failure to find the testicle with the two fingers must be complete before it is attempted.

Fourth Step.—Searching for the Testicle.—The search begins as soon as the hand enters the external abdominal ring and continues while the canal is being opened, in the hope of finding the testicle in the canal (extra-abdominal), and when the hand has penetrated the required distance (six to nine inches) the index finger palpates for a possible fluctuant sac that announces the existence of the intra-inguinal variety (Farmer Miles' No. 4). If these extra-abdominal manipulations show that the canal is free from any evidence of a testicle the diagnosis of intra-abdominal cryptorchidism is then certain, and the perforation of the abdomen as described in step three becomes necessary. The perforation being made first with the index finger, attempt is made to hook up the cord or some part of the testicle without any further enlargement of the opening, and indeed very frequently the intra-abdominal pressure will press the testicle toward the opening when the least bit of traction is applied to any of its appendages. But when these efforts fail after a few minutes' trial, the second finger is passed through the perforation and the search extended over wider limits. The fingers execute wiping movements, first against the parietal peritoneum and then in different directions amongst the vis-

cera, in search of a fine, wire-like cord (the vas deferens) which, when felt, is hooked up or pinched between the fingers and drawn toward the orifice. By the gentlest kind of traction the visceral pressure will bring the testicle through the opening without difficulty. When there is any difficulty in grasping the vas deferens effectually, Farmer Miles recommended that it be trapped firmly between the two fingers by crossing the third over the index finger. Although these manipulations are executed in a few moments by the experienced operator, the novice should work slowly and with great caution, even if ten, fifteen or twenty minutes is consumed in the search. The manipulations must be excep-

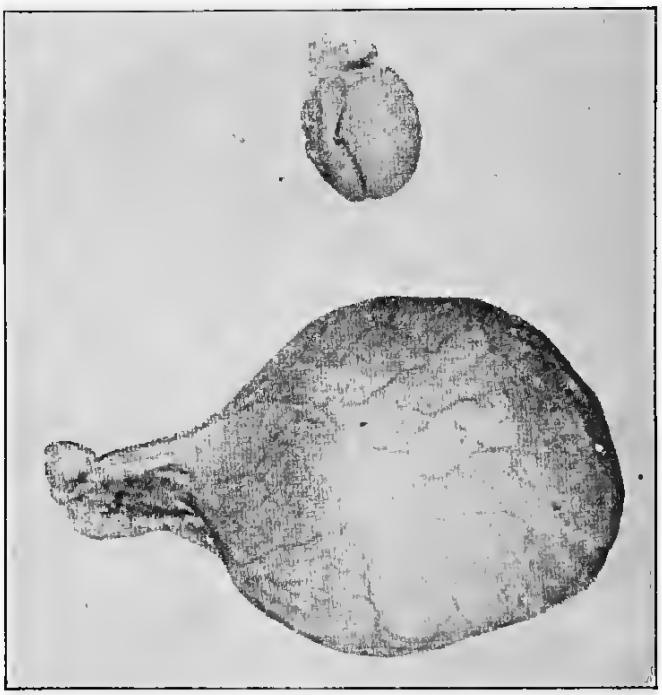


FIG. 136—Cryptorchidic Testicle.

tionally gentle, because the application of force will soon widen the perforation beyond the limits of safety.

If after diligent search it is found positively certain that the vas deferens is not within the reach of the fingers, the whole hand is passed through the perforation and a systematic search is made with all the fingers, but this step must only be taken as a last resort, because a perforation large enough to admit the hand invites prolapsus of the intestines, often with disastrous results. Another method of meeting this exigency is to make a new incision along Poupart's ligament and then penetrate the abdominal cavity behind it with the whole hand. This method prevents prolapse because the pressure of the thigh effectually closes the perforation, no matter how large.

Fifth Step.—Ablating the Testicle.—The ablation is effected in the usual manner, with the emasculator or ecraseur.

Sixth Step.—Preventing Prolapsus of the Intestines.—This part of the operation must never be entirely ignored; sometimes it is a very essential feature of the successful procedure. When the perforation is a small one the only precaution to take is that of keeping a firm pressure with the hand over the perforation as long as the legs are widely parted by the ropes, as sudden tenesmus may send a loop of intestines through it unnoticed. The operator should keep the hand upon the region while the assistant releases the patient from the harness. When the legs close together after untying there is little danger of the accident occurring.

When the perforation is a large one the only safe practice is that of packing the inguinal canal with sterilized gauze and retaining it with a few stitches across the incision. The packing, in order to be effectual, must be voluminous enough at the level of the orifice to actually support the intestines if any should rest upon it. (See Sequelæ, page 272).

MODIFICATIONS.—These technics do not meet every contingency, as they do not answer for several more or less rare cryptorchidic conditions. The most common one requiring a modification of these descriptions is the one we arbitrarily designate as "intra-inguinal" and which Farmer Miles calls No. 4. This testicle is trapped in the internal abdominal ring. The epididymis has passed through the internal abdominal ring, carrying with it the tunica vaginalis, but the body of the testicle is within the abdomen, resting upon the ring. Sometimes the epididymis stretches down at great length, almost descending as far as the scrotum, and when found during the operation it may be mistaken for the testicle until exposed by cutting the tunica vaginalis. This form of cryptorchidism is met by tracing the epididymis upward as far as the ring and then making a perforation one-half inch or so anterior to it, large enough to admit the index finger, with which the testicle is easily hooked out.

In this same variety of cryptorchidism the testicle may be found to have undergone cystic degeneration, in which instance it is found fluctuant instead of possessing its characteristic consistency. Sometimes the cyst is so large that its contents must first be evacuated before it can be brought through the perforation. This may be done with a trocar and canula, or else by simply rupturing the wall with the finger and allow the fluid contents to flood into the peritoneal cavity. The latter course is quite as successful and much

less complicated than the former. These cysts occasionally are dermoid, containing in addition to the serous fluid such unnatural objects as hairs, teeth, horn, etc.

The second variation in the technique is necessitated by the enormous volume of the testicle, which in some instances may be found as large as a child's head, or even larger. Removal under this circumstance is effected by enlarging the perforation.

AFTER-CARE.—The castrated ridgling should be kept tied up for twenty-four hours in a clean stall, and then given a limited amount of walking exercise daily. Turning out in the paddock or pasture is seldom sufficient on account of the invariable inclination to stand about instead of voluntarily taking the required exercise. The practice of trotting the patient is extremely harmful, and while the exercise should be forced, it must never be violent. Standing about in a stall, paddock or pasture on account of the soreness in the groin, or enforced standing in a single stall, in theory, should be desirable after an abdominal operation, but experience indicates that it is quite as harmful as violent exercise. It is possible that the state of absolute repose favors chills as well as the localization of septic foci along the surgical channel, which are dispatched by the drainage provoked by movements of the parts. Whatever may be the scientific explanation of the benefits of exercise, experience soon teaches that it operates to the well-being of the patient, and hence should be insisted upon.

There should be no molestation of the wound as long as the patient is not attacked with fever, no matter how pronounced the stiffness of the hind extremities becomes, but when fever supervenes drainage and irrigation of the canal are essential.

SEQUELÆ and ACCIDENTS.—(1) **Septic peritonitis,** induced always by septic hands or septic emasculator, is the most serious result of the operation, and although it may sometimes be unavoidable on account of the impossibility of thoroughly disinfecting the hands, if the above instructions in that connection are respected absolutely, it is indeed remarkable how badly the operation can be done without infecting the abdominal organs, or surgical tract. On the other hand, if no adequate and intelligent precautions are taken the very neatest operation may turn out badly from this cause. (See Castration, page 244. (2) **Prolapse of the intestines,** is a very common complication of ridgling castration, especially when the perforation has been accidentally

or intentially made very large. In every case some pains must be taken to prevent this accident, and when the perforation has been a large one special treatment becomes essential. The recommendations are described in step 6. (3) **Abscesses** in the inguinal canal sometimes supervene, and may cause considerable annoyance, and even death, after a protracted indisposition lasting several weeks or more. They are treated by early evacuation and antiseptic irrigations with hydrogen peroxide. (4) **Œdema of the sheath and ventral surface of the abdomen,** frequently follow the operation, but unless they reflect from a septic surgical wound, they are harmless. (See Castration, page 244) (5) **Scirrhous cord,** while rare does occur occasionally after cryptorchidectomy. The treatment does not differ from that of the same condition following ordinary castration, but on account of its close proximity to the abdominal cavity operative treatment is much more dangerous. (6) **Hæmorrhage from the inguinal veins** is an outward event of the operation that sometimes occurs when the tearing open of the inguinal canal with the hand is done too harshly, and especially when the incision of the scrotum has been extended too deeply, that is beyond the prescribed limits,—the skin and the dartos. If the incision is carried at once beyond the depth of these two integuments the hand either passes beneath the inguinal plexus of veins or else exposes them to injury during the operation. This hæmorrhage is both annoying and serious; serious when a large one is ruptured high up in the canal where it can not easily be ligated. The accident furthermore delays the procedure, complicates matters, and always excites considerable anxiety on the part of those interested in the animal.

Cryptorchidectomy in Other Domestic Animals.

In the dog, the boar and the buck the operation is best performed through a median line laparotomy, but it must always be preceded by a careful examination of the inguinal canal to determine with certainty that the case is one of intra-abdominal cryptorchidism and not a simple "high flanker," which of course could not be removed by way of the abdominal cavity. The incision is made in the median line between the umbilicus and brim of the pubis, just long enough to admit the index finger, which, after being admitted, hooks up the testicle or its appendages with facility.

In bulls, young or old, the flank laparotomy is prefer-

able. An incision is made in the flank of the affected side large enough to admit the hand, which is then passed through to the region of the internal abdominal ring from whence the testicle is easily brought forward. But as in operating upon the smaller species, especial precaution is taken to exclude extra-abdominal cryptorchidism, by first casting the patient and making a painstaking palpation of the inguinal tract.

CAPONIZING.

DEFINITION.—Caponizing is the name applied to the castration of aves. The bird so treated is called a capon.

INDICATIONS.—The operation is performed chiefly upon roosters, although recently it has been practiced in South Africa upon ostriches. In the former its object is that of improving the commercial value of the animal operated upon. The caponized rooster fattens easier, grows larger and, owing to a well recognized improvement in the taste and tenderness of the meat, brings a much larger price per pound on the market. In fact the demand for capons has always exceeded the supply, even at the fancy price of two to three dollars per head.

As the demands of the epicure are gradually increasing it is likely that the popularity of the operation will likewise increase, although until the present time the economic importance of each operation has been regarded as too trivial to attract any attention from practitioners. In fact the operation is willingly consigned to the fancier and poultryman in this country; the practitioner is not as yet interested enough to have mastered the technique, which to him is a mysterious chapter in his surgical education. The operation is, however, not a difficult one. In France and in Italy it is often performed by cooks, and in this country there are poultrymen who find it no trouble to castrate more than a hundred in a single day with good success.

In ostriches the operation is performed to increase the plume production; an effect that is said to be attracting considerable attention amongst breeders of these animals.

SURGICAL ANATOMY.—The testicles of birds are intra-peritoneal. They are very soft, friable, bean-shaped bodies of about the consistency and not unlike the color of a "chicken-fat" blood clot. They are located in front of the kidneys at the level of the last rib. They are held in position very loosely by their vessels and a loose areolar tissue.

In size they vary with breed, size and age of the animal. In roosters, the most favorable time for operation is at the age of four months.

TECHNIQUE.—In America it has been customary to perform the operation by making an incision between the last two ribs, which is held open with a special spring retractor, while the testicles are drawn out with a blunt, spoon-like forcep. But this technique has been outclassed

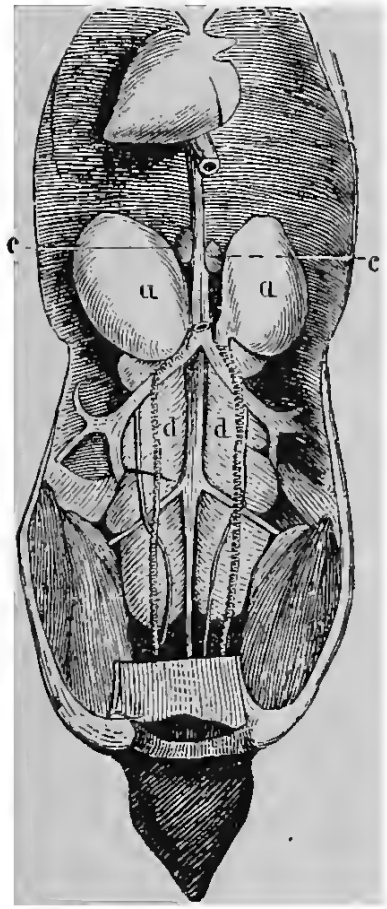


FIG. 137—Internal Organs of a Fowl. a, a—Testicles. c, c—Supra-Renal Capsules.

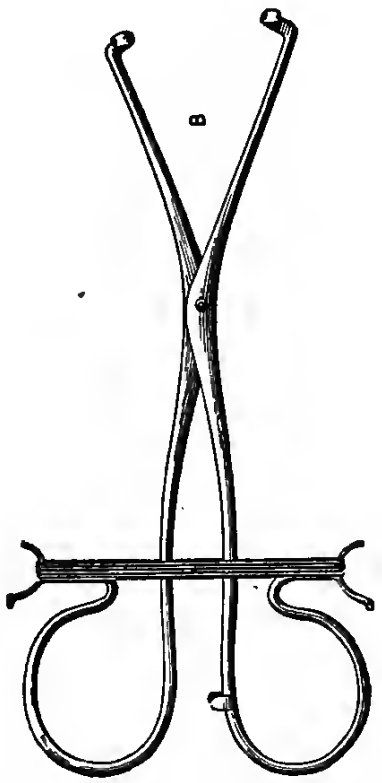


FIG. 138—Retractive Instrument for Caponizing by American Method.

by the Germans, who perform it in a more simple manner and with much better general results, as follows:

The expert operator holds the rooster, back downwards under his left arm, the feet in his left hand, thus exposing the abdomen and flanks. The less experienced may enlist the help of an assistant who sits upon a table or chair and holds the animal on his knees with the back downward and the hind quarters toward the operator.

Either flank may be selected for the incision, which is made midway between the posterior extremity of the ster-

num and the anus. The feathers are plucked, the skin disinfected and an incision just long enough to admit the index finger made through the skin and underlying muscles down to the peritoneum which is lifted and torn with the tissue forcep. If the side air sack settles in front of the opening it can be excised without hesitation.

The index finger is then introduced and passed toward the vertebral column, just in front of the kidney, where a firm but soft body one-half inch wide and three quarters of an inch long is soon recognized. When found the testicle is worked loose all around its circumference with the end of the finger (not the nail) and then "wiped" loose from all



FIG. 139—Securing Cord.

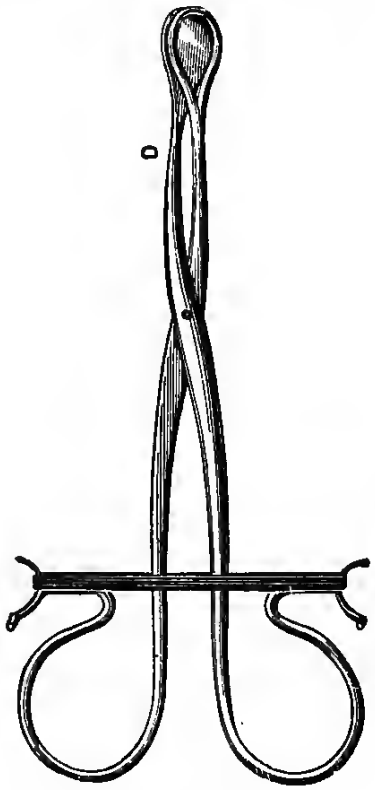


FIG. 140—Spoon.

of its attachments by a down and outward motion and then is left to float at liberty amongst the viscera. The opposite testicle is then treated in the same manner without withdrawing the finger from the abdominal cavity. No attempt is made to remove the extirpated testicles from the abdominal cavity as they will absorb in a short time, without causing any further trouble.

The incision is closed with a stitch and the wound brushed over with collodion. As a mark of identification the comb may be snipped as the animal is released.

Operated animals are fed lightly on soft feed for several days, and protected against inclement weather. Shelter

against rain and drafts and artificial heat in extremely cold weather is essential to the best results. In order that the wound be not unnecessarily molested by movements of the wings the perches are removed to prevent flying, and the animals compelled to roost upon the floor.

SEQUELÆ.—The losses are not great where asepsis is respected and the above after-care carried out. According to Gunther the losses are caused by rough handling of the kidneys when these are at first mistaken for the testicles and almost torn from their attachments before the error is discovered.

The first evidence of a forthcoming death is refusal to eat, which circumstance might always be advantageously met by slaughtering the animal for food before any diseased process has advanced far enough to render its meat unwholesome.

CASTRATION OF BULLS.

INDICATIONS.—Bulls are usually castrated when, having reached the limit of their usefulness, it is decided to fatten them for the market, and although castrated bulls never develop into choice meat cattle, they fatten more rapidly and their general behavior is improved.

RESTRAINT.—Adequate restraint is essential. The standing position is the preferable one. The head is secured in the stanchion and held high with the nose ring in the hands of a strong attendant. The hind legs are hoppled to protect the operator against kicks, and decumbency prevented by one or two ropes passed under the body and fastened to the ceiling beams. The tail is held aside by an assistant or else tied upward and to one side with a strong cord.

INSTRUMENTS, ETC.—Ecraseur and castrating knife are the only instruments needed.

ANTISEPSIS.—A thorough antisepsis is needed more in the castration of bulls than similar operations upon other animals, on account of an admitted susceptibility to complications. Although fatalities are not so very frequent, serious illness is almost universal where antisepsis is disregarded or performed in a perfunctory fashion.

The scrotum must first be washed well with soap and water, then with a solution of mercuric chloride 1-500 and finally with pure alcohol. In executing this step the scrotum is stretched so that the depths of its corduroy rugæ will be

cleansed. The scalpel and especially the ecraseur is boiled or otherwise rendered safely aseptic.

TECHNIQUE.—The apex of the scrotum is taken in the fist of the left hand and resected by one sweep of the scalpel, instead of making individual vertical incisions for each testicle. This form of oscheotomy exposes the ends of both testicles with the tunica vaginalis still covering them. The tunica vaginalis is then manually loosened from the scrotum, to which it is feebly attached by areolar tissue, and the ecraseur chain adjusted over it at the highest possible level without exposing the testicle itself. The ecrasement is performed slowly to assure a safe hæmostasis.

AFTER-CARE.—As long as there is no evidence of local complications the parts are not molested, but if the scrotum fills up with secretions or becomes swollen the wound should be drained and irrigated daily. Formalin ½% gives the best results as an irrigating liquid. Exercise, pasturing, sunlight, succulent feeds and abundance of water, are essential to the best results.

Castration of Calves.

Calves are usually castrated very young, sometimes at birth, but the best breeders prefer to postpone the operation until they have arrived at the age of three to four months, and especially until such time as they can be allowed the advantage of a good, clean pasture. Stable confinement is more dirty, even in the cleanest establishments, while romping about in the pasture, in addition to affording the greatest possible cleanliness, encourages good health and vigor, and thus forestalls complications.

The calf should be secured by "hog tying" the legs or by the sheer force of one or two men. The scrotum is washed with soap and water and submitted to a good friction of mercuric chloride 1-500. The apex is picked up with all of the fingers of the left hand and excised with the scalpel, then when the testicle is released from the tunica vaginalis are pulled bodily out one after the other (castration by avulsion). Shreds of the cord that protrude from the scrotum are snipped off. A dusting with iodoform completes the operation.

Castration of Lambs.

The mortality amongst castrated lambs is higher than in the other species, unless special provisions are made to prevent complications. The scrotum of lambs is a folded,

woolly receptacle for dirt, the manure of the sheepfold is the lambs' litter, and even in sheep kept out of doors, they lie about in denuded places where the flock congregates to feed. If lambs are castrated without precautions to prevent wound infections from these harmful conditions many of them often fall victims to septic complications, which, in addition, are frequently aggravated by inclemencies of the weather. A cold rain, a sudden drop of the temperature or a storm is often a serious matter to a flock of castrated lambs. The age at which lambs should be castrated is less important than the prospects of good, warm, spring weather and a new, clean pasture for them to inhabit during the first ten days following the operation. In addition the manure of the sheepfold, which is usually allowed to accumulate during a whole winter, should be cleaned out and a fresh litter of straw supplied, should weather conditions necessitate a re-confinement of the flock.

A table, a bucketful of mercuric chloride solution 1-200 containing a large number of pledgets of cotton, and a sharp, strong pair of scissors is the equipment required. The scissors are immersed constantly in the antiseptic solution.

The lambs are held by an attendant who sits upon the table adjacent to the bucket of antiseptic solution. The four legs are gathered together and held with the right hand, and the head with the left. The body rests upon the attendant's knees with the buttocks pointing toward the operator.

The scrotum is at once soaked with the antiseptic rinsed from the pledgets of cotton, which are cast aside when soiled. The apex of the scrotum is picked up with the fingers of the left hand and excised with the scissors, which are immediately returned to the bucket of antiseptic. Both exposed testicles are then grasped firmly between the second and third fingers of the right hand as the finger tips of the left squeeze them out of the scrotum. The extirpation is then affected by traction. As the cords are being drawn out the fingers of the left hand, still in the same place, press upon the scrotum as if to close the wound as the cord is leaving it. This squeezing of the scrotum with the left hand prevents wool or any dirt particles from entering the wound.

Protecting pastes such as tar, shellac, wound varnishes or collodion are harmful. If any antiseptic is applied to the wound it should be iodoform.

AFTER-CARE.—As soon as the lamb is castrated he is turned into the pasture or a specially cleaned place previously provided to receive the operated animals. In no case

should they be even momentarily allowed to re-inhabit the uncleaned fold with the rest of the flock. Pasture diet and shelter against bad weather is the only other after-care required. Complications are treated as in other animals.

CASTRATION OF DOGS.

Dogs are muzzled and secured manually or upon the canine operating table. The scrotum is washed with mercuric chloride solution and shaved if ordinary precautions are to be respected, and these are as important in canines as in any of the other species.

Each testicle is ablated separately. The incision is made parallel to the raphe, after pinching up the testicle with the fingers of the left hand. The extirpation is done by traction in small animals, and with the emasculator in the larger ones.

CASTRATION OF CATS.

On account of the difficulty of coping with the feline gymnastics provoked by the restraint and the operation itself, the castration of cats has never been a very popular operation. The danger of personal injury in the form of scratches and bites is not a triviality, especially in cats that are not accustomed to fondling. In handling a caressant cat the crafty surgeon can "apply the barnacles" before the instinct of self-preservation is aroused, but in the individual that has never been handled the maneuver, from beginning to end, is a screeching, scratching, fighting affair that savors of surgery in a menagerie.

There are various methods of securing cats safely, but these afford no protection to the surgeon while the appliance is being adjusted. The body may be wrapped in a blanket or large towel, or forced head downward into a boot-leg, but the best method is to take the cat in the arms, hold the nape of the neck in the left hand and then gather up the four legs with the fingers of the gloved right hand; or, according to Hobday, take the right legs in the right hand, the left legs in the left hand, and then force the head forward by bringing the hands together behind the neck.

Anæsthesia is not indicated on account of the short duration of the operation. The discomfort of the anæsthesia exceeds the pain.

Disinfection, although almost universally omitted in castration of ordinary cats, should not be neglected in the finer,

long-haired breeds, as complications ending fatally are not rare. The disinfection consists of trimming the hairs from the scrotum and washing with mercuric chloride of the usual strength.

The castration is effected by separate incision for each testicle, and extirpation by traction, care being taken to ship off protruding shreds of the cord.

ABLATION OF THE OVARIES.

SYNONYMS.—Ovariotomy; ovariectomy; oophorectomy; spaying.

DEFINITION.—Surgical removal of the ovaries.

INDICATIONS.—The purpose of the operation of ablation of the ovaries varies with each species of domestic animals. Pathological conditions of the ovaries, diagnosed during life, are relatively rare in the domestic animals, and therefore furnish few surgical subjects. Ovarian tumors, ovarian cysts and ovarian abscesses occur somewhat frequently in the bitch, cow and mare, but they are seldom ever diagnosed in the living animal until operative intervention would be useless. And besides, the operations for such conditions belong to a higher order of surgical intervention than is possible to perform in the domestic animals, especially upon the larger species. Spaying of animals does not belong to the treatment of diseases. Its purpose is to augment the usefulness or value of an already healthy subject. In the bitch its chief purpose is to improve the value of a pet, as such, by preventing conception, obscene manœuvers, and the habit of roaming during the period of œstrum, and to admit of free co-habitation with other dogs. In the **ox** the economic value of the operation reaches a higher point than in any other animal. In the **western ranges,** where thousands of cattle herd together, thousands of heifers are annually subjected to the operation with the primal object of preventing the too rapid increase of the herd. It is the policy of the rangemen to spay 10%, 20%, 50%, or even 75% of the heifers, according to the number of breeding animals wanted for the next year's quota. A secondary object of the operation is found in the increased value of the spayed heifer as compared with the virgin or primipara, as a meat producing animal. On the **stock and agricultural farms** the heifers are spayed to admit of their free co-habitation with bulls without interfering with their preparation for market, and also to improve the quality of the meat. In

milch cows the value of the operation can hardly be overestimated, and is as yet but little understood by the American dairyman. It has been demonstrated repeatedly by the American veterinarian, during the last few years, that the operation of spaying a milch cow within a reasonable time after parturition will prolong the milking period one to two years or even longer, without diminution of the supply. When the secretion of milk finally diminishes to an unprofitable point the subject is a desirable one for fattening purposes. In the **mare** the indication is limited to the nymphomanic condition manifested by vicious switching of the tail and kicking in harness. For this condition the operation is not a universal success, but improves and entirely cures a sufficient number to warrant its recommendation on the otherwise useless animal.

Vaginal Ovariectomy in the Mare.

INDICATIONS.—The spaying of mares is practiced today solely to conquer the kicking mare, whose inclination to kick is due to an irritable condition of the genitalia. The disease is generally referred to as **nymphomania,** as the patient appears to be in œstrum constantly or at least very frequently. In harness, while being groomed, or when in contact with other horses in the stable, the tail is switched, spurts of urine are frequently ejected, the clitoris moves actively, and there is an irresistible desire to kick at the stall or in harness to demolish everything behind. In some subjects these manifestations of bad temper are constant, while in others they are periodical, corresponding to certain frequent periods of œstrum. The disease seems to exist in variable degrees of intensity. One will only occasionally exhibit inconspicuous symptoms by leaning against the groom or by feebly switching the tail occasionally while driving, while another will almost constantly switch, kick, piss and even squeal at the slightest provocation. The former is still useful; the latter is a useless, miserable wretch; and between these two extremes are all the intermediate forms. Some are only useful when reduced to fatigue by hard work; some can only be worked single, and others work well for a time and then finally are seized with a desire to act viciously.

The disease has not been satisfactorily explained as to its pathogeny. That it is a disease running a definite, chronic course, accentuating with age, is admitted. Observations clearly prove its existence, but its nature, its location and its

cause are unknown quantities. The ovaries are not always abnormal; generally they seem perfectly sound, and the uterus is not affected with a chronic inflammation. The clitoris, however, is usually red, tumefied, and sensitive, but as this is easily an effect rather than a cause, much remains to be explained about all features of the disease.

An irritation of the genitalia coupled with a bad temper (a shrew) that vents by kicking and which in turn becomes a confirmed habit, must answer for an explanation until investigations prove the real cause.

The results of the operation are not immediate in the confirmed case. From three to twelve months sometimes elapse before there is any perceptible change in the disposition. Generally the urination ceases first, to announce that improvement has begun; then the desires to kick become less frequent and finally the switchings of the tail become more feeble. The latter, however, usually remains to a certain extent for all times; there will always be some inclination to switch at intervals. In younger mares, where the habit of kicking is less confirmed, the cure is more certain and much more prompt. Usually one to two months after the operation the patient has developed into a fairly good individual. Failures have been reported, but it is evident that these are due to the anticipation of immediate relief rather than to the absolute failure of the operation. Futhermore, success in the confirmed subject, depends considerably upon judicious handling. The unfortunate creature should be kept at work, and prevented from kicking by kind treatment, until the habit is forgotten. Rough handling will perpetuate the habit in spite of the operation.

PREPARATION.—The operation is much more easily performed when the bowels are empty. An oleaginous purge three days before the operation, and a restricted regimen for two days, should not be omitted.

RESTRAINT.—Restraint by means of the stocks is much the best. But in lieu of stocks the patient may be placed in a narrow, single stall, the standing position maintained with slings, and the hind legs hoppled to provide against kicking. In addition the nose is twitched, the head held in an elevated position, and a rope stretched across the dorsum to prevent arching the back and to hinder straining. The tail is braided and held upward with a rope passed over a beam or ring in the ceiling. Mares may also be spayed in the **recumbent position,** tied, preferably with the English hopples or other method of fixing the feet together with the legs fully extend-

ed. The operating table answers the purpose well. In the standing posture a good dose of chloral or morphine is helpful, and in the recumbent posture general anæsthesia is almost indispensable.

INSTRUMENTS, ETC., REQUIRED.—1. **Colin's scalpel** (Fig. 141) which has a well convexed blade safely sheathed to prevent cutting until properly adjusted to the seat of incision, is the best knife with which to make the incision, although the common castrating knife, in lieu of the former, may be made to answer. 2. Ecraseur, 22 inches long, (Fig. 142) constructed so that the chain loop can be

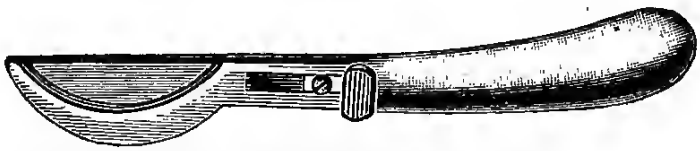


FIG. 141—Colin's Sheathed Scalpel.

conveniently wound up with one hand, is indispensable; the common ecraseur used for castration is inadequate. 3. A **syringe or pump** to wash out the vagina. 4. Antiseptics,—mercuric chloride, 1-1000; alcohol, 50%; and sodium bicarbonate, 1%.

ANTISEPSIS.—The instrument should be boiled to a point of absolute safety and then kept clean until used. **The hands** are washed thoroughly with soap and water, rinsed in mercuric chloride solution, dried with a friction of alcohol, and then enclosed in a clean pair of gloves during the pre-

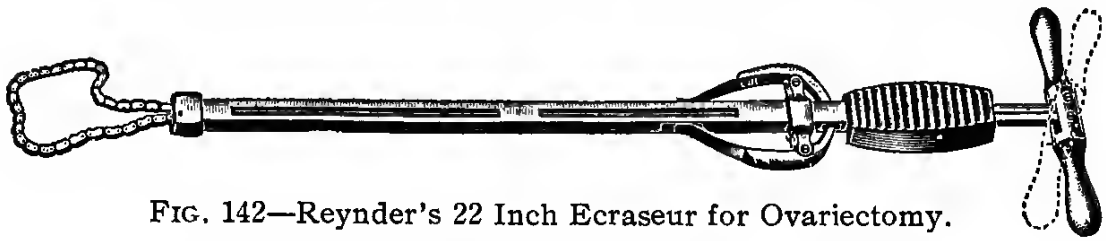


FIG. 142—Reynder's 22 Inch Ecraseur for Ovariectomy.

paratory steps of the operation. The tail is braided and then tied up out of the way and the pudendum is submitted to a good washing with soap and water and then with mercuric chloride. To facilitate the passage of the hand into the vagina a little vaseline is smeared upon the lips of the vulva.

First Step.—Disinfection and Dilation of the Vagina.—The vagina of the subject is generally filthy and sometimes irritated, necessitating liberal cleansing, yet in doing so it is important not to provoke straining by injecting objectionable liquids into it. Water with a little lysol, phenol or very weak mercuric chloride at a temperature slightly in excess of the

body heat, is pumped or syringed gently into every recess of the vaginal tube while one hand holding a pledget of cotton washes it into every wrinkle. After this irrigation the vagina is filled with a warm solution of sodium bicarbonate, one per cent until it is full, and until all of the wrinkles have stretched out. Williams designated this manœuver "ballooning the vagina." The vaginal wall anteriorly is a loose membranous affair that is difficult to incise unless thus stretched out.

Third Step.—Vaginotomy.—The incision is made by taking the scalpel in the right hand, passing it into the vagina until the convex edge lies directly and firmly against the vaginal wall just above the os uteri. The blade is then un-

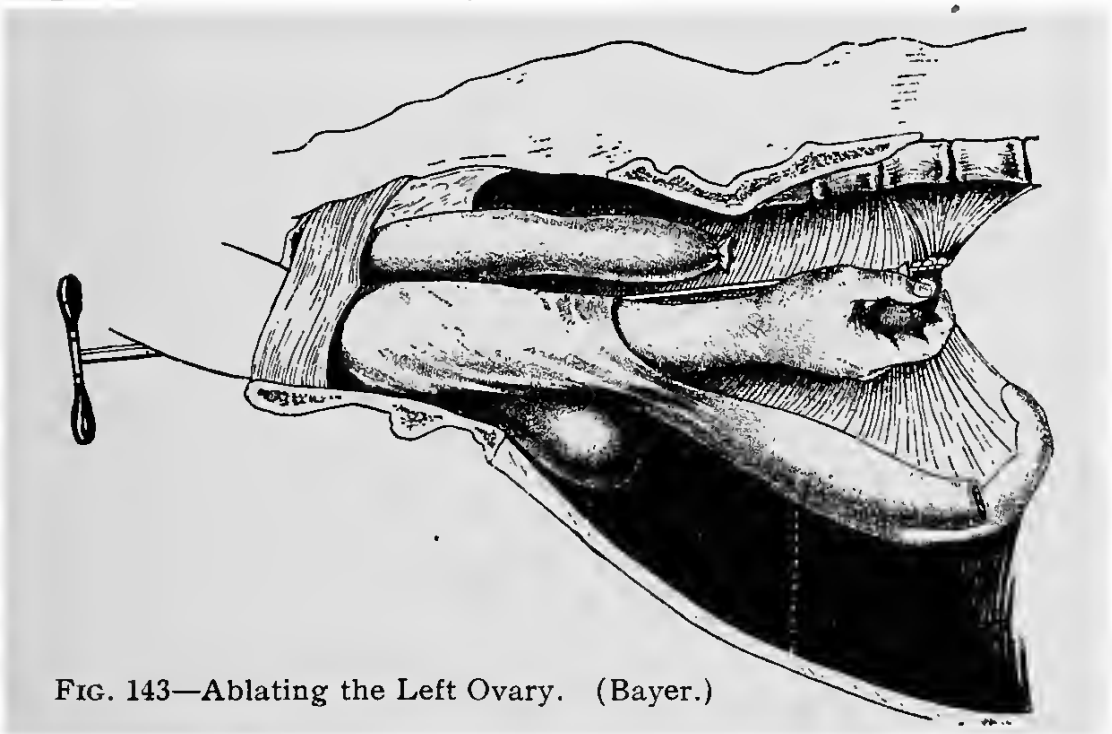


FIG. 143—Ablating the Left Ovary. (Bayer.)

sheathed and thrust through the wall by a sudden forward movement. Sheathed again, the knife is withdrawn and the index finger passed into the incision to determine whether the peritoneum has been incised with the rest of the wall. If not, that is if the incision is not through into the peritoneal cavity, the knife must again be unsheathed and the incision completed. It is not prudent to rupture the peritoneum with the finger. When the incision has been made the knife is either dropped into the vagina or else handed to an assistant, after which the perforation is enlarged by gradually forcing the fingers consecutively into it until the whole hand can be passed into the peritoneal cavity.

Fourth Step.—Search for the Ovaries.—The hand is passed backward along the body of the uterus until the bi-

furcation is reached, then it is deflected to one side, where the ovary is soon found. The organ is easily recognized by its firm texture and undulated surface. The size may vary somewhat. Generally it is the size of a walnut but in certain pathological conditions it may assume the size of a base ball or even a cocoanut.

Fifth Step.—Ablation.—When found the ecraseur is passed into the peritoneal cavity through the incision, paralleling the arm until the chain loop reaches the level of the hand. The fingers are now passed through the chain loop and the ovary drawn into it, and then as soon as the chain rests safely over the organ the handle of the ecraseur is taken in the left hand and worked as rapidly as possible in order to effect a hurried ablation. The crushing of the attachments always provokes some severe straining which rapid ablation reduces to the minimum. The ablated ovary is then deposited on the floor of the vagina and the same steps performed on the opposite side.

The operation is completed by simply bringing out the two ovaries as the ecraseur is withdrawn. The perforation of the vagina is not sutured nor submitted to any form of after-treatment.

AFTER-CARE.—The patient is kept in the standing position on a limited diet for twenty-four hours and then turned into the loose box for ten days, at which time, in the absence of complications, she is ready for work. Protracted rest is unnecessary. In fact, rest and good care that would tend to improve the general health and spirits, especially in adults where the kicking is due as much to habit as to disease, is apt to impel viciousness rather than diminish it. It is advisable to return the patient to good hard work and to keep her everlastingly busy until the habit is gradually abandoned.

SEQUELÆ and ACCIDENTS.—Septic peritonitis is the most likely complication, but it is indeed rare when hands and instrument have been properly cleaned preparatory to the operation. Amongst the accidents are incision of the bowels, especially the rectum, caused by not following the advice to make the incision near the os uteri, or to the cæcum by failing to purge and diet the subject before attempting the operation. Prolapse of the bowels should not be feared, as this accident has never been reported nor has it ever occurred to the author's knowledge.

VAGINAL OVARIECTOMY IN THE COW.

INDICATIONS.—The vaginal operation in ruminants although possible only in full growns, is the preferable one for milch cows, because there is no external wound to complicate matters. In the yearling and smaller two-year olds the vagina is too small to admit the hand and instruments, but in the full grown cow the size of the vaginal tube is ample.

The object of the operation already referred to is chiefly that of increasing the duration of the period of lactation. Ordinarily the milch cows of our dairies fail in their milk secretion after a few months, and at the end of ten to twelve, they gradually dry up until the next parturition. During the interval between the periods of profuse lactation the cost of maintenance often exceeds the receipts from the meager supply. The loss accumulating during œstrum, during the last months of gestation and during convalescence from parturition is entirely prevented by spaying. The spayed cow becomes tractable and amiable in disposition, gains flesh on limited rations, gives an abundance of milk for twenty-four to thirty-six months, and at the end, when the secretion finally becomes unprofitable, is readily fattened for beef purposes and as such brings a much higher price than the ordinary cow. While the spaying of cows with this end in view has not been extensively practiced, the observations already made, show clearly its wisdom where the production of milk is the chief desideratum.

The proper time to operate is two to three weeks after the second parturition, or even after the third calf has been born. The object of the postponement is to allow the udder to develop to its full physiological capacity. The mammæ after the first birth are small and incapable of producing a profitable amount of milk, and as they undergo no further development after spaying, the best results are obtained in cows having fully developed udders.

RESTRAINT.—The operation is performed in the standing position. The head is secured in the stanchion and the body between two blanks constructed in the form of a narrow stall. A railing on either side higher up than the lateral blanks serves to fasten ropes or slings which pass under the body to prevent lying down. The nose may be managed with the leading ring and the hind legs to prevent kicking are tied with ropes or hopples. The tail is either tied or held

upward and to one side. The construction of such a stocks is a matter of but a few moments, either in the cow stable or out of doors.

EQUIPMENT REQUIRED.—The instruments best adapted for the operation are **Colin's** scalpel or common castrating knife, **22 inch ecraseur,** and a **vaginal speculum** or **vaginal stretcher.**

ANTISEPSIS.—In operating upon a number of animals the antisepsis is somewhat difficult to maintain because of the general contamination of everything connected with the work. A reasonably safe state of cleanliness can easily be established for a single operation, or for only a few, but when a large number are hurriedly performed consecutively, the washing basins, the sponges, the instruments and the hands soon become more and more unsafe for intra-abdominal manipulations. Where water is scarce, difficult to procure or is itself contaminated, there is much to be feared in the possibility of seriously infecting a large per cent of the animals operated upon. The most practical precautions in this connection may be done as follows: (1) Rinse the pudendum, tail and buttock with plain water. In order to economize the water a large twenty-four ounce syring or pump is used instead of sponges, for these, if carried back and forth from patient to pail will necessitate the use of a clean pailful for each animal, and even then the pail soon become too filthy to be in any way associated with an abdominal operation. To the water used for this rinsing process creolin or lysol may be added. (2) The anus and vulva, following the rinsing process, are then washed with mercuric chloride solution 1-500, using pledgets of cotton which are cast off when soiled. To facilitate passage of the speculum into the vagina the next step is to lubricate the vulval surface with vaseline. (3) No washing of the vagina is attempted, except in the individual operation where sufficient time to do it properly can be allotted to this step of the antisepsis. To wash the vagina perfunctorily is useless, and in fact is more apt to cause infection than to destroy it. Unless the vagina can be submitted to a thorough cleansing, consuming considerable precious time, much better results will be derived from leaving it strictly alone. The only antisepsis necessary here is to give the seat of incision a few good wipes with a pledget of cotton soaked in the strong mercuric chloride solution, after the speculum has been adjusted and just before the incision is made; and even this may safely be omitted. (4) The instruments are boiled to assure absolute sterilization at the beginning; and to main-

tain them in a safe condition the knife blade between intervals of use is kept immersed in pure phenol and the ecraseur head in the strong mercuric chloride solution. It may be repeated here that although this solution will unpolish the metal it does no permanent harm to the instrument and the safe sterilization maintained thereby easily compensates for this trivial objection. When the mercuric chloride solution becomes bloody or accidentally dirty it is replaced with a new supply. The hands are frequently rinsed in the same solution used for the ecraseur.

A review of these steps shows the reader that the antisepsis is not complicated, only one pail of real antiseptic liquid being required, as it is utilized for the triple purpose of washing the vulva, rinsing the hands and immersing the ecraseur. The phenol for the knife is kept in a salt-mouthed bottle.

When the operator is compelled to assist in securing the animals a clean pair of gloves should be worn between operating intervals to prevent the hands from becoming repeatedly soiled with dirty ropes, stocks, hairs, excrement, etc.

TECHNIQUE.—The technique varies from that of the mare operation only in the use of the vaginal speculum. In the mare some pains is always taken to cause a dilatation of the vagina by filling it full of liquids, while in the cow the dilatation is effected at once, without ceremony, with the vaginal speculum or with a special stretcher. Although it is, of course, possible to perform the operation without the speculum, it is nevertheless too helpful to be omitted.

After the patient has been secured and the antiseptic washing completed the speculum is inserted and screwed open. This dilates the vaginal tube anteriorly, stretching it at the seat of incision. The knife is taken from the phenol bottle, rinsed in the pail of clean water to wash off the caustic coating, and then passed with the right hand to the anterior vaginal wall. The blade is pressed firmly against the wall just above and near to the os uteri and the vagina incised by one quick thrust. With a little experience the force of the thrust can be gauged so as to make a complete through-and-through incision without endangering the abdominal organs. The incision is enlarged by forcing the fingers one after the other through the opening until the whole hand is admitted. The speculum may be removed after the incision has been made. The search for the ovaries and their ablation does not differ from that of the mare operation (see page 182).

AFTER-CARE.—The cows require no special after-care except restriction of the diet for several days. If accustomed to the pasture they may be turned out, but on account of the tendency to overeating when first pastured in the spring, they should not be allowed to run at grass for the first time after the operation.

SEQUELÆ AND ACCIDENTS.—Septic Peritonitis, the one serious post-operative complication, does not often supervene when the above antiseptic precautions were respected throughout, but when careless methods have prevailed, especially in aged and more or less debilitated cows, the fatalities are common enough. Vaginal ovariectomy of cows must not be undertaken under unfavorable conditions, especially conditions which contravene the antiseptic precautions. **Prolapse of the bowels** through the vaginal incision, which would seem possible, is prevented by the wrinkling up of the vagina. Amongst the accidents is the accidental **incising of the intestines** while making the incision through the vagina. This accident is indeed quite possible when the rectum is full, when the incision is made at too high a point in the vagina, when attempt is made to incise the vagina without stretching its walls with the speculum, or when the intra-abdominal tension, from failure to diet the animals, presses the cæcum into juxtaposition with the vaginal wall. **Hæmorrhage** from the ovarian arteries is a much more frequent accident than is generally supposed, and although it is not always serious, death may sometimes occur therefrom. The seriousness harmonizes with the volume lost, and when infection adds to the mischief the chances of recovery are small.

Bloating.—Cows sometimes bloat considerably one-half hour to two hours after the operation, in which instance they may lie down and manifest a somewhat threatening distress. These manifestations are, however, usually transient, gradually disappearing without treatment. Paracentesis of the rumen and the internal administration of antacids is seldom necessary.

OVARIECTOMY IN HEIFERS.

INDICATIONS.—In young she-stuff the objects of the spaying differs entirely from those described in the operation upon full grown cows. Here the chief aim is to develop a more valuable as well as a more economically fed beef animal. The spayed heifer grows faster, fattens easier, cohabits with others without molestation and brings the same

price as steers in the market. On the smaller farms where a few bovines are reared annually to be marketed for beef it is no small convenience and no trivial asset to be able to safely allow all the bovines to herd together in the same pasture or in winter in the same yard, in contradistinction to the annoyance of constantly keeping the sexes segregated in different enclosures. These presents, in addition to the advanced value of the spayed heifer on account of the excellency of its beef, gives a high value to the operation. The operation should be practiced more extensively on the small farms than it has been during past epochs, on account of its great value in animal husbandry. The large majority of American veterinarians have not only failed to encourage the practice amongst stockmen, but they have actually avoided the operation when it has been demanded. This apathy has been due to the graduation of large bodies of students by the veterinary colleges, who are entirely deficient not only in the details of this most useful operation, but who also lack proper knowledge of the essentials of veterinary surgery in general.

On the American ranges the operation of ovariectomy in heifers needs no introduction. It has been performed for years with gratifying results. In fact, the profitable management of large herds would be quite impossible on account of the difficulty of regulating reproduction, and the loss incurred in the wholesale marketing of pregnant females.

RESTRAINT.—The operation may be performed both in the **standing position** and in the **recumbent position.** The **standing position** is the preferable one and should always be adopted where a substantial and suitable yard, chute and stocks can be constructed. The novice will find that the ovaries are more easily found when the viscera hang in their normal relations. A yard leading into a narrow chute admitting the animals single file, and ending at an improvised stocks fitted with a trap for the head, ropes to prevent lying down, and an open space on the left side to expose the seat of operation, constitutes the ideal arrangement when a number of heifers are to be operated upon consecutively. The animals are driven into the chute, prodded along to the stocks, fastened, operated upon and then released at the front end, leaving the stock ready to receive the one waiting behind. With such an arrangement large numbers can be operated upon with minimum delay. The stocks construction is a simple one. It is but the end of the chute, equipped in front with two hinged railings between which the head is trapped, and

two ropes fastened on the top railing of the right side. The ropes drop to the ground and when the animal is driven into the stocks and the head has been fixed between the hinged railings they are brought around the body one at the chest and one at the flank. The front rope passes around the body just below the elbow and the hindermost one passes upward in front of the stifle and then backwards behind the external angle of the ilium. Both are tied with loop knots at the point of origin, thus fixing the patient against the right wall of the stocks. The left side has a wide gap between the railings so as not to obstruct free access to the seat of operation. A hinged door that will prevent the animal from jumping through the gap before being tied, and

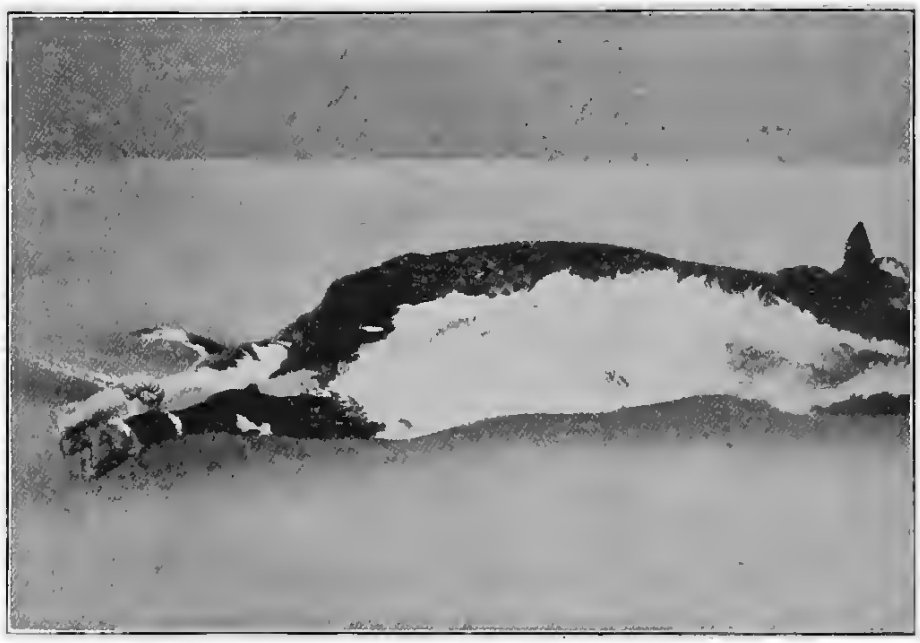


FIG. 144—Posture for Spaying. The Recumbent Position.

which can be quickly dropped as soon as the head is safely trapped, is an excellent improvement, although a removable railing will answer. The author has found it entirely practical to build the left side of the stock only two and a half feet high and then keep the animals from jumping over by lassoing and then dragging them to the front. This leaves the entire side of the animal exposed and gives the surgeon much more freedom.

The **recumbent position** with ropes is the only recourse when the operations must be performed in the open prairie. and may also be adopted when the number of animals to be operated upon is too small to warrant the construction of stocks. The method most suitable is to simply fix the two fore feet and the two hind ones together, each with

separate ropes, which are then used to stretch the fore legs forward and the hind ones backward. The operator takes a kneeling position at the lumbar region. On the ranges the legs are lassoed from ponies and the stretching of the animal into the operating position is accomplished without dismounting.

INSTRUMENTS.—1. Scalpel. 2. Ecraseur, emasculator (spaying) or spaying shears. Of these three instruments the spaying shears, which are nothing more than a large pair of

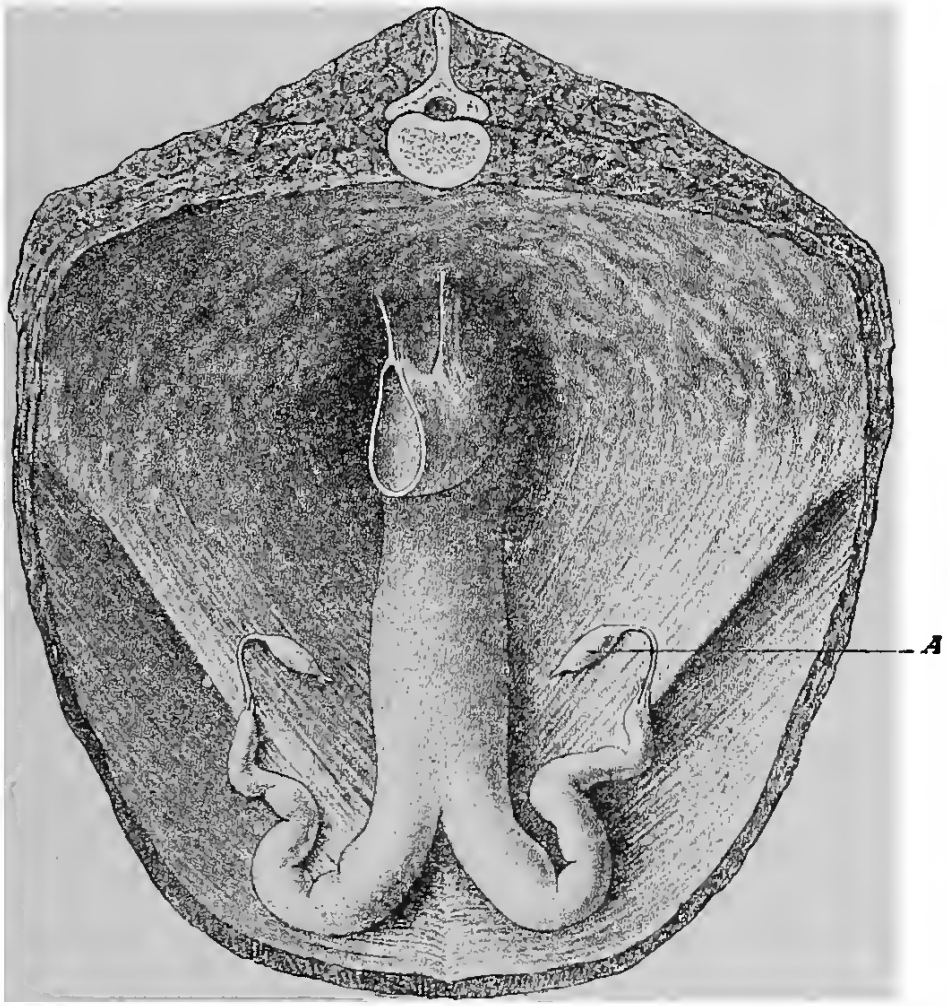


FIG. 145—The Anatomy of the Internal Genitalia.
A, Right Ovary. (Bayer.)

curved scissors, are much the easiest to handle, and although they cut keenly the bleeding resulting therefrom seems to be trivial. At least one experienced spayer, however, with whom the author has consulted in this connection, takes the opposite view that bleeding is often a matter of serious moment when the shears are depended upon. The spaying emasculator effectually prevents bleeding, but is a somewhat less handy instrument, in that a little difficulty is sometimes met in placing the ovarian attachments into its jaws. The

ecraseur is ideal, but too slow. It prolongs the pain, causes struggling and delays matters unnecessarily. 3. Needles, thread, needle holder. The needle should be large and keenly penetrant, the thread strong and small, and the needle holder of sufficient size to enable the surgeon to push the needle through the tough skin without hindrance. 4. Clippers. 5. Razor. The razor is only used when haste is no object, as for example when only one or two animals are to be operated upon. In large numbers, the hair is seldom shaved.

ANTISEPSIS.—There is often much to contend with in this connection. Despite everything the environment generally abounds with filth that is difficult to control. The surrounding earth has often been trampled into dust, which, manure laden, is sometimes constantly blown by gusts of wind into the antiseptics, over the instruments and upon the field of operation, defeating the most painstaking efforts. Dust, if blown about abundantly, should be allayed by sprinkling, and a clean elevated table constructed for the

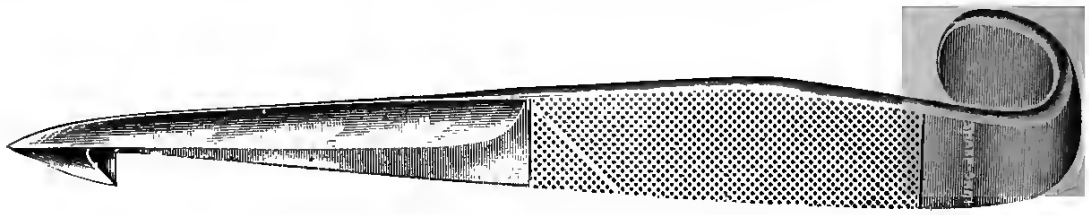


FIG. 146—Jamieson's Spaying Knife.

equipment, instruments, antiseptics, etc., in order that these may be kept perfectly clean.

The surgeon himself should take no part in tying the patient, nor preparing the field of operation, in order to overcome the danger that is certain to result from the alternate handling of the dirty extraneous objects and the abdominal viscera with the same hands. These preparatory steps are assigned to assistants, and the surgeon occupies his time between operating intervals, in maintaining the cleanliness of the hands, the instruments and the antiseptics.

The **instruments,** knife and emasculator, should be boiled before using and the boiling should be repeated as often as time will permit, and to keep them reasonably safe while in use they should be kept in a pailful of lysol solution, ten per cent.

The **hands** are submitted to a thorough washing first with soap and water, second with mercuric chloride solution, 1-500, and then dried with alcohol. The nails are trimmed and well cleaned. The cleanliness of the hands is there-

after maintained by frequent rinsing in the mercuric chloride solution, and if through lack of help it is found necessary to handle ropes, bars, or the patient, clean gloves must be worn to prevent harmful contamination.

The **field** is prepared as follows:—A space over the flank six inches in diameter is clipped and then the loose hairs are sponged off with water. At the same time the surface of the abdomen, the back, and the buttock is sprinkled with water to prevent the flying of hairs. The clipped surface is then given a brisk rubbing with mercuric chloride solution 1-500. For this purpose pledgets of cotton are used, and



FIG. 147—Location of Incision in Flank Ovariectomy and Operator's Position.

when soiled they are cast off, in order to keep the antiseptic solution clean. Shaving the field is not advisable on account of the precious time consumed. However, if speed is no object, shaving is a step in the right direction.

PEPARATION.—The animals should be sustained on a limited diet for at least three days, as intra-abdominal tension from loaded viscera, especially the rumen, is positively a serious obstacle. The full rumen will bulge through the incision, the ovaries are more difficult to locate and post-operative bloat is more certain to occur when the heifers are allowed full rations until the very moment of being submitted to the operation.

TECHNIQUE.—First Step.—Location of the Incision.—The left side is now most frequently selected for the laparotomy, although either will answer. On the left side there is only the rumen while on the right one there is a mass of bowels with which to cope. The incision is made perpendicularly in the very middle of the space between the external angle of the ilium and the last rib, and extends from a point about two inches from the transverse processes of the lumbar vertebræ downwards three and one-half to four inches, according to the size of the surgeon's hands. The author prefers the vertical incision, but others favor a slightly diagonal one extending downward and forward. (Fig. 147.)

Second Step.—The Laparotomy.—The thick skin is cut through at one firm, deliberate stroke, (three and one half to four inches) exposing at once the underlying external oblique muscle, whose fibers extend downward and backward. The division of this muscle is made in the direction of its fibers with the scalpel, and then the incision is torn wider with the fingers, exposing the internal oblique, which is then treated in the same manner; that is to say, it is incised in the direction of its fibers. The underlying aponeurosis and the peritoneum is punctured with the point of the scalpel and then enlarged by tearing. At once the inward suction of air announces that the abdominal incision is complete. The rumen is now in view. The object of making this apparently complicated abdominal incision is to create an automatically closed opening. The incisions through the muscles cross each other in such manner as to effect an almost perfect closure, and the time required to make them is no greater than a direct through and through division of the entire wall.

Third Step.—The Search for the Ovaries.—The surgeon stands with his back to the patient's head, passes the left hand through the incision, backward and downward over the rumen and then across the abdominal cavity to the **point where the brim of the pubis turns upward** toward the shaft of the ilium. It is in this region that the right ovary is found hanging from its appendages. It is recognized by its hanging position, by the facility with which it can be moved about in every direction, by its undulated surface due to the maturing Graffian vesicles, and by its size. The ovaries of hiefers are about the size of the end of a man's thumb, of an acorn, of an almond nut, or of a small hickory nut. The only other structures with which they may be confounded are

lymphatic glands, whose surfaces, however, are always smooth, and whose positions are always fixed.

Fourth Step.—The Ablation.—The ovary is held in the palm while the emasculator is passed to it along the posterior surface of the arm. The attachments of the ovary are then placed between its jaws and the ablation effected at one snap.

Fifth Step.—Ablation of the Left Ovary.—Without withdrawing the hand, or even the emasculator, the other ovary, which occupies the same relative position on the left side, is found and treated in the same manner. Both ovaries are



FIG. 148—Ablation of the Ovaries and Operator's Position.

thereby brought out together, the time consumed is but a moment and the wound in the abdominal wall has had little opportunity to become infected.

Sixth Step.—Suturing the Wound. The wound of the skin is closed with three interrupted sutures which are carefully placed so as to bring neat apposition of the edges. The underlying muscles, on account of the method of division (Step 2), require no sutures.

Seventh Step.—Protection of the Wound against Infection.—The best protecting substance is a wound varnish consisting of melted rosin and linseed oil. Tar, collodion, Canada balsam, et al., may be used.

AFTER-CARE.—The animals are turned to pasture or else given the freedom of a clean yard. The wounds should be inspected at least once during the succeeding eight days, in search of untoward reactions, and at the end of eight days the sutures are removed and the wounds given a final treatment according to their requirements. This after-care is, however, not always possible. In the ranges no attention is paid to the wounds after the animals are once operated upon. The stitches are left to slough out. In every case where heifers can be caught, as it is a matter of but a few moments, the stitches should be removed and the wounds given sensible treatment.

SEQUELÆ AND ACCIDENTS.—Septic peritonitis, hæmorrhage, septicæmia, abscess of the abdominal wall and post-operative bloating are the possible sequelæ. The only accidents likely to occur are accidental incision of an intestine when the curved scissors are used and bleeding from the circumflex illi artery.

Note.—Vanlaw ablates the ovaries of heifers through a flank incision only large enough to admit one finger. The patient is recumbent and the incision is made in the right flank about five to six inches below the external angle of the ilium. The index finger is inserted and by pressing the belly downward with some force the tip of the finger can be hooked over the left ovary, which is brought out through the incision and held there while the finger returns for the right one. When both are brought out they are ablated together with the ecraseur. It seems that others have completely failed to perform the operation in this manner, and many with whom the author has conversed have doubted its possibility. It is, however, personally known to me that Vanlaw has operated upon as many as 20,000 heifers in this manner in a single season.

Ovariectomy in Sows.

INDICATIONS.—Nowadays sows are not very frequently submitted to the operation of spaying, because hogs are marketed at a very early age. The fattening of pigs begins almost from the time of their birth and continues incessantly under forced feeding until they reach that state of unnatural obesity,—the marketable condition,—as early as ten months. Under such conditions spaying is unnecessary. Previously hogs were fattened during the second year of their lives and as a consequence the danger of pregnancy

necessitated preventive measures. Nevertheless, it being a fact that veterinarians are occasionally called upon to perform this operation, its performance should not be permitted to become a lost art.

TECHNIQUE.—The sow is held on the left side by two assistants, and the operator kneels at the back. An incision one and a half inches long is made in the flank in front and a little below the external angle of the ilium. The skin is incised and the fingers complete the perforation. The index finger is passed backward over the fundus of the bladder and hooks up the uterus, which is brought out through the incision. The bifurcation is sought and then one of the cornue is pulled out hand over hand until it brings out the ovary which is cut off with a scissors. The cornue is returned through the incision until the bifurcation is reached again, and then the other one is brought out and treated in the same manner. A single stitch completes the operation.

OVARIECTOMY IN THE BITCH.

INDICATIONS.—The objects of averting pregnancy and œstrum in bitches is chiefly that of preventing them from running about or engaging in obscene maneuvers during the periods of œstrum, which seems to produce a greater pschycological effect in bitches than other domestic females. The spayed bitch is a much more desirable pet, a more faithful watch dog and is much more reliable in the field than the entire animal whose periodical concupiscence greatly distracts from her usefulness in the several capacities for which the dog is utilized. To obtain the best general results the operation should be performed before the bitch-pup has arrived at puberty, because when the sexual impulses of bitches have once developed strongly, it is by no means certain that spaying will entirely destroy them. Although pregnancy is, of course impossible, spayed bitches may quite frequently consent to copulate at definite periods, precisely the same as before ovariectomy had been performed, and this unexpected result can not always be traced to defective surgery, since they have been observed by the author when all of the ovaries and a part of each cornua had been removed.

RESTRAINT.—The bitch to be spayed is tied by the four legs in the dorsal recumbent position with the head declining 15 to 20 degrees. A board or ladder supported against a wall or fence at the proper incline has often been utilized with good advantage in lieu of a properly appointed

table. In the operating room, Young's device (Fig. 149) consisting of a simple triangular trough made by nailing the edges of two boards together and then preventing it from tipping over by nailing a third board across one end, answers the purpose exceptionally well. In the author's operating room this exigence is met by a polished board two feet wide and five feet long, hinged to the wall two and one-half feet from the floor. When not in use it is fastened to the wall with hooks and eyes, where it occupies little space. When turned down for use the free end is rested upon objects of various heights according to the degree of inclination desired. The edges of the board are equipped with screw-eyes at different points upon which to fasten the tie cords from the patient's legs. This is by far the handiest, as well the most economical, dog table for the ordinary veterinary

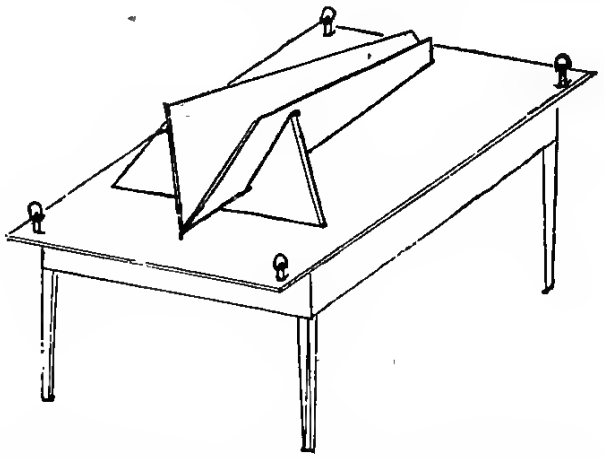


FIG. 149—Young's Table for Spaying Bitches.

hospital where canine operations are not numerically important.

In addition to the restraint, general anæsthesia is desirable to facilitate the technique, as well as to avert the horrifying spectacle of exposing the viscera without any attempt to control the pain. Total general anæsthesia with ether or else partial general anæsthesia with hypodermic injections of morphia may be selected. Of the latter two to six grains may be administered, according to the size of the bitch. These large doses of morphia are both effectual and safe. In fact they are much safer than the administration of ether by inexperienced hands.

INSTRUMENTS.—1. Scalpel, probe-pointed bistoury.
2. Dissecting forceps.
3. Two artery forceps.
4. Needles and silk thread.
5. Scissors.

ANTISEPSIS.—The belly must be shaved and washed well with lysol solution or mercuric chloride after having been submitted to a good cleansing with soap and water. To prevent shedding hairs from entering the field the surrounding parts are wet down with water and the whole region except the field itself covered with towels. Only boiled instruments are absolutely safe, although immersion in phenol for some minutes must answer where boiling can not



FIG 150—The Author's Ovariectomy Forcep for Bitches.

be done. Manual manipulations of the viscera and abdominal incision is avoided as much as possible.

PREPARATION. — As an empty alimentary canal greatly facilitates matters a course of dieting should precede the operation. Solid food is withheld during at least the preceding three days; only liquids are allowed and these in limited quantities during the last twelve hours.

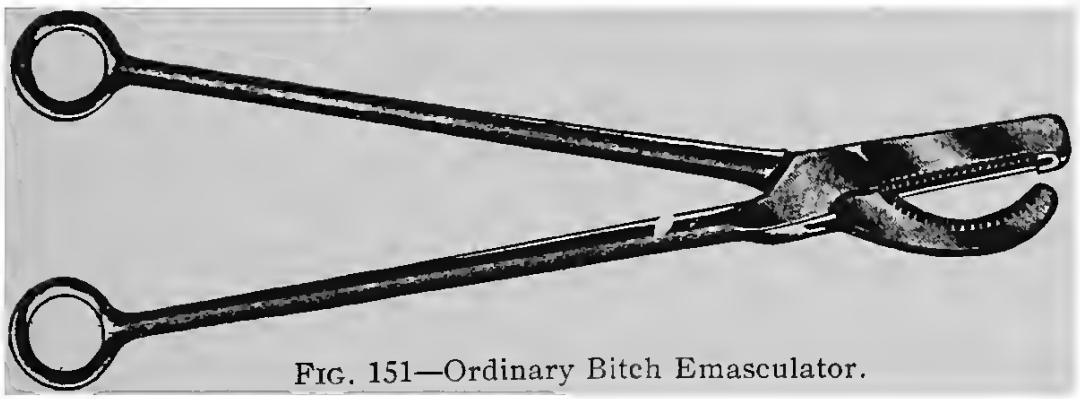


FIG. 151—Ordinary Bitch Emasculator.

TECHNIQUE.—First Step.—Location of the Incision. —The line of incision is about one and a half inches long, crossing the umbilicus so that the anterior half inch overlaps it. It is preferable to select a line at one side of the linea alba, in order to avoid a hernia arising from the failure of this poorly nourished fibrous structure to unite promptly. If the incision is made too far posteriorly there may be some difficulty encountered in bringing the ovary through the in-

cision, even by considerable traction upon the cornua, hence the advisability of overlapping the umbilicus.

Second Step.—The Celiotomy.—Following the line above described the skin and underlying muscles are incised. The latter are divided cautiously to avoid puncturing the peritoneum prematurely. When the latter is exposed it is punctured at one end of the wound with the scalpel and then divided along the entire course of the incision with the probe-pointed bistoury. A grooved director passed beneath the

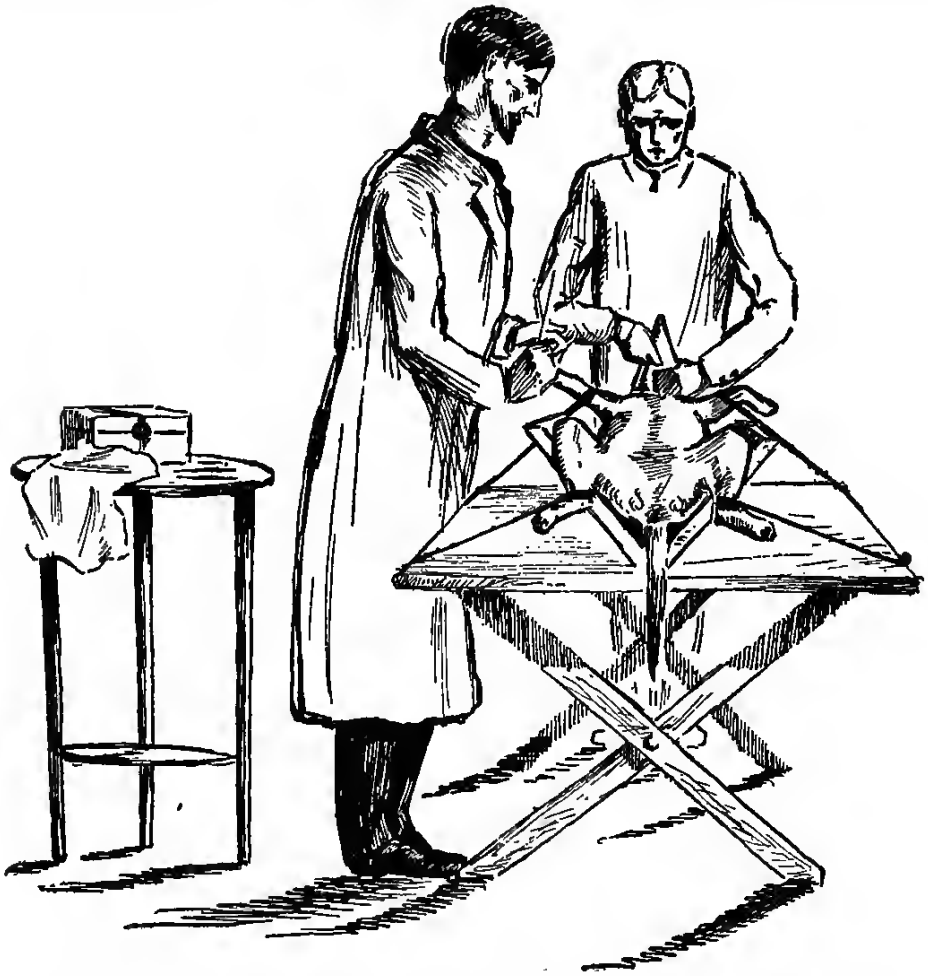


FIG. 152—Bitch Secured and Anesthetized by Young's Method.

peritoneum may also be employed to guard against visceral injury.

Third Step.—Search for the Uterus.—There is no immediate attempt to find the ovaries; the uterus or one cornu is sought, and as these lie just beneath the bladder, which is always conspicuous, little difficulty will be encountered. The novice may facilitate matters by passing a probe into the uterus through the vagina. The probe, if moved about gently, promptly discloses its position in one cornu or the other.

Fourth Step.—The Ablation.—When the uterus has thus been discovered it is hooked up, either with the index finger or with a blunt tenaculum, and brought out through the wound. The bifurcation is sought and then gentle traction upon one of the cornua soon brings the ovary attached to it into view. The ovary will be recognized from adipose masses by its elongated form and its relatively firm texture. Its ablation may be effected in various ways. The simplest safe method is to grasp the attachments of the ovary firmly with the artery forceps and then cut it off with the scissors, leaving the forceps to hang until the opposite ovary is brought out and ablated in the same manner. The forceps are allowed to remain for a few moments while preparation for the next step is being made. This method of ablation

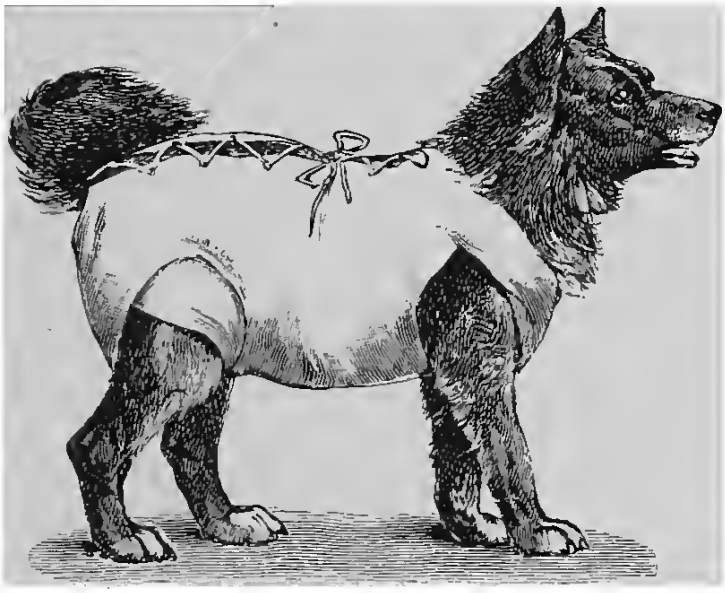


FIG. 153. Bitch Properly Bandaged after Ovariectomy.

is simple and never fails to prevent bleeding, except in bitches in heat, where ligation with catgut is the only absolutely safe expedient.

The emasculators in miniature, sold under the name of "bitch emasculators," besides being entirely too cumbersome, seldom prevent bleeding as effectually as the above method.

Fifth Step.—Suturing the Wound.—The operator may select between the three following methods: (1) Through-and-through interrupted sutures of silk; (2) a row of buried catgut interrupted sutures for the muscles and peritoneum, taken together, and a row of silk interrupted sutures for the skin; and (3) removable buried sutures of silk. Of these the last is recommended. (See page 59.)

Sixth Step.—Post-operative Protection. — The sutured wound should be protected by a firm body wrap to assure

against microbian invasion, to support and immobilize the abdominal parietes and to prevent the patient from tearing the sutures with the teeth. Chemical antiseptics are not employed in dogs, even under the bandage, on account of the possibility of licking them should the bandage come off.

AFTER-CARE.—A clean wound will require no further attention until the eighth day, when removal of the stitches becomes necessary. The patient, by gradual stages, is allowed to return to its normal diet and is given the freedom of a small kennel. Running about, especially during the first few days, is harmful.

ACCIDENTS AND SEQUELÆ. — (1) **Hæmorrhage** from the ovarian artery of one or of both ovaries sometimes occurs. It is not rare for the peritoneal cavity to fill quite full of blood when some error in ablation has been made, e. g., when in pregnant bitches or bitches in heat no ligatures were applied to the arteries. When the bleeding is noticed before the wound has been sutured, attempt may be made to again bring up the end of the cornu and apply a ligature around the bleeding place, but when the wound is either partially or completely closed before the accident is noticed no attempt should be made to arrest it. Between the two evils of prolonging the operation while the wound is reopened and the vessels ligated, and that of trusting to spontaneous arrest, by all means choose the latter. The application of cold compresses over the abdomen and loins is helpful.

(2). **Hernia** is much less common in bitches than in cats, but it does sometimes occur when the muscles, on account of improper suturing or sepsis, have not united while at the same time firm union of the skin promptly occurred. The **prevention** consists of making the incision to one side of the linea alba, of effectually suturing the peritoneum and muscles, and of preventing sepsis by cleanly methods. A **cure** can only be effected by a radical herniotomy.

(3) **Prolapsus of the bowels** is a common occurrence during the operation, especially on the unanæsthetized animal. By straining a whole mass of small intestines sometimes press out through the incision to the dismay of the surgeon. The accident, however, is more annoying than serious, but it should be promptly met by returning them before the volume is too large and before they have been unnecessarily infected.

Delayed prolapse may occur during the first three days from the bitch tearing out the stitches with the teeth, and as the accident may not be promptly discovered fatal results

may be expected. The accident is prevented by effectual body wraps, and when it has occurred the treatment should consist of prompt return of the bowels after having submitted them to a thorough cleansing, and of closing the wound with through-and-through interrupted sutures.

(4) **Anorexia** persisting for a few days, is a quite common sequel, but is more common in cats than in bitches. There is no apparent cause in many cases, and despite treatment death sometimes supervenes from actual starvation. Alcoholic stimulants, aromatic bitters and forced feeding is the proper treatment.

(5) **Shock** sometimes supervenes a prolonged operation performed without anæsthesia, and in which considerable blood has been lost. This accident is met with strychnia, ammoniacal stimulants, friction, tight abdominal pressure and subcutaneous injections of normal salt solution.

(6) **Septic peritonitis** is by no means as common a sequel in bitches as in the larger domestic animals, but it does occasionally occur after abominably filthy operations, or in enfeebled animals where the antiseptic precautions were not free from fault. The prevailing impression that dogs can tolerate filthy abdominal surgery with impunity should be dispelled if this formidable although uncommon sequel is expected to be prevented.

Ovariectomy in Cats.

There is no essential difference in the technique from that described above, except that the smallness of kittens makes the operation somewhat more tedious. It is in the sequelæ that the greatest difference is found. Cats are much more sensitive to ovariectomy than bitches; all of the sequelæ are more likely to occur and in a much more severe form. Hernia, septic peritonitis, and anorexia are quite common.

Ablation of Scirrhous Cords.

INDICATIONS.—The decision to operate upon an enlarged spermatic cord depends upon whether the tumefaction is in reality a permanent sclerosis, an encroaching new growth, or simply a temporary swollen condition dependent upon an active though sometimes stubborn inflammatory process that will eventually subside spontaneously. It sometimes happens after castration that one or both of the spermatic cords become the seat of an inflammation that

gives the inguinal region a physiognomy simulating scirrhous cord, but which in reality is but the reflection of a transient morbid process. One, two and sometimes three months after the operation the region of the scrotum appears to be in bad condition. The incisions, instead of healing, continue to discharge a limited amount of pus and the cords on palpation are found hard, enlarged and somewhat painful. Notwithstanding that such a condition is often the precursor of a real scirrhous cord, it is always advisable to postpone operative intervention until its chronicity is positively established by the lapse of considerable time or by ample evidence that the growth is increasing instead of diminishing in size. A tumefied cord that continues to enlarge after six weeks, or one that continues to sojourn at the end of four months, may safely be pronounced chronic, and hence is a fit subject for ablation. while on the other hand, one that is only of three, four or five weeks' standing and that shows a decided inclination to cicatrize into a smaller and smaller object from time to time may be prudently treated expectantly for several months, in hopes that operative treatment may eventually prove unnecessary. It is true that ablation will more promptly dispatch these recent cases then the expectant treatment ever does, yet the wisdom of submitting the patient to a second operation that is fraught with considerable danger, can always be questioned in view of the excellent recoveries that often occur without operation.

There is, however, no excuse for indecision when the chronicity is well established, nor in any of the scirrhous cords found many months or years after castration. Here, ablation should be practiced without delay, to prevent the diseased cord from growing to a size that would render the operation more and more hazardous.

When the growth is enormous, or when large and bilateral, especially if the patient's health is bad from the constant drain from the disease or from overwork, the operation is exceptionally dangerous. Fatalities are common. In such cases it is always advisable to postpone the operation until the vigor can be restored by rest, healthful exercise, tonics and good feeding. In view of the high mortality the wisdom of undertaking the ablation of enormous scirrhous cords in more or less emaciated subjects is indeed doubtful. Although the worthlessness of the patient may be admitted, there will be little credit gained in performing a difficult operation whose mortality is so high as

that of ablating exceptionally large scirrhous cords from debilitated horses.

RESTRAINT.—The horse is in the dorsal position with the casting harness, and the hind legs are spread out so that the inguinal region is accessible. General anæsthesia is not only advisable but highly essential to the success of the operation. In small unilateral scirrhous cord the partial general anæsthesia of chloral hydrate (one to one and a half ounces given as a drench one hour before operating) is sufficient, but when the growth is so large and widely adherent as to necessitate a long, painful dissection, chloroform anæsthesia can not be arbitrarily omitted. The operation is much too painful and of much too long duration to be performed without general anæsthesia. The omission is not only brutal but also invites fatal results from shock, syncope, exhaustion from straining against the restraint, hæmorrhage and sepsis.

On the operating table after the anæsthetic has been administered the uppermost leg is drawn toward the ceiling with a rope and the tail is tied backward to prevent switching into the field should the patient partially recover from the anæsthesia during the operation.

INSTRUMENTS.—The equipment is as follows:

1. Scalpels.
2. Dissecting forceps.
3. A number of artery forceps.
4. A tumor grappling forceps or large tenaculum.
5. Threaded needles for ligating vessels.
6. Needle and thread to suture the incision.
7. Large needle and thread to ligate the cord if found necessary by failure of the ecraseur to crush it off.
8. Ecraseur.
9. Antiseptic solutions.

TECHNIQUE.—First Step.—Disinfecting the Field.—As the field is often covered with putrid secretion, some of which is desiccated over the skin, a preliminary washing, before casting, is advisable. After the patient is in position the growth is squeezed with the hands to evacuate as much of the pus in the sinuses as possible, and then the sinuses are irrigated with a strong solution of mercuric chloride. This precaution prevents the flow of microbe-containing pus into the surgical wound during the dissection. The whole region is given, in addition, the usual surface cleansing with soap, water and mercuric chloride.

Second Step. — Dissecting the Growth from the Surrounding Attachments.—Two curved incisions are made so as to leave them between an elliptical island in whose area all of the orifices or raw tissues, if any exist, are contained. The tenaculum or grappling forcep is then hooked into the tumor and given to an assistant who is instructed to lift the tumor up with considerable force. The skin is dissected from the tumor uniformly on all sides until three to four inches of the growth is exposed in every direction; then an attempt is made to tear the remaining adhesions by grabbing the tumor in both hands and working the fingers upward between it and the skin until the narrowest available part of the cord is reached, near the internal abdominal ring. Spurting vessels encountered are taken up with artery forceps and if very large, ligated. When the growth is thus entirely freed from all of its surrounding attachments and now can be freely surrounded with the hands at every part, search here and there is made for bleeding vessels and the flow controlled.

Third Step. — Ablating the Growth.—The ablation is generally effected with the ecraseur, but when the growth is voluminous at the point of ablation the chain may be deemed unequal to the task and it may be necessary to decide in favor of a ligature instead. It is admissible to first attempt to crush it off with the ecraseur, and if developments indicate that this can only be done at the risk of breaking the chain, the cord just below (outward) the level of the chain is transfixed with the needle and thread preparatory to ligation. When the thread is in place each half of the cord is tied separately and as tightly as possible. If the cord is very large and there is danger that the first ligature thus applied is insufficient, a second one is applied at the same level so as to cross the first at right angles, thus effecting a quadruple ligation. Before releasing the chain of the ecraseur the cord is cut off with the scalpel about one-half inch from the ligature.

Fourth Step.—Final Arrest of the Hæmorrhage.—Despite every effort to control bleeding, as the operation proceeds there is always such a copious flow coming from so many directions when the ablation is complete that systematic torsion and ligation would be tedious if not quite impossible. Rather than allow the patient to lose more blood while attempting to control the bleeding with forceps, it is much better to immediately pack the cavity with cotton soaked in mercuric chloride solution 1-500 and then suture

the incision of the scrotum tightly to retain it. This packing should be done piece by piece, so that pledgets may be packed into every recess where they will exert direct pressure to the bleeding vessels when the incision is sutured.

AFTER-CARE.—The packing is removed at the end of twenty-four hours and the cavity irrigated thoroughly with lysol, phenol or sublimate solutions twice each day until the ligatures have sloughed off. Exercise, good food, and clean surroundings must be insisted upon.

SEQUELÆ AND ACCIDENTS. — Shock, hæmorrhage, septicæmia, paraphimosis and recurrence of the growth are the untoward results of the operation.

Shock and Hæmorrhage.—The loss of blood, which is always considerable, the pain of a tedious dissection, and the terrible agony of crushing the peduncle of the growth, combine three very likely causes of post-operative collapse,—a sequel of the operation that may always be expected when the growth is large, when the disease is bilateral, and especially when the patient is none too robust at the beginning. The symptoms of this unfortunate accident manifest themselves immediately after the operation by the inability of the patient to rise after having been released from the restraint. The body is bathed in perspiration, the pupils are dilated, the respiration accelerated and jerky, and in spite of frequent urging the patient makes no effort to rise, and then after becoming delirious finally dies several hours later from syncope. In milder forms the patient rises half exhausted, shows colicky symptoms, and then either sinks into the severe state of the disease or else revives and then improves during the succeeding two or three hours.

The prevention consists of (1) the administration of chloroform, (2) the proper control of the bleeding vessels to forestall a serious loss of blood, and (3) the proper preparation of the enfeebled patient.

The treatment consists of ammoniacal stimulants internally, strychnia hypodermically and the intravenous and subcutaneous injections of normal salt solutions.

Septicæmia follows unclean methods of operating, especially when the resulting sepsis is predisposed by systemic weakness or by the ligation of large vessels which, by depriving certain areas of tissues of an adequate supply of blood, leave them prey for the microbes deposited in the course of the operation. The **prevention** consists of exceptionally good antisepsis while operating and of good drainage and irrigation during the first three to six days

of convalescence. When ligatures are applied to the stump of the cord, it is essential that they should have been sterilized, as this focus is generally the hot-bed of this grave sequel. As the stump below the ligature must slough off, it is important to prevent putrefaction therein, first by applying an aseptic ligature and then by good antiseptic treatment until the cavity rids itself of this harmful element.

The treatment after the disease has developed consists of providing a free drainage of the purulent cavity, and of submitting it to frequent irrigations of hydrogen peroxide and mercuric chloride solution. Care is taken to reach every recess of the cavity with the former, after which the froth resulting therefrom is washed out by a good and prolonged irrigation with the latter. To still further combat the infectious process the cavity may then be wiped throughout with pure tincture of iodine, or, better still, with a solution consisting of iodine crystals one part and ether sixteen parts. This leaves a coating of iodine over the entire area that acts as a permanent antiseptic to the tissues between the intervals of treatment.

Internally quinine is par excellence the best medicament. It should be given in large doses frequently repeated.

Œdema of the Sheath and Paraphimosis.—After ablation of scirrhous cords the sheath always becomes more or less œdematous; sometimes it is enormous and in rare cases the condition is permanent. Paraphimosis may result, depending upon the amount of swelling developed in the prepuce and the sheath. (For treatment and prevention see Castration, page 252).

Recurrence of the Growth.—In spite of the fact that it is very frequently impossible to remove all of the growth because it ascends into the internal abdominal ring, and the ablation must be made through a large sclerotic peduncle, it is rare that the stump becomes the focus for a recurrent formation. On the contrary, the stump shrinks up and the cavity cicatrizes around it in perfect harmony. Our experience is like Moller's, who refers to 100 cases, all of which were permanently cured. There are, however, rare cases, clearly of botriomycotic origin, which encroach upon the peritoneum and abdominal organs, wherein there is no arrest of the onward trend after mere ablation of the external part of the neoplasm. But such instances are hardly recurrences; they are the result of incomplete ablations due to the inaccessibility of a great portion of the diseased parts. In short recurrence of scirrhous cords is rare; the operation, in so far as this sequel is concerned, is generally successful.

CHAPTER V.

FISTULÆ.

RADICAL OPERATION FOR FISTULA OF THE WITHERS

DEFINITION.—Resection of necrotic parts of the supra-spinous ligament, sometimes including portions of the underlying spinous apophyses together with the construction of dependent drainage of the fistulous tracts and purulent sinuses associated therewith.

INDICATIONS. — Excepting acute superficial abcesses of the withers suppurating processes that are commonly designated as "fistulæ of the withers," consist of a necrosis of the supra-spinous ligament with or without implication of the subjacent bones, and in every case this causative "necrotic center" must first be disposed of before a diseased process will progress toward recovery; but on account of the position and direction of the tracts and sinuses, resection of the necrotic structures alone is not sufficient. Drainage must also be provided for them. Classical surgical intervention, therefore, has two objects: (1) the total resection of all the necrotic elements and (2) drainage of the purulent tracts and sinuses. These two objects are named in the order of their importance. To operate upon fistulæ of the withers with the object of simply providing drainage at dependent parts is not sufficient intervention; the causative element must, in addition, be removed. Although the evacuation of the confined pus through incisions made here and there at more or less dependent parts may tend to arrest the onward march of the disease, and the incisions may be useful as drainage orifices besides serving as channels through which to apply medical treatment, the highest ideals in modern surgery are never thus attained. The suppurative process goes on and on, week after week, and although it may sometimes finally subside, it also very frequently continues until chronic septicæmia or a disgusted owner ends the loathsome scene, and all this because within the depths of the tracts a necrotic ligament, acting as a foreign body awaits removal.

However, no matter how essential is the resection of the

necrotic portion of the ligament and bones, the operation must not always be hurriedly resorted to. In the early stages, while the tumefaction of the withers is large and the exposure of the depths would necessitate making enormous incisions to effect a perfect resection, and while the extent of the necrosis is yet difficult to determine, radical intervention should be postponed. Incisions at dependent points to evacuate the pus, to establish a drainage, and to admit of a preparatory irrigation must be first made and then after two or three weeks, when the acute inflammatory stage has thus been cut short and the onward encroachment arrested, resection of the ligament may then be practiced with much greater facility and with much better results.

The chronic fistula of the withers, already riddled with fistulous tracts, or any specimen that is already discharging from one or more orifices, should, on the contrary, be immediately submitted to the radical operation.

In extremely old cases, where pus in considerable quantities has been discharging for months, and where the tracts have burrowed deeply behind the scapula, the patient may not possess sufficient vitality to withstand the hæmorrhage and shock of the operation, for it is indeed common for such fistulæ of the withers to reflect over the whole organism in the form of a veritable chronic septicæmia that manifests itself by emaciation and other general symptoms. The futility of operating upon such subjects needs little comment.

The author divides fistulæ into three classes for operative treatment. These are: (1) those located posteriorly, (2) those located on the highest point of the withers, and (3) those located anteriorly. These are named in the order of their seriousness, the latter being the most formidable of all fistulæ affecting the equine species. The first is generally superficial and is otherwise more accessible for operation; the second varies in seriousness according to the depth of the tracts; while the third, located over the first and second dorsal spines under the ligament nuchæ, between the two lateral groups of cervical muscles, and just above the entrance of the thorax, is a veritable puzzle to the surgeon on account of the inaccessible location, often difficult to master.

RESTRAINT.—The stocks are by far the best apparatus to secure horses for operations upon the withers. These may be supplemented by the administration of ten drams of chloral hydrate in a drench one hour before operating. The stocks should be provided with slings to prevent lying down and with a back strap to restrict upward movements. The

sides should be boarded up to protect against kicks. **Casting harness** has no redeeming feature for such operations. It is always more satisfactory to construct stocks than to attempt the operation with the absolutely unsatisfactory restraint provided by harness. **The operating table,** on the contrary, is fairly satisfactory, as the surgeon has fair access to both sides, on account of the elevated position of the patient.

INSTRUMENTS, ETC.—

1. Scalpel and scissors.
2. Curved probe bistoury.
3. Dissecting forceps, probes.
4. Artery forceps, several.
5. Tumor forceps, large.
6. Needles and silk suture, seton needle.
7. Wadding of cotton.
8. Antiseptics.

A large curette should be available in event of finding disease of the spinous processes.

TECHNIQUE. — First Step.—Disinfection. — As the withers is often found in a bad state of filth, considerable time should be set aside before the operation begins to clean up the region. If possible the surface of the withers and shoulders is washed and cleansed with patience the day preceding, as otherwise much time is always lost in bringing the putrid region into fit state for operation. The enlargement and a liberal surface around it, including the mane hairs some distance forward, is clipped and scrubbed with soap and water and then rinsed with sublimate solution. Shaving, although not absolutely necessary, is always indicated. Fluctuant abscesses are lanced and irrigated and fistulous tracts discharging copiously are syringed out.

Second Step.—The Resection.—On the side most affected a **longitudinal incision** is made parallel to the median line and about one inch outward and long enough to overlap the enlargement anteriorly and posteriorly. In depth it is carried just beyond the inferior limits of the supraspinous ligament, which is then dissected out as far forward and as far backward as the incision admits. The ligament is cut through transversely, gripped with the tumor forceps, and then carefully dissected back to the other end of the incision, where the resection is completed by another transverse cut. In the middle the resected part is generally found riddled with disease, but gradually terminates into a healthy condition toward the ends, and beneath the diseased part

the spinous processes are generally more or less affected. These may need attention or not, according to the amount of disease found. Ordinarily a little curettage is sufficient. Extensive resection of the spines is very seldom ever indicated, and is always a dangerous procedure, in that fatalities often follow and healing is more retarded than encouraged thereby. Exfoliated parts must, of course, be removed and the underlying roughness smoothed up with the curette, but the sawing off of large parts of the spines still nourished with circulation, is not recommended.

To control bleeding, which is always copious, the author uses hot iron cauterization along the walls of the incision before the resection proper begins.

Third Step.—The Drainage.—The direction and the course of the various tracts are now traced out from the wound to their very depths. For this purpose probes and sounds which can be bent at will may be required when the tracts are deep; in other instances the fingers may be long enough to find the bottom. The aims here are to leave no tract or sinus undiscovered, to find the most dependent part of each, and to drain each to the surface of the body, if possible at points where gravity will carry off the discharges. This latter aim is often more easily said than done, owing to the thickness and the disposition of the region through which the openings must be made. The tracts may lead beneath the voluminous superior cervical muscles just above the last cervical vertebra, downward along the long spinous processes of the dorsal vertebræ to the articulation of the ribs, or across the spines to the opposite side of the body. Superficial tracts may be found between the outer layers of muscles or just beneath the skin. In rare cases pus has been found to burrow along the dorsal spines and intercostal spaces as far down as the sternum, **but the chief point of predilection is the space between the dorsal spines and the cartilage of** prolongation, where the sinus is found resting upon the attachment of the serratus magnus, and whence it frequently extends forward as far as the level of the first cervical segment, resting between the lamellar portion of the ligament nuchæ and the cervical portion of the same muscle.

After the causative lesion,—the necrotic ligament and bone,—has been removed, the cure will then depend upon the ingenuity displayed in draining these depths, and maintaining the drainage until cicatrization is complete. If the first part of the operation has been sanguinary to a danger-

ous degree, this step may prudently be postponed for two or three days or more, especially when it is evident that the making of orifices through thick vascular muscles will cause a too great loss of blood. **It does not matter how deep the sinuses are located, or what position they occupy, their drainage by gravity is essential to rapid recovery.**

Various methods may be adopted in tracing tracts and locating depths of sinuses. If an estimate can not be made of the position by simply passing a probe or sound along the tract, sometimes by moving it about impressions of its end can be felt with the other hand pressing upon the surface of the body. Sometimes the exact position can be located by packing the tract and sinus full of gauze with a gauze packer until a bulging announces the exact location. Injections of methylene blue solution two per cent into the tract stains the course and often may thus facilitate tracing by dissection. But by far the most certain and rapid method of tracing tracts and establishing drainage is that of passing a **bendable seton needle** into the bottom of the sinus and then thrusting its point through to the surface of the body at one stroke. A tape is thus drawn through the tract to serve as a guide to enlarge the opening to the desired dimensions.

This seton method of constructing and maintaining drainage is by far the most effectual if the tape is successfully carried to the very depths of the sinus and then directly out to the surface. It provides a maximum of drainage with a minimum of injury to healthy, non-implicated tissues. In the fistulae located at the **highest point of the withers** the point of exit of one seton is **just anterior and a little below the anterior angle of the scapula,** and that of the other **between the posterior angle of the scapula and the dorsal spines.** Tapes so adjusted drain perfectly the space between the cartilage of prolongation and the spinous processes, if they are fearlessly passed deep enough to follow the floor of the sinus. **In fistulæ located anteriorly** with the sinus resting upon the last cervical and first dorsal segments the point of exit is the **middle of the neck just in front of the shoulder.** When necessary the opposite side is treated in the same manner. Rubber drainage tubes, well perforated, may be used instead of tape setons. These are drawn in with the tape tied to one end.

In more superficial fistulæ incision through the skin and muscles into the bottom of the sinuses may answer well enough, but in deep specimens the incisions close before the

deep-seated lesions of the ligament and bone have safely cicatrized.

AFTER-CARE.—The wound and the setons are washed daily with strong antiseptics. The latter, after being washed clean, may be soaked in tincture of iodine before being drawn into the tract, and the wound along the withers is packed with boric acid, or boric acid ninety-five per cent and iodoform five per cent. The tape, at the end of eight to ten days, should be replaced with new ones larger than the first, to widen the tracts. At the end of twenty-five days they are removed. Cicatrization is generally complete in thirty-five days.

SEQUELÆ AND ACCIDENTS.—Such radical intervention upon the withers is not without danger. The untoward happenings are (1) septicæmia, (2) malignant œdema, (3) tetanus, (4) gangrene, (5-6) shock and hæmorrhage and (7) recurrence of the fistulæ, the first five of which are generally due to improper respect for cleanliness. Sometimes, these microbian conditions are predisposed by systemic enfeeblement of the patient, which is made still worse by the exhausting effects of the operation, and the creation of ischemic areas by cutting large vessels is also an etiologic factor that must not be overlooked. A weak subject submitted to a long, sanguinary operation, that was none too clean and in which the wound was packed tight and sutured for twenty-four hours to control bleeding, very frequently falls prey to fatal infections of the withers. These sequelæ must be prevented by avoiding operations on enfeebled subjects, by cleanliness of hands and instruments, by controlling blood flow with forceps, ligatures or hot irons and, lastly, by not packing and suturing the wound tightly, if done at all.

Shock and hæmorrhage are seldom very serious in themselves. The shock is never great and the bleeding can always be controlled when threatening. They are, however, formidable predisposing factors to the sequelæ just enumerated, from which standpoint preventive measures are essential. Partial general anæsthesia with chloral and rapid work prevent shock as well as the unnecessary loss of blood. In the recumbent position chloroformization may be deemed advisable in patients none to vigorous.

Recurrence of the Fistulæ.—Fistulæ recur after radical intervention from failure to remove all of the necrotic portion of the ligament. The extent of the necrotic process may have been under-estimated. or the operation itself, by

inviting infection, may have caused onward encroachment. However, recurrence may follow failure to drain all of the tracts, failure to establish drainage at dependent parts, but particularly failure to maintain drainage until the central lesion has safely healed.

Radical Operations for Quittor.

SYNONYMS.—Resection of the lateral cartilage.

DEFINITION.—Radical operation for quittor is a total ablation of the lateral cartilage on the affected side, after having exposed it by removing a section of hoof and then making an upward flap of the sensitive laminæ, coronet and skin.

INDICATIONS.—Chronic quittor is a necrotic process affecting the lateral cartilage. It is a slow, creeping morbidity beginning at one part of the cartilage, generally the posterior, and traveling forward until the whole structure has been destroyed and replaced by connective tissue. During the evolution of the destructive process a number of abscesses form consecutively, point at the coronet, and leave in their wake fistulous tracts which cicatrize slowly. While one tract is cicatrizing another abscess is already evolving to form another, generally a little anterior to the preceding; and the process continues until the anterior extremity of the cartilage is reached. The entire cartilage having been totally destroyed, the quittor is cured spontaneously and as evidence if its previous existence, there is left a tumefied condition of the quarter that seldom entirely disappears. During the evolution of this process there are periodical attacks of lameness resulting from the forming of another abscess and which subside when the abscess bursts. The morbid process may also, in some cases, not entirely rare, attack the underlying synovials and pedal articulation and thus cause incurable complications—in the form of articular or thecal abscesses, ("open joint" or "open sheath").

In exceptional instances quittors,—so called,—may consist of nothing more than simple suppurative tracts in the sensitive laminæ without implicating the cartilage (country quittors.) These cicatrize less stubbornly and always yield to simple treatment. And again, a quittor may attack a part of the cartilage and cicatrize without attacking the remainder. But these incidents are the exception and not the rule.

The average quittor of city horses is "cartilaginous" and

often stubbornly sojourns as long as a vestige of the lateral cartilage remains undestroyed by the disease process, or until the cartilage is removed or disposed of by surgical intervention. Quittors that seem to have been cured without disposing of the cartilage, sometimes show, on post-mortem examination, that the cartilage has in reality disappeared or has been replaced by fibrous tissue, or else has undergone calcification. That is to say that even though a quittor may have cicatrized promptly after an operation at the posterior part of the cartilage, the entire structure may be found to have undergone these pronounced structural changes. In short, the whole cartilage, as a rule, must first be disposed of, before a cure can be effected; and since spontantous destruction is a slow process that incapacitates the horse for months, that sometimes develops serious complications and that always leaves a permanent blemish and deformity of the foot, **the total and immediate resection** of the cartilage at once suggests itself as rational treatment. Such was the reason-



FIG. 154—Quittor.

ing of Bayer, who first described a method by which the lateral cartilage can be resected with a degree of safety that would warrant its adoption by the practitioner.

These radical operations described by Bayer, Moller and Frick, and which have been performed extensively by various American practitioners in recent years, must not be thought of where strict asepsis can not be maintained throughout the entire preparation, performance and aftercare. Neither should they be attempted for quittors mutilated by previous operations or caustic treatments, because of the difficulty encountered in separating the anatomical elements without serious danger of encroaching upon the subjacent synovials, after cicatricial tissues have changed the anatomical constitution of the diseased area, often by adhering to the synovial capsules beneath. When the quittor is old, the quarter badly enlarged by new tissue and there is reason to suspect that the changed remains of what once constituted the lateral cartilage is firmly adhered and fused to the articular appendages beneath, total resection is ex-

tremely hazardous on account of the certainty of laying open the pedal articulation in the attempt. **On the other hand, it is safe enough in plain, uncomplicated cartilaginous quittors, during the earlier stages of their evolution.**

In **superficial quittors** originating from coronary wounds, total resection is often unnecessary, since the necrotic portion of the cartilage can easily be lifted out with a curette through a simple supra-coronary incision.

RESTRAINT.—Lateral recumbent restraint is essential. The leg must be fixed so as to keep the affected foot under perfect control. General anæsthesia is ideal, although cocainization of the plantar nerve of the affected side will answer when the former is deemed inadvisable. When a **general anæsthetic** is decided upon all of the preparatory non-painful steps (disinfection, paring of the hoof, etc.) are executed before administration in order to shorten the duration of the anæsthesia, and when **regional anæsthesia** is selected the best possible results are obtained by injecting about five grains of cocaine hydrochlorate in the form of a four per cent solution at three or four different points over the course of the nerve along the inferior third of the metacarpal region. A perfunctory injection at one point is generally ineffectual, and at best the anæsthesia is sometimes limited to the posterior part of the foot, despite every effort to place the solution directly upon the nerve trunk.

ANTISEPSIS.—The antisepsis must be thorough throughout, beginning twenty-four hours before operating and continuing until the parts are safely healed; otherwise, serious if not fatal implication of the underlying synovials in septic inflammation is inevitable. The first step is the removal of the shoe, followed by ridding the sole, frog and wall of every dirt-harboring recess with the file and paring knife. After the hoof has been thus prepared, and the hair clipped closely as high as the metacarpus and the part over the affected quarter shaved, the foot is soaked for some hours in a strong antiseptic bath. On removal from the bath the whole hoof is wrapped in a thick layer of cotton and bandages rinsed out of a strong solution of mercuric chloride, 1-500, or one-half per cent solution of formalin. These are occasionally re-moistened with the same solution during the twelve to twenty-four hours preceding the operation, and are left on until the horse has been cast and secured in proper position and there is no longer any danger of soiling the field.

Upon removal of the antiseptic pack the field is submitted

to a good friction with alcohol and then painted with a fifty per cent solution of tincture of iodine.

The instruments should be either boiled well or else submerged for twenty minutes or more in pure phenol and then managed so as to prevent their subsequent contamination while operating.

The hands must be cleaned in the usual manner and gloves worn while handling the patient and casting apparatus; and after the operation has begun unnecessary handling of the wound must be avoided.

The sutures, above all, must be perfectly sterilized and the needles handled only with forceps. Care must be taken not to drag the threads over dirty parts of the hoof, leg or table.

INSTRUMENTS, ETC.—

1. Horseshoer's knife.
2. Scalpel.
3. Curettes (sharp).
4. Blunt chisel.
5. Dissecting forceps.
6. A strong forcep to tear off the section of hoof.
7. Small full-curve needle and suture material, catgut or silk.
8. Sterilized antiseptic solution of mercuric chloride 1-500.
9. Sterilized cotton.
10. Lowering net of rubber.
11. Tar bandages. A total of about twenty yards.
12. Iodoform, or an etheral solution of iodine crystals ten per cent.

The tar bandages are made by simply rolling common fabric bandages in pine tar. Sage knives, right and left, employed by some operators, are handy but not absolutely essential, as no difficulty will be found in removing the cartilage with the common scalpel and curette.

TECHNIQUE.—The feat of resecting the lateral cartilage is accomplished by different methods, each of which is but a slight modification of the other. The variations will be mentioned in each step.

First Step.—Removal of the Hoof Covering the Whole Base of the Cartilage.—Beginning at a point along the coronet, slightly in advance of the anterior end of the cartilage, a curved groove is cut backward through the wall so as to dip downward about one and a half inches from the coronet at its middle and to end at the heel opposite the posterior

end of the cartilage. The groove, made with the horseshoer's knife, is cut completely through the hoof until the sensitive laminæ and coronary cushion at each end are visible and bleeding throughout its whole length. The semicircular section thus isolated is then carefully torn off with the pincers, after having been pried up with the blunt chisel. The step is completed by trimming off hanging portions of the perioplic ring which may adhere to the skin along the upper margin of the coronary cushion.

This step may be executed in part before the animal is cast. The groove may be made in the hoof and the whole section to be removed may be trimmed down to a thin layer,



FIG. 155—Bayer's Operation for Quittor. First Step.

but as a bulky portion of hoof can be torn off with much less injury to the sensitive laminæ than a thin one, the aforementioned method is by far more preferable.

Second Step.—Making the Flap to Expose the Cartilage.—Moore's Method:—Beginning at a point just below the coronary cushion and three-eighths of an inch from the edge of the hoof incision anteriorly, a similar incision is made through the sensitive laminæ, following the entire semicircle three-eighths of an inch inwardly, so as to leave space for reuniting the incision with sutures. Posteriorly the incision is carried through the coronary cushion and enough of the surmounting skin to make a supero-anterior flap that will expose the whole cartilage. The laminæ are now carefully

dissected from the periosteum of the os pedis and the perichondrium of the lateral cartilage as far upward as the superior border of the latter. In other words, the upward dissection continues until the whole cartilage is exposed except a small part that underlaps the incision posteriorly. This step is sometimes complicated by pathological conditions. The laminæ may be found riddled with tracts, which renders their dissection into a substantial flap quite impossible, and the coronary cushion and the skin surmounting it may be perforated by one or more openings, all of which make the flap a very flimsy affair after all of the attached granulations have been excised.

Bayer carries the incision through the coronary cushion anteriorly as well as posteriorly, making a symmetrical, U-shaped, upward flap; but as the reunion of the coronary

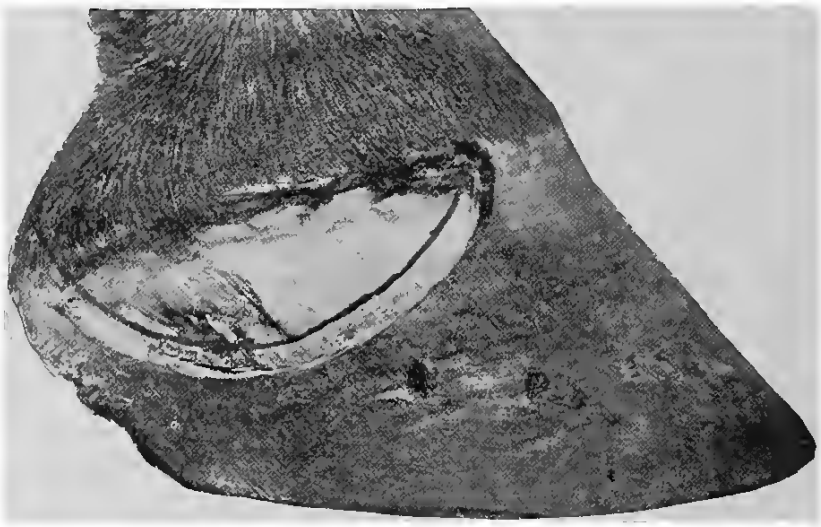


FIG. 156—Dark Line Shows Course of Moore's Incision.

cushion is one of the anxious anticipations, and since the resection can be as well effected without it, the author recommends the method of Moore, which conserves to a certainty the continuity of the coronary cushion anteriorly.

Moller and Frick dispense with the flap entirely by resecting and sacrificing the sensitive laminæ covering the base of the cartilage, and then resect the latter by a process of excavation. (Fig. 160.)

Third Step.—Resection of the Cartilage.—The best method of removing the cartilage is to carefully shave it down thinner and thinner with the scalped or sage knife, to the underlying tissues, to the excellent advantage of the healing process and to the much greater safety to the subjacent synovials. This method is slightly slower than the resection of the cartilage in one or two entire pieces, but it is by far the most satisfactory in the end.

The picture presented by the lateral cartilage affected with quittor is variable. Generally at one point it will present a green colored area surrounded by a marble-white field, indicating the extent of the necrotic process. The green portion may be exceeding small or it may be quite extensive. In some cases, pieces of cartilage surrounded by granulations are found detached from the main body, and in old quittors it may be difficult to identify the cartilages as such.

Other methods require a tedious separation of the inner surface of the cartilage from its underlying attachments, which cannot be done without causing some anxiety for the

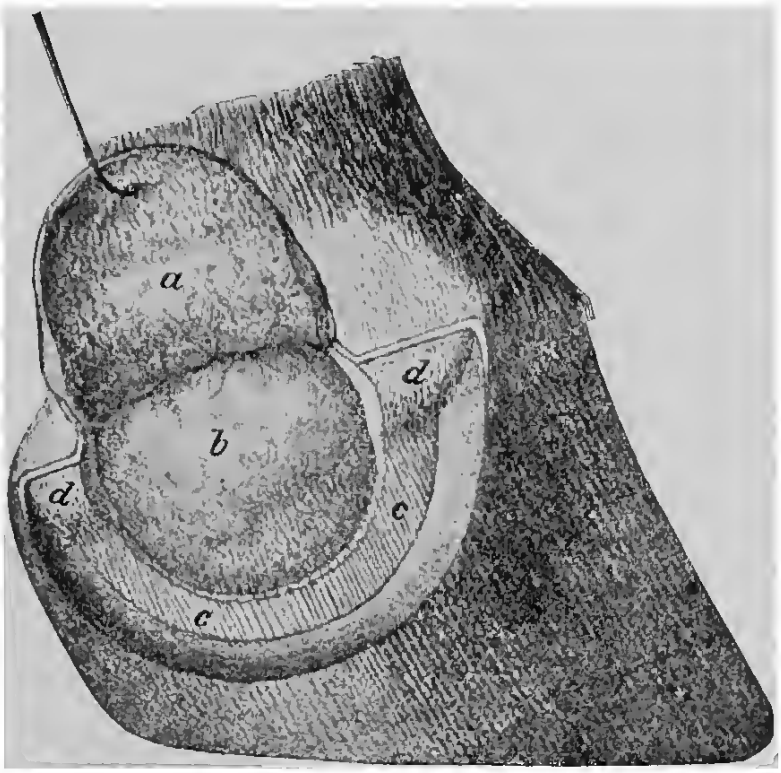


FIG. 157—Second Step of Bayer's Operation for Quittor. *A*, Flap. *B*, Lateral Cartilage. *C*, *C*, Laminæ. *D*, *D*, Coronary Cushion.

safety of the capsule of the pedal articulation and the sheath of the perforans tendon.

Fourth Step.—Suturing the Flap.—The flap, which now fits somewhat loosely over the excavation, is sutured from end to end, special care being taken to neatly approximate the skin and coronet posteriorly. The laminæ are constituted of very delicate tissue that tears easily with threads, and as a consequence these should be drawn together with great caution. Interrupted sutures are preferable. Catgut has no advantage over silk, as absorption of the suture is not essential to the success of the procedure.

Fifth Step.—Application of the Protective Dressing.—

The operation being completed, the field is rinsed off by flushing with the sterilized antiseptic solution, and then, after drying, it is dusted liberally with iodoform, iodoform-ether mixture, or preferably iodine crystals dissolved in ether. The latter mixture leaves a thick coating of pure iodine over the whole field after the ether evaporates, and besides the iodine is carried into every recess. A piece of dry sterilized cotton is neatly fitted into the semi-circular space and then a larger piece enveloped around the whole foot, after which the tar bandages are applied so as to cover the entire pastern and hoof. In order to at least partly control bleeding the bandages should be drawn fairly taut.

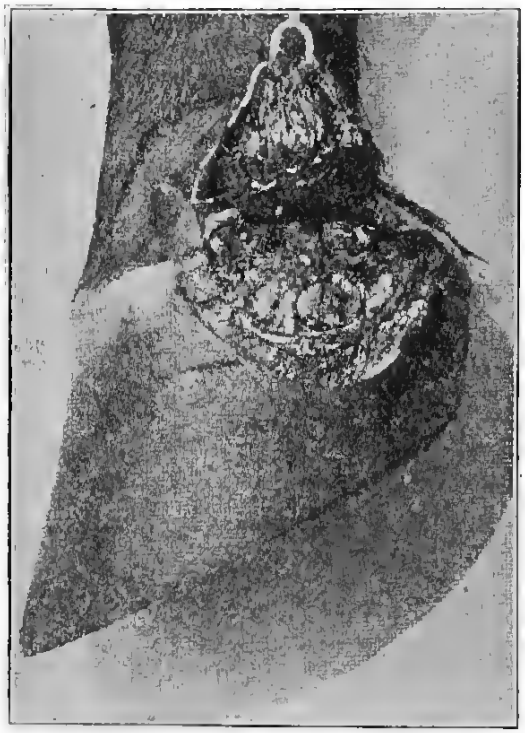


FIG. 158—Third Step of Bayer's Operation for Quittor. The Cartilage Resected.

AFTER-CARE.—The horse is given the freedom of a loose box, well bedded and clean, and the bandage is not removed until the ninth or tenth day, at which time the sutures are removed and the wound given a good sprinkling of iodoform. The subsequent attention must be governed by the condition of the wound. If there are no signs of sepsis the reapplication of an aseptic dressing of cotton and bandages will be sufficient attention for several days more, but the error of applying dressings of doubtful purity must be carefully guarded against at this time, and until the eighteenth to the twentieth day has past, after which there is little danger from infection of extraneous origin.

The practice of leaving the wound bandaged with the original dressing for twenty days is imprudent, even though there appears no evidence of sepsis, because when the evidence of infection becomes apparent by fever it is often too late to ward off impending disaster. The treatment of this wound should be no exception to the treatment of wounds in general. If aseptic it may safely be left undressed during the first week or so, but thereafter infection is quite certain to enter into the situation unless measures are taken to prevent, and these measures should consist of occasional antiseptic dressing according as the condition of the wound indicates.

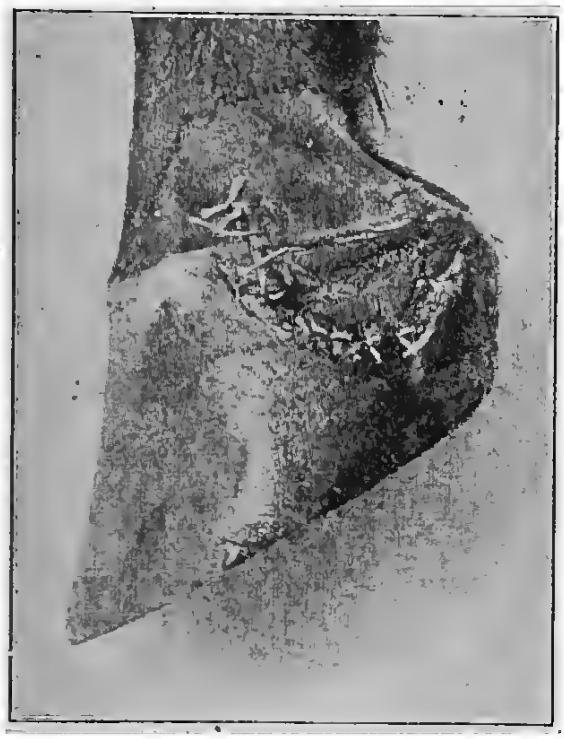


FIG. 159—Fourth Step of Bayer's Operation for Quittor. The Flap Sutured.

During the first week or ten days the temperature of the patient is taken twice daily, and if pyrexia appears immediate and repeated dressing with irrigations of hydrogen peroxide followed by iodoform ether is an imperative necessity. Otherwise, an active infective inflammation will soon send havoc to the underlying synovials, cause gangrene of the flap, or even end in serious septicæmia.

The horse, under favorable conditions, is ready for moderate work at the end of sixty to ninety days, but sometimes will again become incapacitated by the inability to attach the shoe to the hoof on the affected side. The removed portion of the wall, by growing down to the nail-line, leaves no place

to drive the nails until the new wall from the coronet descends far enough to receive them. The hoofs regenerated from the laminæ of the flap are seldom thick enough nor sufficiently tough to adequately support the shoe.

The entire disappearance of all of the hyperæsthesia that follows this transgression upon so sensitive a region requires considerable time, even after the breach has been reclothed with horn.

SEQUELÆ AND ACCIDENTS.—(1) **Sepsis** is the chief enemy of the wound of this operation. Performed for a disease of a septic nature, upon a part that is difficult to

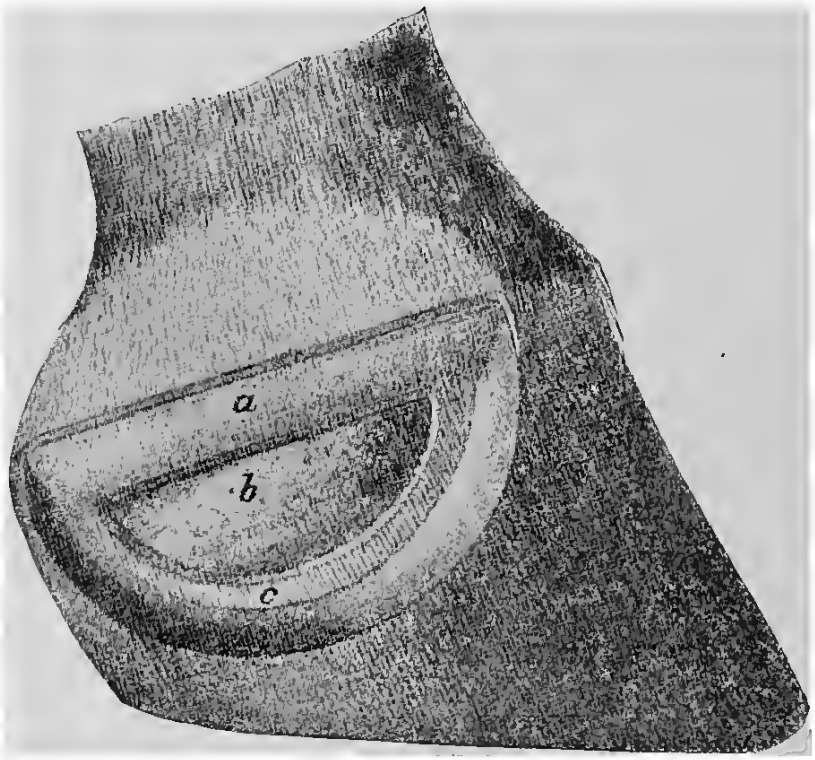


FIG. 160—Method of Exposing Lateral Cartilage without Invading the Coronary Cushion (Frick). *A*, Coronary Cushion. *B*, Lateral Cartilage Uncovered. *C*, Laminæ.

cleanse, often under conditions unfavorable to the maintenance of operative cleanliness, and very frequently upon a patient whose vitality offers little resistance to microbian invasion, it is no wonder that the wound sometimes reacts badly. This sequel ends variably. Sometimes it is trivial and yields promptly to antiseptic treatment, while at other times the inflammation invades the articulation and ends fatally. Between these two extreme results of infection are such sequelæ as loosening of the flap with subsequent tardy healing of the wound, deformity of the hoof, infection of the tendon sheath, and obstinate lameness.

(2) Accidental incision of the capsular ligament of the

pedal articulation is one of the accidents that might occur while resecting the cartilage. When the foot is flexed the cul-de-sac protrudes against the cartilage and is easily incised with the knife. The accident is prevented by careful dissection and by keeping the joint well extended while operating, and when it does occur its seriousness depends upon whether or not the wound becomes infected. It is of no consequence whatever if asepsis prevails during the healing of the wound.

(3) Laying bare the pedal articulation occurs when the cartilage, already transformed into cicatricial tissue, is inseparable from its internal relations, which in turn are fused with the capsular ligament. In trying to remove the cartilage the whole side of the articulation may suddenly appear in the foreground. The prevention of this accident is found in the chief contra-indication, i. e., old quittors accompanied with pronounced structural changes of the region.

(4) Claudication following the operation varies in severity and duration. Sometimes it is permanent and will yield to no other treatment than unilateral plantar neurotomy, although it will generally subside gradually with time. In most cases there is no lameness except a slight tenderness manifested in walking, until the foot is taxed by work, then the hyperæsthetic state of the region is announced by an annoying claudication that only time or neurotomy will eradicate.

THE AUTHOR'S OPERATION FOR QUITTOR.

GENERAL REMARKS.—Extensive observations on all imaginable forms of treatment, medical and surgical, indicate beyond doubt that simple operations ingeniously executed, bring better general results than the radical operations of Bayer, Moller and Frick, even if the most extravagant claims of the adherents of the latter methods are granted as a basis for comparison. In the first place, total resection of the lateral cartilage is by no means universally indicated for quittors, since there are quittors and quittors in which such intervention is little less than an invitation of disaster. Furthermore, if it could be claimed without fear of successful contradiction, that these procedures were uniformly curative, and that they never endangered life and never caused permanent disability, there still exists the difficulty of successful performance against them. Moreover, the time required to restore the patient to full and complete

usefulness, which is the best argument used in their favor, is always much greater than after the simple operations. True, the foot subjected to Bayer's operation is externally healed, often at the end of forty days, but ninety days, one hundred and twenty days and sometimes six to eight months often elapse while the patient's total or at least partial disability continues; and not infrequently, in the end, it is found necessary to perform neurotomy to banish the tenacious claudication.

The simple operations sometimes, though rarely, require six months to effect a cure, but the hoof comes out of the ordeal sounder and without the annoying lameness that so often supervenes the radical methods, and compared as regards untoward sequelæ the simple methods are found much safer. The chief argument, however, in favor of the conservative operations, is the fact that some quittors are cured by them in twenty to thirty days, many in forty to sixty days, and indeed few require more than ninety days, and often with little evidence of their previous existence remaining.

RESTRAINT.—Lateral recumbent position and plantar cocainization is the best restraint. The operating table is by far the most satisfactory apparatus, as the foot can be kept cleaner, and besides admitting of better immobilization it is in a more comfortable position for the operator.

INSTRUMENTS, ETC.—

1. Scalpel and dissecting forceps.
2. Small curved probe-pointed bistoury and a probe.
3. Curette.
4. Hoof knife.
5. Flexible metallic probe.
6. Tourniquet.
7. Bandages.
8. Antiseptics.

HÆMOSTASIS.—The rubber tourniquet applied to the upper third of the metacarpus is an absolute necessity. It must be so adjusted as to perfectly prevent bleeding. To prevent post-operative bleeding, packing and bandaging is depended upon.

ANTISEPSIS.—Removing the shoe, trimming the horn smooth throughout, scrubbing and antiseptic washing must not be omitted. The hair about the coronet on the affected side is clipped and shaved or removed with a depilatory, and aseptic instruments only should be used.

TECHNIQUE.—First Step.—Searching the Depths and

Direction of the Sinus.—The probe is passed carefully into the orifice and a patient search is made for the lowest point of the tract, by bending its end to different curvatures and attempting to pass it downward in different directions until the tract is traced to the bottom, which generally corresponds to the level of the attachment of the cartilage to the os pedis. Thus gauged the position of the bottom of the tract is determined externally by measuring with the part of the probe that was buried.

Second Step.—Opening the Bottom of the Tract.—A crescent-shaped piece of hoof about one inch long is then removed with the hoof knife from the point indicated as the bottom of the tract by the probe. When the laminæ and coronary cushion have been thus exposed and the oozing blood bailed out, the probe is again passed into the tract, and an attempt made to feel its point beneath them, to insure that the hoof has been stripped off at the proper place. If the probe now seems to pass beyond the limits of the removed hoof, additional paring is done until the bottom of the tract is reached. The laminæ are then incised transversely and a small rectangular or elliptical piece removed. Sometimes, when the tract is not deep, a part of the coronary cushion is included with the laminæ, the object of the incision being to open the bottom of the tract by sacrificing as little hoof-forming tissue as possible. The probe is again passed into the tract, and now its point can easily be felt beneath the loose connective tissue exposed by removing the laminæ. This connective tissue is the outer wall of the tract, and when incised a few drops of bloody pus escapes and the shiny end of the probe appears.

Third Step.—Search for and Resection of the Necrotic Part of the Cartilage.—With the protruding probe in the tract as a guide at first, the foreground is curetted gently by careful outward strokes to unmask the cartilage beneath. As a certain amount of blood will flow into the wound despite the tourniquet, incessant bailing is essential. The curettage, and sometimes dissection with the scalpel and forceps, continues until the outlines of the diseased portion of the cartilage appear in the foreground. The diseased cartilage is recognized by its marble white color, fringed here and there with pea-green portions which are sometimes free, detached bodies, and by being easily separated from its surroundings. The curette is now passed under the edge of the diseased portion and a systematic resection piece by piece effected, always cutting outward. As much of the cartilage

as can be easily reached is removed in this manner in every direction from the incision, providing the curette can be easily passed beneath the edge. When the curette can no longer hook up the edge by passing easily under it, the resection may be considered complete enough as this indicates that all the diseased part has been removed.

The curette is then directed into the orifice from above, and all of the old granulations of the tract are scraped out except those contiguous to the articulation at the bottom and inner part of the sinus. The close proximity of the capsule of the pedal articulation and the synovial membrane of the navicular sheath must never be forgotten.

Fourth Step.—Inserting the Seton.—The cavity and tract are now syringed out with pure tincture of iodine and a sterilized seton of muslin large enough to fit moderately tight into the tract is inserted and tied in a loop.

Fifth Step.—Bandaging.—The orifices are then wadded and an aseptic bandage applied to prevent bleeding.

AFTER-CARE.—The after-care consists of daily injections of tincture of iodine along the course of the seton, which is turned in and out at each dressing. Iodoform is sprinkled freely over the seton and over each orifice, and boric acid in abundance is held in place with cotton and the bandage is applied so as to cover the whole affected quarter.

At the end of twenty days the seton is removed and the tract prevented from cicatrizing too rapidly by daily injections of permanganate of potash and zinc sulphate in strong solution.

SEQUELÆ.—(1) Articular complications may follow improper use of the curette in excising the cartilage or the infection from filthy methods of operating or after-care.

(2) The most common untoward result is the recurrence of the quittor from the onward progress of the inflammation to other parts of the cartilage, which event necessitates a second operation at the end of about forty days.

Radical Operation for Poll-Evil.

DEFINITION.—A resection of the ligamentum nuchæ from its attachment on the occiput backward to the level of the dentata.

INDICATIONS.—Poll-evil may be defined, without fear of successful contradiction, as a necrosis of the anterior portion of the ligamentum nuchæ. Although it may possibly sometimes have its origin as a bursitis between the ligament

and the axis or in a subcutaneous abscess, the force of the morbid process is always sooner or later centered upon this yellow elastic structure, which, by undergoing a slow process of destruction, acts as a foreign object, and provokes the evolution of a succession of abscesses and fistulous tracts and the formation of more or less connective tissues around them. The process may be acute, subacute or chronic from the beginning, but in every case it finally terminates into a chronic morbidity, encroaching more and more into the depths of the poll until the periosteum of the atlas, the atlas itself, the occipital bone, the occipito-atloid articulation, the meninges and even the brain and spinal cord become seriously implicated. Spontaneous cicatrization is exceptional; poll-evil, on the contrary, usually runs a slow but certain course toward a fatal termination, unless prevented by curative measures. The close proximity of the disease to the highly sensitive nervous structures and to the cranio-vertebral diarthrosis adds materially to the seriousness of this fistulous condition as compared with similar conditions at other parts of the body.

The operation described below is indicated in almost all poll-evils. The only exceptions are superficial abscesses and processes implicating only the tendons of the cervical muscles (superficial poll-evil), which conditions yield to simpler interventions.

It is important to resort to the operation early; before the process has, by reason of its duration, encroached upon the subjacent structures,—the bones, synovials, meninges, brain, etc. There is never any reason to postpone the operation after the physiognomy of the region or the chronicity of the process indicates that the ligament is involved.

CONTRA-INDICATIONS.—This radical operation is useless and dangerous against poll-evil implicating the bones, articulation, meninges, etc. Its usefulness is limited to the uncomplicated form. Moreover, it must be avoided in the weak, debilitated subject, whose vitality will totter under the shock provoked by the operation, or whose state of health clearly indicates nervous involvement.

RESTRAINT.—The operation can only be successfully performed in the recumbent position, under the influence of general anæsthesia. Restraint without general anæsthesia is not sufficient, on account of the great pain, the copious bleeding and the long duration of the procedure. The operating table is almost indispensable to its successful execution, although by propping up the head after the anæs-

thetic has been administered, harness restraint may answer, but always with much less satisfaction than with the table, which brings the field into an accessible position.

INSTRUMENTS REQUIRED.—

1. Scalpel.
2. Probe-pointed curved bistoury.
3. A number of artery forceps.
4. A large tumor grappling forceps.
5. Firing irons and forge.
6. Needles and thread.
7. Gauze or cotton packing.

The firing irons are not absolutely essential, although they are the author's preference to effect a safe hæmostasis. The thermocautery, in lieu of the irons, will be found helpful in partially controlling the flow of blood from the numerous spurting vessels.

TECHNIQUE.—First Step.—Preparation of the Field.—As the field is generally in a filthy state this step may be advantageously executed before the animal is cast. The forelock, mane, and the hairs covering the poll are trimmed, well washed, shaved, and then submitted to a good cleansing. The fistulæ are squeezed to evacuate as much pus as possible, and superficial abscesses are lanced and irrigated.

Second Step.—Incision.—The incision overlaps the crest of the occiput anteriorly and extends backwards as far as the spine of the dentata. It is almost twelve inches long in the ordinary sized horse, and parallels the median line on the uppermost side. The incision, if made from one-half to three-quarters of an inch above (the horse lying) the median line, is still within the area of mane hairs and will therefore leave no visible scar, and furthermore it is handier to operate above the median line than below it, or even directly along its course. The incision is at once carried to the depth of about two inches or more along its whole course through the thick tissue that underlies the mane and the new-formed connective tissue that generally accompanies poll-evil. The knife should almost touch the atlas in the middle; it should overlap the level of the inferior surface of the ligament anteriorly at the occipital crest, but posteriorly the exposed position of the spinal cord in the atlo-axoid may be respected by a gradual, diminishing depth.

Third Step.—Arrest of Hæmorrhage.—Already a copious flow of blood from numerous vessels will have been provoked, and as the vessels spurt from hard sclerotic walls which prevent successful use of the forceps, actual cautery

by means of previously heated irons may be used to exceptionally good advantage. The field is thus at once cleared of masking blood and the loss, whose total will be considerable before the procedure is completed, is materially diminished. The bleeding walls are well seared by passing the hot irons over them a number of times.

Fourth Step.—Detaching the Ligament from the Occiput.—The index finger of the left hand is then passed under the ligament at its point of attachment to the occipital bone to serve as a guide for the bistoury, which is now slipped under the ligament and drawn slowly upward until a complete detachment is effected.

Fifth Step.—Dissection of the Ligament.—The ligamentum nuchæ is not a very distinct structure. On the contrary, it is very closely fused to the aponeuroses and tendons of the cervical muscles whose attachments it receives; and besides it is generally enlarged and agglomerated with plenty of new-formed connective tissue, all of which leave rather indistinct outlines to follow. Anteriorly, where the bursa is interposed beneath, is the only unattached portion of the ligament, and it is here that the dissection should begin. The first step to this end is to grasp the now detached end with the tumor forceps, which is then used to lift the ligament out as fast as it is dissected loose with the scalpel. The resection includes not only the ligament but also the new connective tissue and the tendinous structures of the superior cervical muscles. In fact, the central structures of the poll (whose anatomical outlines are always indistinct) are virtually all enucleated, laying bare the occipital protuberance and the whole superior surface of the atlas. Approaching the atlo-axoid space, the dissection is deflected outward so as to leave abundant protection to the spinal cord in that region. Even when the necrotic process seems to overlap the atlo-axoid space, it is prudent to follow this precaution and then remove the remaining portion ten days later, at which time it will have separated from its relations by the formation of a more distinct line of demarcation.

Sixth Step.—Final Control of the Hæmorrhage.—The hot irons are now passed over the parts bleeding most copiously, hæmostatic forceps fastened to any vessels bleeding conspicuously and the wound packed loosely with cotton soaked in antiseptic solution. The latter is retained by several loosely arranged sutures. The slight bleeding that does not respond to these efforts is left to flow out and arrest spontaneously. Tight packing and suturing of the wound is dan-

gerous from the pressure exerted upon the spinal cord in the atlo-axoid space, and from the danger of the confined blood finding its way into the neural canal.

AFTER-CARE.—Twenty-four hours after the operation the stitches are cut and the packing and forceps removed. Then, after submitting every part to a good irrigation with mercuric chloride solution, and dislodging and washing out every blood clot from the different recesses, every part is sprinkled liberally with iodoform twenty-five per cent and boric acid seventy-five per cent. Thereafter antiseptic irrigations and the application of the dusting powder above mentioned are continued until cicatrization is complete. The wound is examined daily for sloughing shreds of ligament or adjacent tendons which may delay the healing process. Cicatrization is generally complete in thirty days.

SEQUELÆ AND ACCIDENTS.—(1) **General paralysis,** induced by involvement of the spinal cord in an effective inflammation extending from the wound, or from pressure of the wound-packing or blood, occasionally supervenes this radical operation, but this incident is rare if reasonable antiseptic precautions are taken during and after the operation, and the wound is not packed and sutured too tightly. The symptoms of this untoward termination may begin to manifest themselves as early as the third day, from technical errors, or they may not appear until the second week, or even the third week, from insufficient antiseptic after-care. The patient refuses food, develops a fever of 103° to 105° Fahr., walks with gradually accentuating difficulty and finally is unable to rise. If raised with sling, life is prolonged for a few days more, but in every case death ensues.

(2) **Excessive loss of blood and shock** go hand in hand, and although they occur frequently enough, they are indeed rare when the operation is performed under adequate anesthesia and when a little care is displayed in controlling the bleeding. If no anæsthetic is administered and no attention paid to the enormous flow of blood that continues from the time the operation begins until it is completed, the patient will have reached a state of extreme exhaustion that is disastrous to its subsequent welfare.

Operation for Pectoral Fistula of Horses.

INDICATIONS.—Pectoral fistula is a chronic fistulous condition of the inferior part of the chest along the course of the sternum. It has its origin in a wound or contusion that injures the sternum, either directly or by invasion of

the inflammatory process. The sternum, its cartilaginous extremities, and sometimes the costal cartilages, are involved in an inflammation that reflects upon the surroundings by causing the formation of an abundance of fibrous tissue, perforated by one or a number of fistulous tracts that dis-

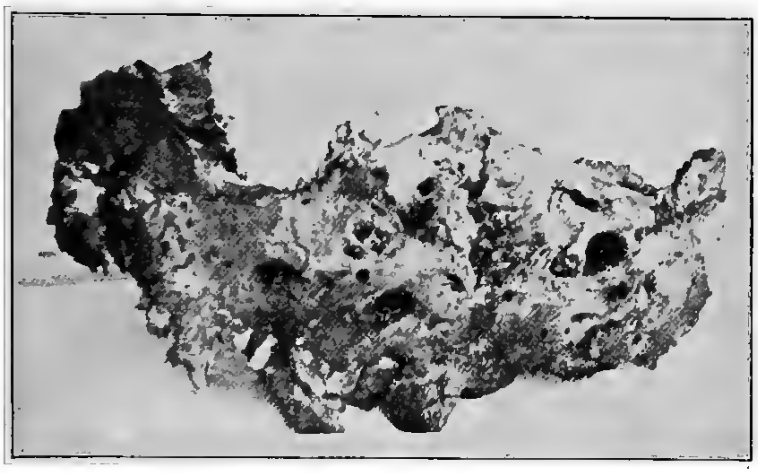


FIG. 161—The Sternum of a Horse Affected with Pectoral Fistula.

charge a limited amount of pus. Parts of the sternum exfoliate and may be removed through the tracts; other parts may become riddled with honeycombed compartments and the adjacent cartilages may tumefy and finally undergo cal-



FIG. 162—Sternum and Two Ribs of a Horse Affected with Chronic Pectoral Fistula.

careous degeneration. The course of the process is decidedly chronic; there is no tendency towards spontaneous cicatrization. On the contrary, the enlargement grows and the osseous and cartilaginous invasion extends, until finally

the whole pectoral region is the seat of an enormous enlargement that interferes with locomotion.

Delayed cicatrization of punctured wounds entering the anterior surface of the chest (see page 491) due to the sojourn of desiccated pus, sloughs or sequestra from the sternum, is another matter, and does not belong to the same order of morbidities as the lesion we aim to describe under this head. The real pectoral fistula is located inferiorly, has its origin inferiorly and discharges inferiorly, and is no more nor less than an inflammation of the sternum. The external manifestations harmonize with the amount of the bone involved. The lesion may be small when only a circumscribed spot of the bone is affected, or it may be enormous, indicating a general involvement of the whole bone and the cartilages attached to it. If not botryomycotic, it certainly seems to be due to some other specific cause.

TECHNIQUE.—The patient must be cast or secured upon the operating table with the uppermost leg drawn upward. If cast there must be no ropes or straps crossing the breast.

An incision is made in the median line along the whole length of the enlargement, which in some cases is more than a foot long. The incision is carried fearlessly downward until the knife meets resistance from the sternum. Then, in order to give a better exposure of the bone, a few slices of the fibrous walls are extirpated near the bottom of the wound, on both sides, but it is not prudent to transgress too far from the median line on account of the danger of dividing large vessels. Attempts are made to trace the tracts into the bone, and to submit them to a thorough curettage. If a tract leads into a cavity, it is enlarged by chiseling to give good drainage and to remove any sequestra it might contain. Other tracts into the bone are searched for, and if found submitted to the same treatment. The tracts in the fibrous mass are curetted and made to communicate directly with the surgical wound. All of the tracts in the fibrous mass, and the cavities in the bone, are irrigated with a strong solution of copper sulphate and then seared thoroughly with hot irons until all of the bleeding is controlled. The searing not only destroys much of the growth, but retards cicatrization of the wound until the bone itself is ready to be reclothed with soft tissues.

AFTER-CARE.—In the standing position little can be done to the wound except irrigating it with antiseptic water. In the hospital the patient should be secured upon the table

every second day at least, and the bone cavity and tracts submitted to a good cleansing with the copper sulphate solution. When the eschar has sloughed off the walls are re-seared, to retard the too rapid healing of the wound. This burning is repeated three or even more times, each of which finds the growth smaller. When the physiognomy of the region seems to indicate that the growth is disappearing, and the discharge from the sternum has ceased, the treatment is discontinued and the wound is allowed to close.

Operation for Iliac Fistula.

INDICATIONS.—By "iliac fistula" is meant fistula in the region of the external angle of the ilium. This fistula is always due to fracture of the ilium. Segments of bone broken from the angle, or the whole angle when broken from the main body, are often drawn downward by the muscles attached to them, and as the accident is always attended with considerable bruising of the soft tissues and the influx of more or less blood and serosity, a favorable field for inflection is at once created. An abscess forms, points or is lanced, but the orifice does not heal. On the contrary, it continues to discharge or may apparently cicatrize only to point again, until finally its chronicity is well established. The bone, contrary to expectations, does not die and separate from the soft tissues, but instead tends to grow larger by the activity of its still well nourished periosteum, and to become more firmly fused with a mass of connective tissue. Behind this mass a pus cavity has formed, and in a position contiguous to the abdomen where it can not be easily managed. In fact, a chronic fistulous condition of the most obstinate and inaccessible order has been established. The pus sac locates itself either behind the segment adjacent to the abdominal parietes or else along the shaft of the ilium near the coxo-femoral articulation. In either case it is not an inviting location for radical intervention.

Simple iliac fistulæ may be due to the existence of a well separated sequestrum adjacent to the angle, in which case incision and abstraction with forceps is immediately followed by cicatrization, but this is a minor affair as compared with the case in which a large segment of viable bone and the mass of fibrous tissue with which it surrounds itself, form the outer wall of the abscess cavity and whose inner wall is related closely to the abdomen.

TECHNIQUE.—There are two courses that may be

pursued. The first and most desirable one is extirpation of the broken segment with all of the fibrous tissue that surrounds it, and the second is drainage of the pus cavity below the segment and the insertion of a seton to maintain the drainage orifice until the sac has safely cicatrized. The first should be chosen when the bone is small, and the second when the size of the bone and its proximity to the abdomen would render its extirpation hazardous.

In either case the operation should, if possible, be performed in the standing position, because decumbency changes the anatomical relations in the most confusing manner imaginable. The stocks are excellent. If the recumbent position is found necessary the English hopples are far the best, because with them the leg is extended and the field handy to approach.

Th first step is to make an incision from the external angle of the ilium, where the fistulous orifice is located, downward and backward until its lowest part overlaps the segment. The incision may be from four to ten inches long, according to the size and position of the segment.

In the next step a part of the bone is exposed by dissection and then grasped with large tumor forceps. With these the bone is drawn upon and turned about as the tedious dissection to release it entirely is complete. If found to have branches extending into inaccessible positions, it may be sectioned with a saw and extirpated piece by piece.

Having abstracted every vestige of the segment, the attention is directed to the pus cavity. If found to extend into parts where the pus will not drain by gravity, a dependent drainage is provided.

The cavity is packed with antiseptic cotton and closed temporarily with sutures to retain it. This dressing is removed at the end of twenty-four hours and the cavity treated with abundance of antiseptic powder until cicatrization is well advanced.

When extirpation is not thought advisable, attempt is made to locate the bottom of the tract by probing, and an opening made at the level indicated by the depth of the probe. To facilitate the probing the original orifice may be enlarged. When the lower opening has reached the tract below the segment, a seton is passed through it from the original orifice. The seton is renewed every few days but is not dispensed with entirely for three to four weeks. The results from this method are uncertain.

OPERATION FOR RECTAL FISTULA.

INDICATIONS.—When the rectum becomes injured by rough handling, by harsh or dry feces, by impactions, or by irritant enemata, abscesses often form in the wall at the injured point. These abscesses may point in the rectum and thereby establish a communication between it and the abscess cavity, constituting at once the **simplest form of rectal fistula.** Sometimes in addition to the tract into the rectum another one is formed from the abscess cavity to the surface of the body at the side of the anus, by the accumulation of pus, flatus and fecal matter in the peri-proctal space. At other times the pus of the abscess cavity gravitates over the ischial arch through the obturator foramen, around the brim of the pubis, or over the shaft of the ischium and then, after finding its way between the internal femoral group of muscles, points at the surface in the internal femoral region, generally just inside and slightly above the stifle, or at the bottom of the groove between the sheath and the thigh.

Proctal and periproctal abscesses of this character do not always develop into chronic fistulæ; in fact, they usually cicatrize promptly after discharging their contents either in the rectum, perineum or femoral region. **Occasionally, however, the tract becomes chronic and continues to discharge a limited amount of pus from the surface orifice month after month, showing no tendency whatever toward spontaneous recovery. This is the rectal fistula of animals.**

Successful intervention is not always possible. When the tract extends only to the side of the anus or over the ischial arch, there is always a chance to submit it to treatment that will encourage cicatrization, but when the tract directs its course from the thigh through the obturator foramen or sciatic notch, or around the brim of the pubis, meddlesome interference may end in fatal abdominal complications. Furthermore, as long as they are compatible with health there is little excuse for the performance of a dangerous operation against them. The following simple procedure is preferable for all of them:

TECHNIQUE.—The patient is secured in the standing position with sideline or stock when the orifice is at the anus, and with the casting harness if it extends below the pubis into the femoral region.

The rectum is emptied manually and an attempt is made

to widen the tract and estimate its capacity by passing a smooth, flexible sound to its remotest part, or as far as possible. A torturous tract may be difficult to follow, and to facilitate matters it may be necessary to enlarge the orifice and direct the sound by placing the hand in the rectum, whereby a corrected impression of its course and progress can be determined.

Having thus explored the tract and having estimated its capacity, a mixture of paraffin, 95% and subnitrate of bismuth 5% melted into a liquid is injected into it at 112 degrees Fahr., until the capacity of the cavity is fully taxed. An all metal syringe, of sufficient size to hold all of the liquid required, is employed for the purpose, in order that the operation may be completed in a single injection. The mixture must be injected with considerable force so that it will flow to the remotest part of the tract before it hardens, and the syringe must be heated to prevent the mixture from hardening within it.

No after-care is required, and unless the tract leads into a large abscess cavity cicatrization will usually follow forthwith.

Operation for Cervical Fistula.

INDICATIONS.—By "cervical fistula" is meant a purulent fistula located in the cervical region at some point between the withers and the poll. They are usually located in the lower third of the neck and generally below the level of the cordiform portion of the ligamentum nuchæ. The center of the disease is between the two lateral groups of the superior cervical muscles related to the lamellar portion of the ligament and bodies of the vertebræ. The perpetuating cause is the necrosis which the ligament has undergone. The tracts may point on one or both sides, but in every case the disease itself is central.

TECHNIQUE.—The operation against this fistula is best performed in the standing posture because the normal relations of the anatomical structure are thus maintained. Stocks are much the best.

After cleansing the region on both sides in the usual manner an oblique incision about four inches long, paralleling the line of the vertebral column, is made on one side of the neck slightly below the supposed location of the necrotic center, which is usually about two inches above the vertebræ. It is carried inward through the perfectly healthy muscles to the lamellar portion of the ligament. Then, after

enlarging the original orifice of the tract above, a large seton is passed between the two points. If there is an additional orifice on the opposite side a second seton is passed from it through the whole neck to the surgical incision.

These setons are treated with antiseptics and turned about daily for twenty days, or as long as the amount of discharge indicates that the cavity is yet unprepared for cicatrization. When the discharge continues to be abundant, especially from the uppermost orifice, an incision large enough to admit the hand, paralleling the muscle fibers, is made at the level of this orifice. The hand is then passed into the incision and the cavity explored to discover the



FIG. 163—Cervical Fistula.

obstacle against gravity drainage. By boring with the hand or with the aid of a cutting instrument a direct, unobstructed communication is established between the two openings, and then a large seton is again inserted to maintain it. Extensive resection of suspected dead elements is not attempted on account of their inaccessibility and the utter impossibility of determining the extent of the affected zone.

The setons are dispensed with as soon as the discharge has diminished to the amount of pus usually produced by setons. Thereafter antiseptic irrigation is depended upon as long as the tract remains open.

CHAPTER VI.

THROAT OPERATIONS.

TRACHEOTOMY.

DEFINITION.—Tracheotomy is surgical incision of the trachea. In veterinary surgery its object is intubation of the trachea to prevent an impending dyspnœa due to some temporary or permanent obstruction to the upper air passages.

HISTORY.—Tracheotomy is as old as veterinary surgery itself; mention of its performances is found in the very oldest treatise on veterinary science. It is such a simple operation, often very much needed to save life, and giving such prompt relief to the distressed respirations of certain obstructing diseases, that it has always been an inviting procedure to the veterinary practitioner during all epochs. A threatening phlegmon, an encroaching abscess or a tumor that produced loud and labored breathing has always been regarded sufficient justification for its performance, often, however, without first having carefully considered the possibility of palliating the condition by less radical, though slower means. It is very evident, from information obtained in a general way, that the operation has in the past been too frequently resorted to, both for the relief of inflammatory obstructions of a temporary character and for permanent stenoses; in view of the fact that very often a serious, incurable obstruction of the trachea frequently follows its performance. Today tracheotomy is rather reluctantly performed for permanent obstructions, and it is only resorted to in acute diseases when there is sufficient evidence to indicate that a fatal dyspnœa is otherwise inevitable. In short, the present day veterinary practitioner weighs the indication more carefully, knowing the great probability of causing a permanent obstruction by the operation that relieves the temporary one.

INDICATIONS.—The indications for tracheotomy in veterinary surgery may, for the sake of convenience, be divided into two classes, namely: (1) Diseases producing temporary obstructions, and (2) Diseases causing stenoses of a more or less permanent character.

(1) **Diseases producing temporary obstruction of the upper air passages. Influenza** (horse distemper) complicated by abscess of the guttural or superior cervical lymphatic glands

gives the practitioner more indications for tracheotomy than all other diseases combined. This disease, besides its abscesses which bulge across the lumen of the air passages, is also accompanied with more or less inflammatory tumefaction of the aerial mucous membrane. These two conditions combined produce the most formidable temporary obstruction imaginable. Frequently the abscess alone will extend across the entire lumen, or even meet a similar abscess from the opposite side, and totally obstruct the passage of air. At other times the abscesses are wanting and the tumefied mucosa alone obstructs the passage. In this latter event, palliative means of dealing with the disease should first be tried, for very often a very threatening dyspnœa due to nothing more than œdema of the pharyngeal and laryngeal mucosa will subside promptly without tracheotomy; and besides, the labored respirations, by forcing air through the swollen passage, tend to preserve a capacity that would soon be totally and persistently obstructed after the operation had been performed. Tracheotomy is more harmful than beneficial to the disease process. It favors encroachment. In these cases the operation should be postponed until a crisis definitely indicates that the life of the patient is in imminent danger from suffocation. When abscesses constitute the obstruction matters are somewhat different, because the passage of air will have little influence in preventing them from bulging inward. They are formidable obstructions and can only be diminished by evacuating their contents when they have matured. During the period of their development nothing but tracheotomy will preserve the respirations. In short, serious dyspnœa due to abscess, should be promptly met by intubation of the trachea, whilst that due to œdema of the mucous membrane should be treated expectantly until suffocation becomes imminent.

Acute uncomplicated **pharyngo-laryngitis** (sore throat) occasionally threatens to occlude the glottis but as in the laryngitis of influenza, tracheotomy should be postponed to the last, in view of the frequency with which the obstruction disappears under medical treatment.

Spasm of the glottis sometimes provokes a serious dyspnœa of short duration that only tracheotomy will relieve, but these seizures usually prove fatal or else are relieved spontaneously before arrival of the practitioner. They can also be cured by simply limiting the passage of air into the anterior nares. This disease is, judging from its manifestation, more of an inco-ordinate action of the vagus, than a spasm.

The vagus fails, the inspired air drives the arytenoids into the laryngeal lumen, the organism cries for more oxygen, the second attempt to inspire carries the arytenoid still farther into the larynx, increasing the obstruction, the demand for oxygen now being great, a third attempt to inspire drags the arytenoid downwards, completing the obstruction, and death ensues. A real spasm, owing to the greater strength of the dilators, would dilate instead of constrict the laryngeal opening and glottis.

Foreign Bodies in the Pharynx.—In the ox foreign bodies in the pharynx may obstruct the larynx and produce a threatening dyspnœa demanding tracheotomy, when the removal can not be promptly effected. This condition, choke in its literal sense, is not very common on account of the facility with which such obstruction can be removed. Bradley reports the history of a case in which an ox swallowed a square block of wood that lodged in the pharynx which was removed with some difficulty after the patient's life was saved from suffocation by tracheotomy. Analogous cases may occasionally be encountered.

Primary Abscess of the Guttural Lymphatic Glands.—(Tuberculosis) (actinomycosis).—Large abscesses sometimes develop in the lymphatic glands about the throat in the absence of any pronounced abnormality of the mucous membranes. In the horse their cause is obscure; probably a simple pyogenic infection carried to them from the nasal mucous membrane explains them. In the ox they are often actinomycotic or tuberculous. In certain rare instances they encroach upon the air passages to the extent of threatening suffocation. If their contents cannot be evacuated owing to their immaturity or other causes, tracheotomy may be necessary to preserve life until their development is complete.

In certain surgical operations on the larynx and pharynx tracheotomy becomes necessary to preserve the respirations while these organs are being obstructed by the surgical work. These include particularly operations for the cure of roaring and operations on the guttural pouches. Intubation of the trachea in these same operations is also sometimes necessary to protect the flow of blood into the lungs. Inflatable tubes which act as tampons are used for this purpose.

To Irrigate the Bronchial Tract.—Williams (W. L.) performs tracheotomy to irrigate the lungs with antiseptics, to combat inflammatory conditions. The rationale, logical enough, has not been met by a general adoption of this

method, however effectual it might have proven in dispatching pulmonary inflammations.

(2) **Diseases Causing Permanent Stenoses.—Roaring** in horses due to laryngeal hemiplegia or other causes has always been considered an indication for tracheotomy. Perfectly useless work-horses are made useful, and roaring race horses made to run faster and farther. Sometimes the operation is in demand simply to prepare a running or trotting roarer for the ordeal of a single race or two. In spite of the fact that the operation is effectual enough for the time being, it never proves satisfactory in the end, and is certain to cause the development of a second still more formidable obstruction at the seat of intubation. Permanent intubation of the trachea is a passing treatment. It is fast becoming obsolete in the face of operations which tend to cure the causative disease, instead of simply temporarily relieving the dyspnœa.

Furthermore, the development of an incurable deformity of the trachea at the seat of intubation is not the only objection to permanent intubation. The tube and wound becomes a filthy pest that receives little attention from the ordinary stable attendant. The area becomes putrid, fetid, unclean, loathsome to the layman and a disgusting affair to a modern practitioner.

Permanent intubation should be avoided except in certain rare and special instances of strictly incurable conditions of the larynx or trachea when it is desired to prolong a horse's usefulness for a short period. Two, and even three years of work have thus been obtained from otherwise useless horses, true enough; but more often the attempt is abandoned in disgust after a few months. Where horses are scarce, expensive, or impossible to procure, such measures are defensible. Generally, they bring little applause.

Purpura Hæmorrhagica often threatens suffocation by obstructing the anterior nares with a large cutaneous œdema, that can not be met with any other remedy than tracheotomy. Here also, however, the operation is postponed to the last on account of the behavior of the surgical wound, which is certain to become the seat of a new diseased focus. The region often swells enormously after the operation. Sometimes the tissues become so thick that the tube will not reach the trachea.

Tracheotomy is less damaging to the old horse than to the young. It can be performed with impunity in an old, hardened trachea, but is liable to collapse or distort the

young, soft one, which facts should be taken into account in judging its indications.

EQUIPMENT.—The equipment necessary to perform the operation is: Scalpel, dissecting forceps, tracheotomy tube, clipper, razor and antiseptic solution.

RESTRAINT.—The operation is always performed in

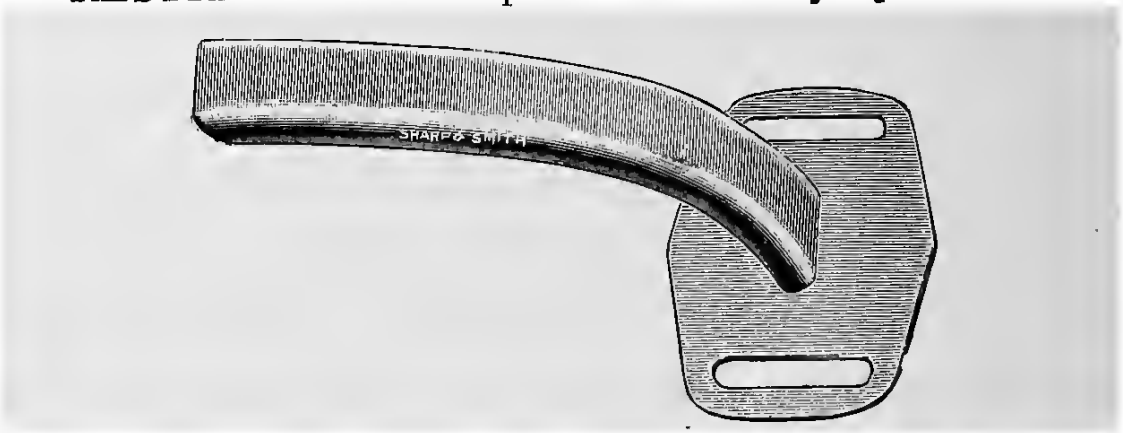


FIG. 164—Trachea Tube, with Beveled End to Insert between the Rings.

the standing position and generally without the aid of local anæsthesia. The latter is, however, very helpful in the restive horse, especially one attacked with a dyspnœa so serious as to render inadvisable the application of the twitch. The

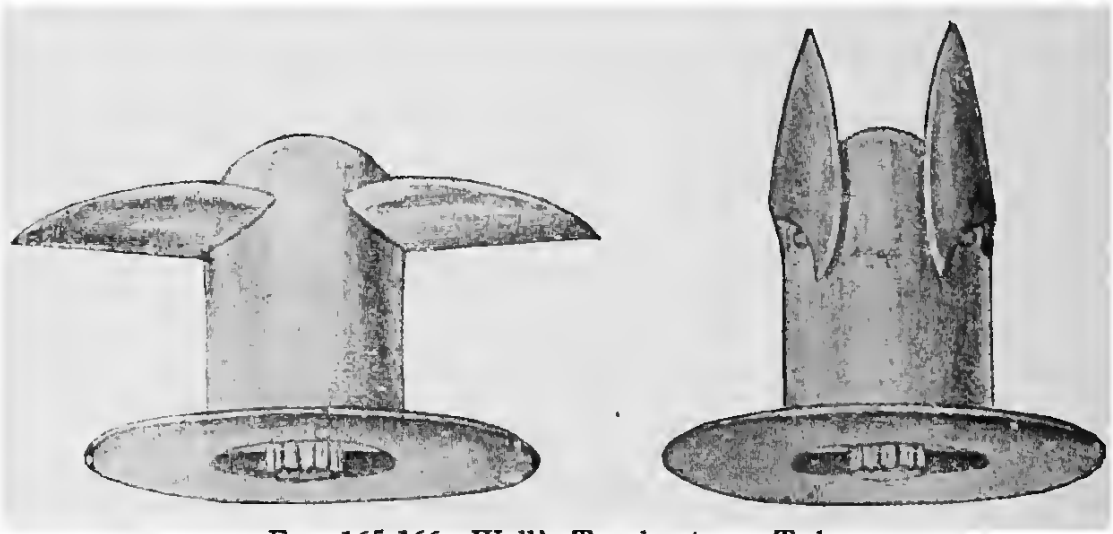


FIG. 165-166—Well's Tracheotomy Tube.
Fig. 165—Opened as if in Position.
Fig. 166—Closed Ready to Insert.

injection of a five per cent solution of cocaine subcutaneously greatly facilitates the work.

TECHNIQUE.—First Step.—Locating the Seat of Operation.—Tracheotomy in the horse is usually performed in the center of the middle third of the trachea at a point where the muscles are spare. The location is selected by mental calculation, as there is no land-mark to direct. If for any rea-

son this special location is not expedient it is preferable to make the incision higher rather than nearer to the lungs.



FIG. 167—The American Self-Retaining Tube.

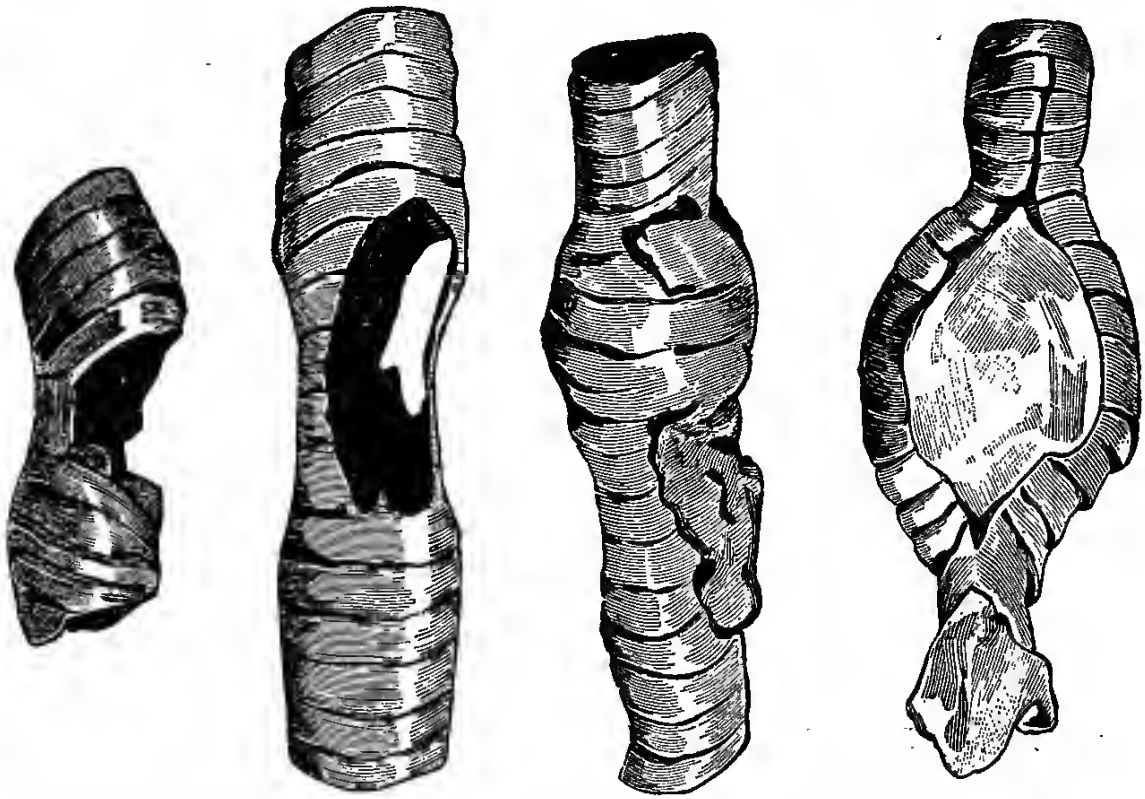
Second Step.—Exposing the Trachea.—The incision to expose the trachea is made about one and a half inches long,



FIG. 168—The Incision.

through the skin and subjacent muscles directly along the median line. Immediately over the trachea is a layer of areo-

lar tissue which must be incised and parted or else dissected away before the rings are brought plainly into the foreground. In order to perform tracheotomy well it is essential



that the ring lying within the scope of the incision be plainly exposed.

Third Step.—Incising the Trachea.—Incisions into the



FIG. 169—Forms of Tracheal Deformity Resulting from Tracheotomy.

trachea are made according to several different directions. Two rings may be divided requiring a tube flattened from side to side; a part of two rings may be excised so as to make a rounded hole, requiring the use of a small, round tube; or a

transverse incision may be made through the connecting band between two rings, requiring the use of a tube flattened from above downward. The kind of tracheotomy must therefore depend upon the kind of tube at hand, but preference should be given to the transverse incision through the connecting ligament, as this method lessens the danger of causing a stenosis. In the young horse no other tracheotomy should ever be performed.

Fourth Step.—Inserting the Tube.—The tube improvised for insertion between the rings is wedge-shaped. Its point is simply pressed into and then through the opening in a downward direction, and then kept in place with a tape passed around the neck. Kragness has perfected a self-retaining tube of this same pattern that dispenses with the use of the retaining tape. The other self-retaining tubes of circular shape require division of the rings and are therefore less desirable except for permanent intubation.

AFTER-CARE.—The tube should be removed and cleaned in a hot antiseptic solution every day. Small tubes, when considerable sputum flows through them, may require a semi-daily cleansing to keep their lumen free from incrustations. At each removal the condition of the throat is tested by plugging the opening and as soon as breathing is found possible the tube is dispensed with. It is advisable to compel the patient to force air through the obstructed throat frequently in order to keep the passage open, as well as to determine the amount of obstruction that still remains. Prolonged intubation should be avoided.

SEQUELÆ.—Tracheotomy may sometimes increase the severity of or provoke a descending inflammation of the aerial mucous membrane, but complications of this character are, fortunately, rare. Strange to say, pneumonia is seldom ever caused by tracheotomy, in spite of the fact that the wound often becomes very putrid.

The most formidable sequel occurs some weeks, months or even a year after the operation, in the form of a permanent constriction of the tracheal lumen, due to a collapse or distortion of the rings, and a cicatricial contraction of the soft tissues connecting and surrounding them. In the old, mature horse, this sequel is much less liable to occur, because the rings are hardened enough to preserve their contour against inflammation and pressure.

But in the suckling, the yearling, the two-year-old, tracheotomy is positively damaging. The cartilaginous rings are soft and susceptible to injury that terminates in a permanent deformity of their shape.

WILLIAMS' OPERATION AGAINST ROARING IN HORSES

DEFINITION.—A resection of the mucous membrane lining the vocal ventricle with the object of fixing the vapid arytenoid cartilage with cicatricial tissue.

INDICATIONS.—The operation is indicated for roaring due to laryngeal hemiplegia regardless of the severity of the affliction. Roaring of this variety exists in all degrees of severity and in horses of all ages after having passed the period of colthood. It is seldom seen in yearlings, is rare in two-year-olds but thereafter it is a common affliction. The operation is most successful in adults whose laryngeal and tracheal cartilages are less susceptible to harmful inflammations provoked by the operation than younger subjects. The operation should be avoided under the age of five years, before which age it should only be performed as an emergency.

The role played by the vapid arytenoid cartilage in the causation of roaring is that of being drawn into the laryngeal lumen by the air current. Normally, during inspiration, the arytenoids are drawn apart by the crico-arytenoideus posticus muscles; that is to say, the space between them is widened at each inspiratory act. In the forcible inspirations required to supply air during exertion, they are drawn widely apart; in fact they are forcibly imbedded into the soft structures around them, leaving the laryngeal opening free from any obstruction. When the motor nerve governing these movements is paralyzed and the muscles upon which the movements depend are atrophied as a consequence of the paralysis, the left arytenoid cartilage hangs limp and helpless against the air current, and is drawn inward by the air instead of being drawn outward by the muscles during each act of inspiration. Its movements are passive. Generally, however ,the paralysis is only partial; the muscles are only enfeebled, and the cartilage moves faintly, although not sufficiently to counteract the forcible air currents required to supply the lungs during severe exertion. Roaring may be lucidly depicted as a **constant combat between the air current** and **the enfeebled crico-arytenoideus posticus.** When the air current is gentle, as in ordinary respiration, the strength of the muscle is sufficient to prevent roaring, but as soon as the balance of power is against the muscle, the cartilage flips into the lumen of the larynx and audible noise is at once produced.

With these facts in mind the object of surgical intervention is plain; the flipping of the cartilage before the air cur-

rent must in some way be prevented. To this end, various operations have been performed, the first of which was the total resection of the affected cartilage **(arytenoidectomy)**; but as serious complication always supervened sooner or later it was soon discontinued by each surgeon who elected to adopt it as the treatment of roaring horses. Later, arytenoidorrhaphy, which consists of suturing the arytenoid cartilage to the inner surface of the thyroid, was attempted, and for a time seemed to give fair results. Experience, however,

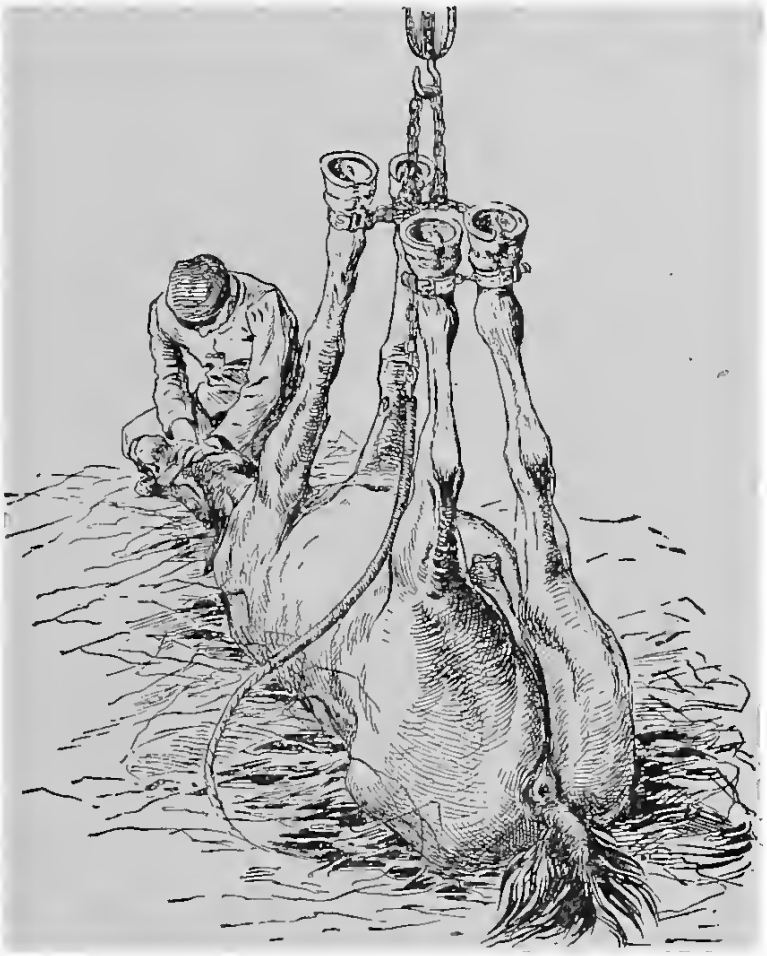


FIG. 170—Dorsal Position Required in the Performance of Laryngeal Operations.

soon relegated this procedure to disuse, chiefly on account of its uncertainty. More recently partial resection of the arytenoid was employed without sufficient success to merit adoption. To these might be added resection of the vocal chord on the affected side, bilateral resection of the vocal chords and cricotomy, all of which have been proven useless.

Today the operation of Williams is attracting the most attention. Statistics to date indicate that it is more effectual than any of the methods previously employed, although it is by no means without fault, nor without its failures.

RESTRAINT.—The horse is cast with the ropes or harness, anæsthetized with chloroform and then rolled into the dorsal position with the head well extended along the floor. Williams performs upon the operating table under profound anæsthesia. The author has performed it frequently without the aid of an anæsthetic, the head being held by three strong assistants, one on each side holding the halter and ear, the other at the nose. But that this method is far from meeting the highest ideals, goes without saying, for when the critical steps of the procedure are reached an unavoidable movement is exceedingly annoying.

The recommendation in this connection, based upon frequent trials, is to administer chloroform.

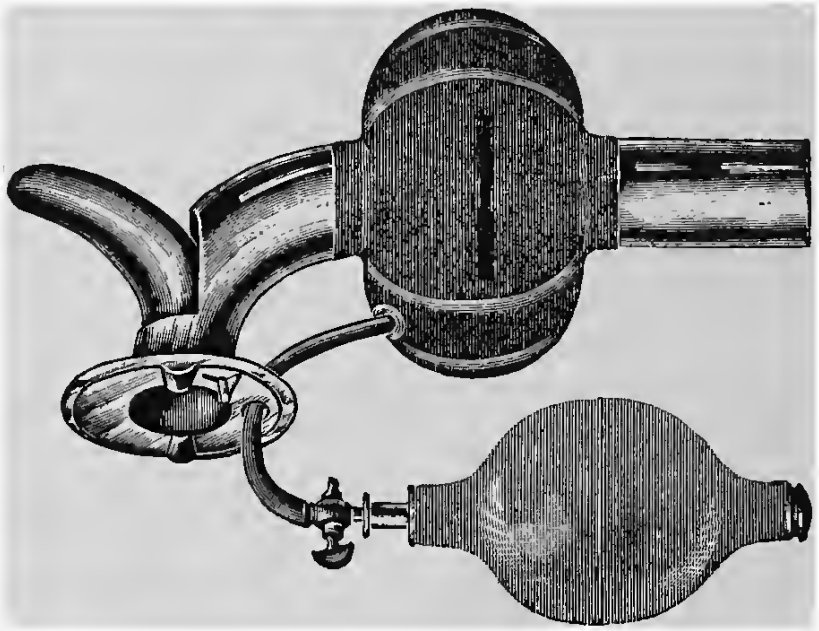


FIG. 171—Form of Trachea Tube Used to Prevent Post-Operative Aspiration of Blood.

INSTRUMENTS, ETC.—

1. Scalpel.
2. Dissecting forceps.
3. A number of artery forceps.
4. A long pair of scissors.
5. Hand or spring retractors.
6. A long handled tenaculum, or a long forcep.
7. Clipper and razor.
8. Antiseptic solutions.
9. Cotton pledgets for washing and bailing.

ANTISEPSIS.—Ordinary antisepsis is demanded. It is advisable to avoid immediate infection of the parts operated upon with septic instruments. Although the wound is unavoidably left exposed to infection after the operation, the

invasion comes after the tissues are better protected against microbian invasion than at the time of completion of the operation. A clean, shaved field, sterilized instruments, clean antiseptic solutions, and clean hands are essential to the best results.

TECHNIQUE.—First Step.— Preparing the Field.—As the field is one not easily cleansed while in the standing position this step is usually postponed until the horse is down and rolled upon its back. If it is not desired to prolong the duration of the anæsthesia it may precede its administration. The space between the angles of the jaws as far forward as the

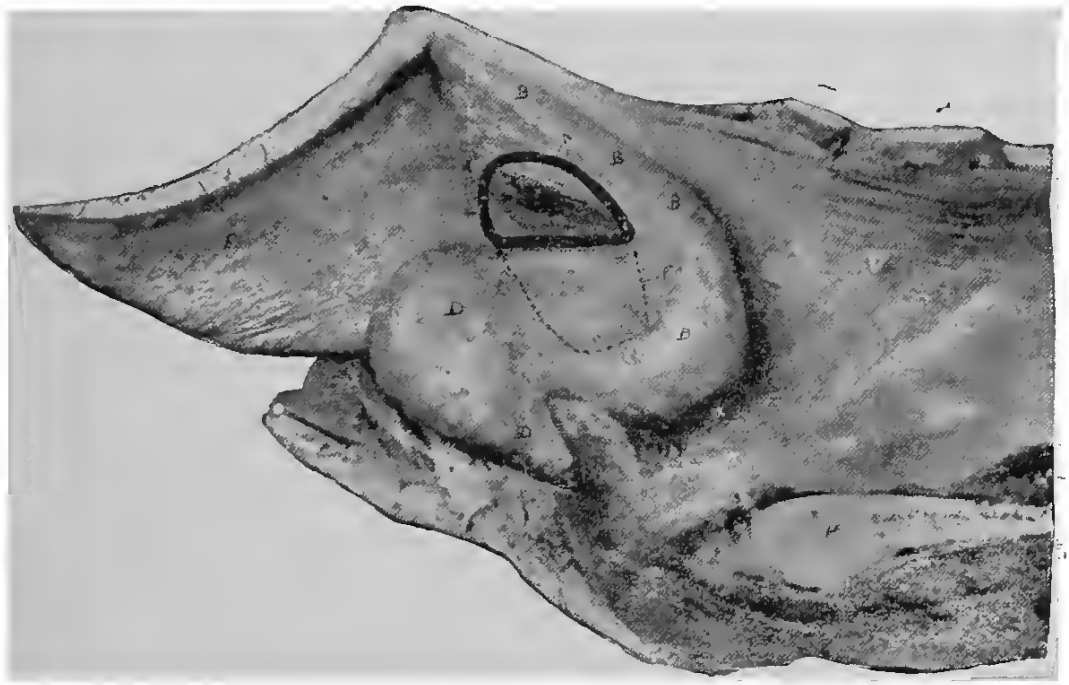


FIG. 172—Longitudinal Section of Larynx. Dark Line Indicates Course of the Incision in Williams' Operation.

A, Vocal Ventricle. *B*, *B*, *B*, Vocal Chord. *C*, Profile of Ventricle Beneath the Arytenoid Cartilage. *D*, *D*, Arytenoid Cartilage. *E*, Epiglottis. *H*, Bezel of Cricoid.

base of the hyoid bone and overlapping the first ring of the trachea is clipped, shaved and washed clean with mercuric chloride solution 1-500 and then rubbed with alcohol.

Second Step.—Incising the Skin and Underlying Muscles.—The incision is made in the median line, extending from Adam's apple anteriorly to the first ring of the trachea posteriorly. Adam's apple in the operating position lies between the jaws a little anterior to its angles. It presents itself as a rounded protuberance that is easily felt with the fingers, but it must not be mistaken for the base of the hyoid bone, located about two inches further forward.

The incision is at once carried through the subjacent mus-

cles until the underlying cartilaginous structures appear in the foreground. The retractors are applied and the wound widely opened, while the fascia covering the larynx is divided to give a better view of the anatomical structures exposed. These, naming from before backward, are Adam's apple, crico-thyroidean membrane (ligament), cricoid cartilage (a narrow ring), the crico-trachealis ligament, and lastly the first ring of the trachea.

Third Step.—Laryngotomy.—The scalpel is pushed through the crico-thyroidean membrane just behind Adam's apple and drawn backward through the structures above



FIG. 173—Performing the Intra-Laryngeal Step.

named. Although Williams has found it necessary to include the first ring of the trachea in the incision its division may be omitted since any intra-laryngeal surgery can be performed through an incision extending to and not including any part of the trachea. The bleeding from small vessels is now controlled with the hæmostats and then the retractors are moved into the cavity of the larynx.

Fourth Step.—Resecting the Mucous Membrane from the Ventricle.—The mucous membrane of the ventricle is picked up with the forceps just below the edge of the arytenoid cartilage. Beginning between the forceps and the border of the cartilage an incision is made through the mucous membrane

around the entire margin of the ventricle. The separation of the mucous membrane now begins and attempt is made to bring it out intact in the form of a sac. This is done by dissecting from above downward around the entire circumference of the marginal incision previously made around the ventricle. When the separation has proceeded some distance it is continued and completed by blunt dissection with the handle of the scalpel as the edges are simultaneously drawn upon with forceps.

The dissection of the mucous membrane from this deep cavity, which extends in a disadvantageous direction, is simplified by immediately sacrificing the vocal chord, but experience seems to indicate that this structure, in the interest of a successful termination, should be invaded as little as possible.

Fifth Step.—Dressing. — Accumulated blood is bailed from the larynx and trachea and the wound is dusted moderately with iodoform and protected against the aspiration of litter into it while the patient is reviving from the anæsthetic, by wrapping the neck with a clean towel.

AFTER-CARE.—The external wound is washed daily with an antiseptic solution and then dusted with iodoform five per cent, and boric acid ninety-five per cent. In twenty days the wound will have healed and the patient may be exercised moderately and be returned to its usual work at the end of thirty days. The cure from this operation is not instantaneous; improvement comes slowly during the weeks succeeding the convalescence. If, however, there is no improvement after two months, the operation may be considered a failure.

SEQUELÆ.—(1) **Chronic inflammation of the laryngeal cartilages,** either local or general, is the only serious sequel of the operation. This may manifest itself locally upon the cricoid cartilage whose continuity was sacrificed to gain admission into the larynx, or it may attack the whole organ. In either event it ends in stenosis that causes a roaring more formidable than the original. The cartilages become hard and deformed and sometimes the whole organ undergoes a hypertrophy of the soft structures together with a calcification of the cartilages that ends fatally during the succeeding twenty-four months. The prevention of this sequel seems impossible although it is the author's opinion that the changes in the cricoid cartilage can be prevented by more gentle use of the retractors. The general affection is undoubtedly due to post-operative infection, and hence is unavoidable.

2. **Pneumonia and bronchitis,** which would seem to be

very probable sequelæ, seldom occur, and when they do occur they may usually be attributed to the chloroform variety of these diseases.

3. **Dyspnœa.**—A serious dyspnœa sometimes occurs during the second to the fourth days of convalescence due to swelling of the mucous membrane, and possibly, also, to submucous emphysema. This possibility necessitates placing the patient under constant surveillance until danger in this connection has passed. Its occurrence is met by intubation of the trachea through the original incision with a common rubber hose, which the attendants should be provided with to meet the emergency. Tracheotomy may be found necessary where this constant surveillance is impractical.

CHAPTER VII.

OPERATIONS FOR HERNIA.

DERR'S OPERATION FOR UMBILICAL HERNIA.

DEFINITION.—A method of clamping umbilical hernia by means of skewers and ligatures.

INDICATIONS.—Exomphalocele is an abnormality of young animals that tends towards spontaneous recovery as the affected subject grows older. They generally appear about the third week after birth when the navel has healed and the fœtal structures (urachus, umbilical vein and artery) have undergone the regular course of post-natal atrophy. While the navel is still an open wound and the umbilical orifice is still plugged with these fœtal vessels the intestines are prevented from protruding, but when the skin has healed and the vessels have atrophied without simultaneous closure of the orifice, the intestines whose weight increases from day to day, bear down upon the elastic skin and at once produce a typical hernia. Later, as the animal grows older, the mesentery grows relatively shorter and the orifice tends to become smaller and smaller, with the effect that the hernia gradually disappears spontaneously. The spontaneous disappearance of umbilical hernias under these influences of growth and development has an important bearing upon their management, and has been the cause of extravagant claims for certain lines of treatment which have been credited with results that nature itself accomplished.

Blisters, caustics, actual cautery, trusses, clamps and supporting bandages are so many expedients used to effect cures, and whilst they are helpful in assisting nature to correct the abnormality, they should only be credited with the benefit actually derived from them, since the umbilical hernias that disappear without their use are indeed legion. Amongst these various modes of treatment for recent exomphaloceles, the truss is the most effectual as well as the least troublesome to apply. The truss appropriate for this purpose consists of a round piece of soft wood (pine) having a rounded protuberance in the center that will fit loosely into the orifice, and strong elastic bands that will encircle the body to hold

it in place. Such a truss, once well fitted to the body, can be worn without discomfort to the patient until, two to four weeks later, the hernia is found to have disappeared. The only objection to this mode of treatment is the chafing of the skin of the flank by the edge of the elastic band, and this can be overcome by tying the band forward to a girth. And if the truss tends to slip forward from its position it can be held backward with a breechband.

More radical intervention is, however, required as soon as it becomes evident that simple methods will fail, or when the patient has reached the age of four months without showing any improvement; or, finally when the hernia tends to enlarge instead of decrease in volume as the subject grows older. It may, therefore, be said that an umbilical hernia in a patient of four months or more is a fit subject for operative treatment. To delay thereafter invites progress toward a state of incurability.

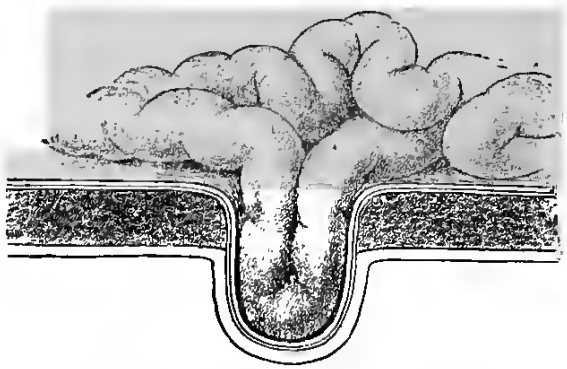


FIG. 174—Umbilical Hernia.

RESTRAINT.—The patient, being usually an easily managed youngster, is simply thrown to the ground and held with the hands; or matters may be facilitated materially by tying the legs with cords. No form of anæsthesia is necessary.

INSTRUMENTS, ETC.—

1. Scissors.
2. Scalpel.
3. Two steel skewers, from four to five inches long.
4. A yard of strong braided silk.
5. Antiseptic solutions.
6. A tumor forceps.
7. Wire cutter.

The two steel skewers should be pointed sharply at one end to facilitate penetration. Wire nails with the heads cut off and the ends pointed with a file answer the purpose well.

ANTISEPSIS.—The antiseptic precautions necessary to

prevent complications consist of a thorough washing of the field and perfect sterilization of the skewers.

TECHNIQUE.—First Step.—Marking the Field.—While the patient is still in the standing position four marks are made around the base of the hernia equally distant from one another. The marks are made by simply snipping off a tuft of hair at each spot. Chalk marks or any certain method of isolating the skin constituting the sac after the patient is placed upon its back, will answer. This marking process is essential because the relation of the skin to the orifice changes as the animal is thrown from the upright to the recumbent position, and unless the skin constituting the sac is thus located it will be found that the ligature lies to one side or other of the orifice when the patient is again upon its feet, after the operation is completed.

Second Step.—Inserting the Skewers.—The patient, having been cast and secured safely enough to prevent molestation, the space lying within the circle outlined by the four markings is cleansed with antiseptic water, and shaved. The center of the field, which may now occupy a position at the side of the orifice, is then lifted either with the fingers or with

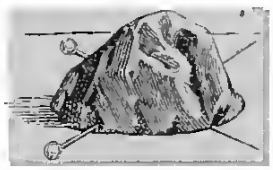


FIG. 175—Skewer Scheme for Derr's Operation.

a tumor forceps and drawn up with some force. At the spots previously marked four small incisions (mere punctures) to serve as entrances and exits for the skewers, are made with the point of the scalpel. Through these, the sac is transfixed with the skewers so that they cross at right angles in the center.

Third Step.—Ligation of the Sac.—The silk ligature is now passed around the base of the sac beneath the four protruding ends of the skewers in the form of a double-half hitch, and drawn as tight as its tensile strength will admit, and after the hitch has been secured by a knot to prevent slipping a number of tight wraps are made with the remainder of the thread. The protruding ends of the skewers are then shortened with the wire forceps.

AFTER-CARE.—Little after-care is required. However, the parts should be occasionally examined for possible complications. In warm weather the strangulated sac may become putrid and even fly-blown unless occasional antiseptic treatment is applied. In such events a wash of formalin solu-

tion, two per cent, followed by dusting with iodoform, is indicated.

At the end of fifteen to twenty days the sac sloughs off, leaving a small granulating breach which heals during the succeeding few days.

SEQUELÆ.—(1) **Recurrence of the Hernia.**—The operation, though in the author's opinion the most effectual against umbilical hernia, is not always successful, for there are old cases that prove too refractory to recover under any line of surgical treatment. The failures are, however, fortunately few amongst young animals; it is only the old standing cases of yearlings, two-year-olds and three-year-olds that rebel against this, and in fact any of these palliative operations. In the case of old standing the ligature should not be tied as tight as in young ones, in order to delay the sloughing off of the sac until the orifice has filled up with ciciatricial tissue. Derr, in order to increase the local inflammation about the orifice, has found it beneficial to inject sterilized salt solution subcutaneously around the base of the ligature in old cases, which, in conjunction with the application of the ligature rather loosely turned apparent failures into success.

2. **Peritonitis** is a rare complication, resulting only when the omentum of which the contents of the hernia is sometimes composed, was punctured with the skewers.

3. **Tetanus.**—One case of tetanus has been reported, but as that one occurred before the etiology of the disease was known, little need be feared in this connection if proper antisepsis is respected, especially in regard to the sterilization of the skewers.

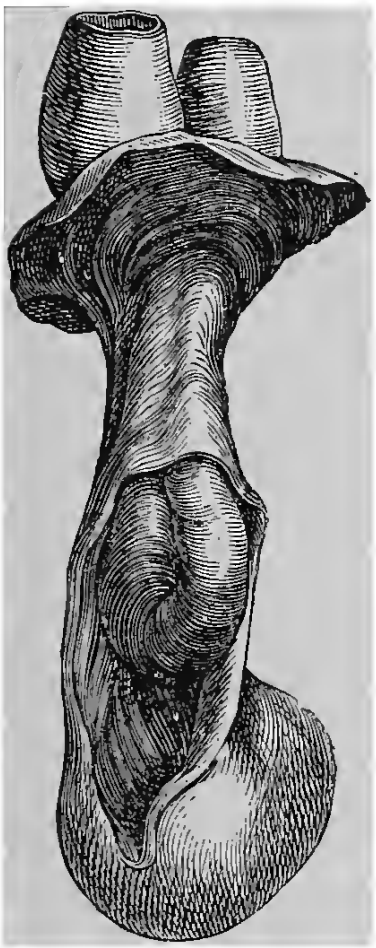
Vanlaw's Operation for Scrotal Hernia.

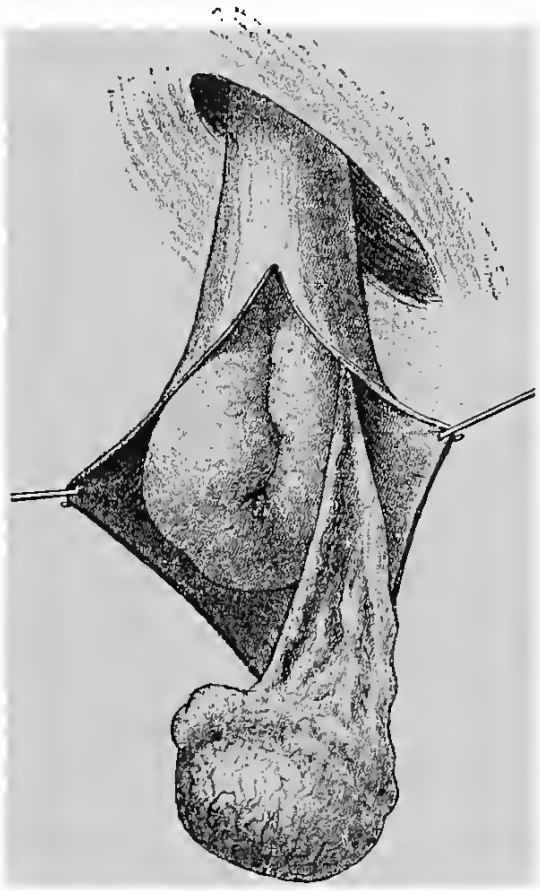
DEFINITION.—A method of ligating the tunica vaginalis near the internal abdominal ring so as to entirely obliterate scrotal hernia without suturing the orifice itself.

INDICATIONS.—Vanlaw's operation is indicated for any oscheocele in any of the domestic animals. Scrotal hernias should be operated against early in life, as the chances of successful intervention decrease with age. The operation necessitates sacrifice of the testicle, hence it is performed at the time of castration. In animals, the cure of scrotal hernia with conservation of the testicle is rarely ever attempted. Although the attempt has been successful a number of times, the danger of fatal complications is great and the chances of permanently curing the hernia are small.

Notwithstanding the fact that scrotal hernias sometimes disappear spontaneously in the young, and that they are often compatible with health, the more important facts that they constitute a serious unsoundness, that they become more and more incurable with age, and that they are often the cause of fatal colics, clearly indicate the course to pursue.

In the suckling and in the yearling success is universal, whereas in older subjects there is always more danger of fatal results or failures, hence the inadvisability of procrastinating is evident. On the other hand, in adult stallions still





FIGS. 176-177—Two Scrotal Enteroceles.

useful as studs the only excuse for recommending operative intervention is a strangulation of the contents that can not be otherwise managed. When scrotal hernias of studs are compatible with health, the practitioner should leave them severely alone. Moreover, the loss of one testicle would decrease the value more than the hernia of ordinary size.

In the small animals operative treatment is successful at any age. Dogs, cats and pigs submit to the operation without apparent post-operative discomfort in almost every case.

RESTRAINT.—Dorsal recumbent position with ropes or

harness, the hind legs well parted, the hind quarters elevated and general anæsthesia is the essential restraint for the operation.

INSTRUMENTS, ETC.—

1. Castrating instruments.
2. Large curved needle and braided silk.
3. Long probe-pointed bistoury.
4. Small trocar and canula.
5. Several hæmostatic forceps.

ANTISEPSIS.—The antisepsis begins with a thorough washing of the inguinal region after the patient is rolled into

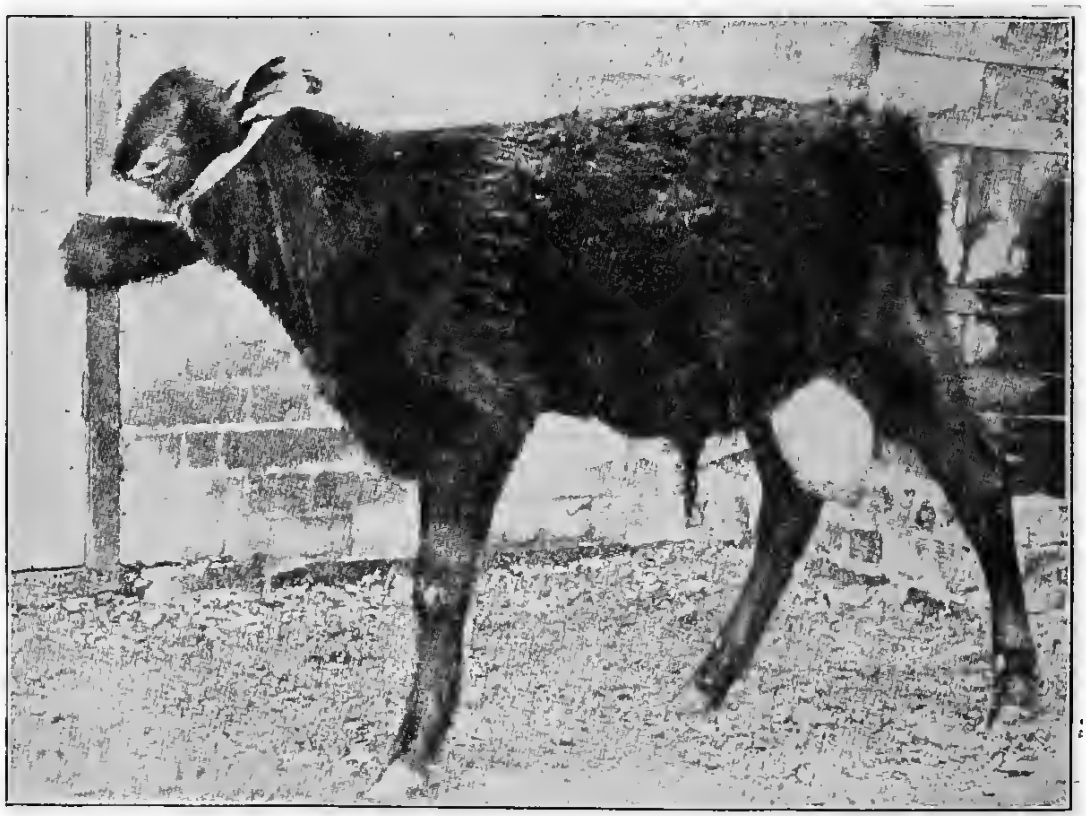


FIG. 178—Scrotal Enterocele in a Calf.

position. The scrotum is washed with soap and water and rinsed with mercuric chloride solution 1-500. The legs and adjacent parts of the body should be moistened to prevent hairs and dirt from flying upon the wound. The needle, emasculator and thread are sterilized by boiling or by strong chemical disinfectants. Under no circumstances should the sterilization of these be neglected, as asepsis of the tissues they touch is essential to the success of the operation.

TECHNIQUE.—First Step.—Incision of the Scrotum and Isolation of the Sac.—An incision about six inches long is drawn across the scrotum parallel to the median raphæ over the most prominent part of the sac, but through the

outer integument only. The tunica vaginalis is temporarily left intact, while it is separated from the outer integuments by tearing, as far up as the internal inguinal ring. When the sac formed by the tunica vaginalis is thus separated from the surrounding attachments and now hangs out in the shape of a pear, the posterior part is examined for large blood vessels, which frequently are found entering the sac. If these vessels are found to exist, as is generally the case in old hernias, they are ligated at two places about one inch apart and then divided between the ligatures.

Second Step.—Reduction of the Contents and Castration.—The contents, if not previously reduced by gravity, are, if possible, pressed into the abdominal cavity, leaving only the testicle within the sac. The sac is then incised and the testicle ablated just above the epididymis.

Fourth Step.—Ligation of the Sac.—The sac is then inspected internally to determine whether the contents have been safely returned into the abdomen. If irreducible by gravity it may be necessary to press them up with the fingers, and when this fails the orifice may be enlarged in the forward direction with the probe-pointed bistoury, guided with the index finger. If the irreducibility is due to distention of the bowels, the gas is evacuated with the trocar and canula.

The sac, including the spermatic cord, as near to the internal inguinal ring as possible, is then transfixed with a double strand of braided silk. Each half is tied separately with tightly drawn knots and the protruding ends are then wrapped several times around and then tied again to assure against slipping.

The sac and the spermatic cord below the ligature (as if in standing position) is then cut off transversely about one inch from the ligature.

Fifth Step.—Dressing.—The scrotal cavity is packed with an antiseptic gauze or cotton, retained with two of three interrupted sutures. The object of the packing is that of providing a support for the intestines that will keep them from bagging into the orifice until swelling develops to perform that mission.

AFTER-CARE.—The packing is removed at the end of forty-eight hours, after which the cavity is syringed out daily with iodoform-ether, five per cent, until the ligature has sloughed off and cicatrization is well advanced. In addition, the patient is kept in the standing position for four to five days immediately following the operation.

SEQUELÆ.—(I) **Peritonitis,** manifested by the ap-

pearance of fever three to five days after the operation, is the most likely untoward complication. Its prevention is found in cleanly methods and its treatment consists of local irrigations of the wound and appropriate internal remedies,—quinine, echinacea, aconite, etc.

2. **Recurrence of the hernia** is possible after the ligature has sloughed off and the orifice has failed to close up with cicatricial tissue. This occurrence is met in hernias having exceptionally large orifices, and especially when the sac near the internal ring is constituted of a delicate, stretched-out membrane that sloughs off hurriedly and then gradually allows the intestines to gravitate into the scrotum. This accident sometimes leads to a delayed complication in the form of a subacute peritonitis, local enteritis or peritoneal abscesses.

3. **Shock** sometimes supervenes, although this sequel is most likely to follow operations for strangulated hernias where the subject is already in a delicate condition before the operation began.

OTHER METHODS—(I)—The covered operation, so-called, has the advantage of not exposing the tissues to external influences. The modus operandi consists of reducing the hernia by gravity and manipulations and then pinching up the sac,—skin and all, including the testicle,—with a strong clamp, which is allowed to remain until it sloughs off. In this method, if the hernia is irreducible, the sac is incised and the orifice enlarged anteriorly with the bistoury, after which the scrotum is pinched up as above mentioned.

2. **The uncovered operation** consists of pinching the tunica vaginalis with a clamp after having dissected it out, as in Vanlaw's operation. The testicle and redundant parts of the sac are cut off one inch below the clamp, which is not removed until the third or fourth day.

Operation for Strangulated Hernia.

INDICATIONS.—Operation for strangulated hernia is an emergency intervention. When indicated, that is to say, when strangulation of a hernia exists, it must not be delayed. In the treatment of colic co-existing with scrotal hernia it is important to determine without delay whether or not the hernia is playing any part in the cause of the intestinal pain, and when it is once incriminated it is essential to constantly scrutinize the developments in view of deciding to operate before incurable damage has been done.

The greatest obstacle confronting the practitioner in deciding upon operative intervention for strangulated hernia is the fact that the operation can not very well be successfully performed without sacrificing the testicle involved, and since the loss of a testicle in a stud is a serious matter, the inclination to postpone is always quite as tenable as the decision to operate immediately. Moreover, it is impossible under all circumstances to lay down an absolute law as to when a colic due to hernia actually requires an operation. What might seem to be a threatening condition at the beginning may, after a few hours of waiting, prove to be an entirely harmless colic in no way associated with the hernia; and on the other hand, an at first apparently trivial colic may soon develop into a plain case of intestinal strangulation. With these possibilities in view, the plain duty is to give the suspect constant surveillance and then operate just as soon as the diagnosis of strangulation is established beyond doubt, and before the damage to the incarcerated loop is too great. A too long delay invites certain death, while a too early intervention needlessly sacrifices the testicle. The surgeon's judgment protects against these two evils by operating at the proper time.

Above all things, the unwisdom of operating upon a hopelessly affected case, a dying subject, must be emphasized.

TECHNIQUE.—The operation for the relief of strangulated hernia does not differ materially from that performed against non-complicated scrotal hernia (Vanlaw's operation). The patient is cast, anæsthetized, and rolled to the dorsal posture. The tunica vaginalis is dissected out, the testicle removed and then the intestines are replaced into the abdominal cavity. If any difficulty is encountered they are punctured to reduce the volume and if still refractory kelotomy is performed. The extreme dark color of the incarcerated intestines is not always an indication of gangrene; on the contrary, when the operation was timely, they are soon restored to a normal condition after being released and returned to their position within the abdomen. The coloration of intestines under the least provocation is a property belonging to them, and must not be misjudged in intestinal surgery.

In any event, especially in the large species of domestic animal, the surgeon has done his full duty when he has restored the strangulated intestines into the abdomen, because the only other recourse (enterectomy and approximation) is always futile.

The intestines having been returned, the tunica vaginalis

is ligated near the ring in the manner described in Vanlaw's operation. The cavity is packed with antiseptic gauze, which is retained with sutures across the scrotum.

The patient is given a large dose of an oleaginous purgative, sustained on a strict liquid regimen, and is given such other internal remedies as the general systemic condition indicates.

OTHER METHODS.—Strangulated hernias are sometimes successfully relieved by simple manipulation of the sac after placing the patient in the dorsal posture, and one case reported by Stringer was permanently cured of its hernia by plugging the orifice with the testicle after reducing the contents by gravity and taxis. The testicle never again descended into the scrotum, the hernia never returned and the stud regained its health and lived a useful existence for years.

SEQUELÆ.— 1. **Enteritis** extending from the initial strangulated focus is the chief untoward result. The pains continue after the operation has been performed and death soon ensues. There is no successful treatment.

2. **Gangrene of the Loop.**—When the incarcerated loop of intestines has become gangrenous or unviable on account of the duration of the period of incarceration, the patient dies within a few hours, with all of the symptoms of shock. Treatment is of no avail.

3. **Peritonitis** is more liable to supervene than in the operation for uncomplicated scrotal hernia, on account of the enfeebled condition of the patient. It is manifested by fever, slight colics, inappetence lasting during the week following the operation, and usually terminates fatally.

Radical Operation for Ventral Hernia.

INDICATIONS.—Ventral hernias are most common in the ox and the horse. They are due to violence inflicted with blunt objects which rend the inner integuments without lacerating the skin. In size they vary from small flattened fluctuant projections to enormous sacs that contain almost the entire viscera. In the horse they are usually located near the costal margin or else along the linea alba, although sometimes found at any dependent part of the cavity. In the ox they are most frequently found near the flank.

The most exaggerated type of ventral hernia found in domestic animals is seen in pregnant mares (hysterocele due to **rupture of the prepubian tendon** Fig. 179). The weight of the fœtus and gravid uterus tears the prepubian tendon from the

brim of the pubis and thus bears down upon the unsupported abdominal parietes until an enormous hernia is produced. The accident is undoubtedly predisposed by a rarified condition of the skeleton (osteomalacia) and is always incurable.

As regards the prudence of surgical interference against these abnormalities it may be said that so long as they are not too unsightly and are compatible with health, they should be left strictly alone. The operation is a dangerous one, the omentum is generally firmly adhered to the sac, the expense is always considerable and the actual increase in the value of



FIG. 179—Enormous Ventral Hernia Due to Detachment of the Prepubian Tendon.

the affected subject is trivial. In fact, after every phase of the proposal to operate is carefully weighed, pro and con, the decision is generally against meddlesome intervention. Here and there, however, the practitioner is called upon to act. An unsightly protrusion on the abdomen of an otherwise excellent horse may sometimes be regarded as sufficient cause for interference by a fastidious owner. In bovines, relief is sometimes sought in an attempt to reclaim an excellent individual. Here there is always salvage by slaughtering for food when the operation seems destined to fail.

In recent ventral hernia attempt must always be made to

retain the contents within the abdominal cavity by bandages or by application of a truss, in hopes that the breach will close, or at least leave a much smaller orifice than if the con-

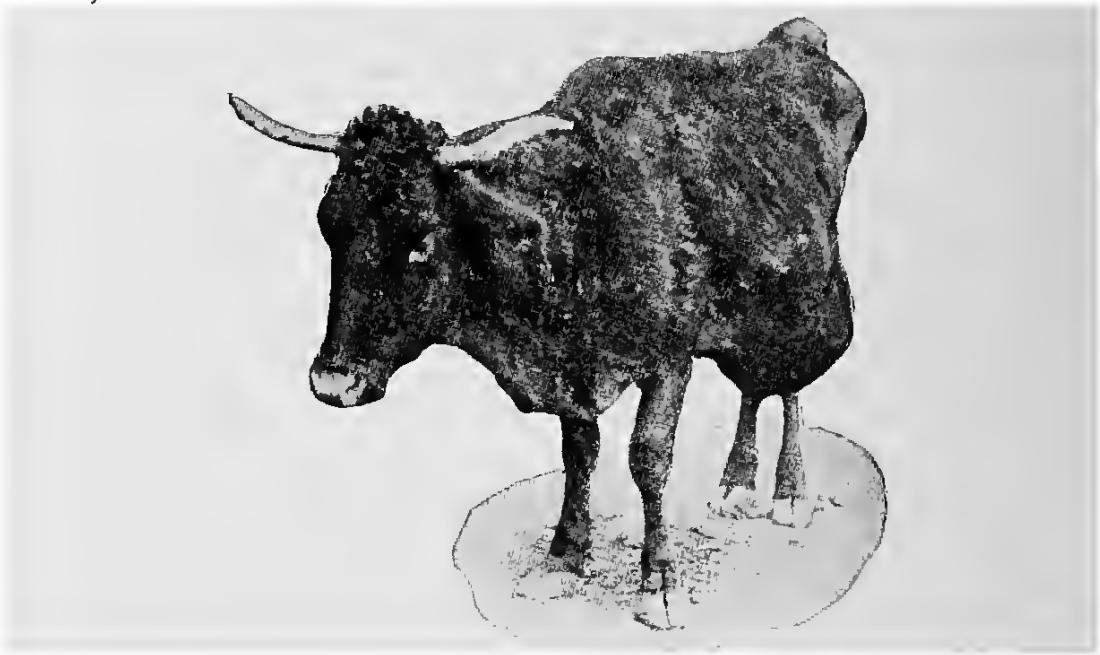


FIG. 180

tents were allowed to make matters worse by their weight. A truss, made by tacking a rounded block of soft wood to a square piece of sole leather somewhat larger, which is held in place with strong elastic bands encircling the body, will



FIG. 181

often accomplish wonders in the treatment of recent ventral hernias. The rounded piece of wood should fit loosely into the breach. As fast as healing progresses, the block is trim-

med smaller to correspond with the diminishing size of the breach. Several excellent recoveries from this treatment have been recorded, among which the following is the most remarkable:



FIG. 182

A bay driver, hitched to a post having a rounded top, jumps over the post and is empaled at a point midway between the umbilicus and the pubis. It required the assistance

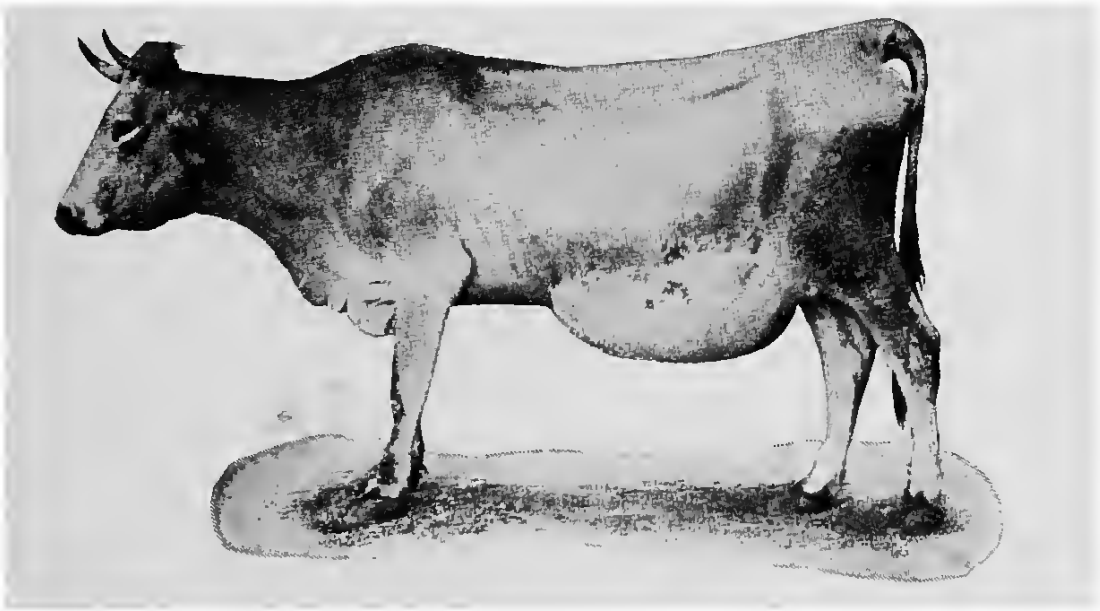


FIG. 183

FIGS. 180, 181, 182 AND 183—Forms of Ventral Hernias in Bovines.

of a force of men to lift him off. When released a ventral hernia the size of a large bucket immediately appeared. The breach was round and six inches in diameter. A body bandage was applied to retain the intestines temporarily. Later

the truss above described was adjusted and managed as mentioned. At the end of six weeks the recovery was complete.

PREPARATION.—A long dieting process, beginning at least ten days preceding the day of operating, is absolutely essential. **The abdomen must be empty,** otherwise successful results are impossible. The ration is gradually reduced for four to six days, a laxative of oil of linseed is administered and then only liquid food in limited amounts is allowed during the three days immediately preceding the operation. The patient is actually starved, in order to reduce the abdominal tension.

RESTRAINT.—Recumbent restraint and general anæsthesia is necessary. The hernia must be exposed uppermost, and the anæsthesia should be profound. No matter how small the hernia may be, local anæsthesia will not answer.

ANTISEPSIS.—The sac and a liberal area surrounding is clipped, shaved and washed with mercuric chloride before the patient is cast. This may be done twenty-four hours in advance of the operation. At the time of operating a good washing with mercuric chloride followed by a bath of pure alcohol, is advisable. The instruments and the sutures are boiled and kept free from contamination while in use. The sutures especially, must be absolutely aseptic. The hands are covered with rubber gloves, or in lieu of these, they are covered with common gloves while preparing the patient, and then when the operation begins, disinfected in the usual manner.

INSTRUMENTS.—

1. Scalpel.
2. Dissecting forceps.
3. Artery forceps, a number.
4. Abundance of strong braided silk.
5. Abundance of strong catgut.
6. Tenacula.

TECHNIQUE.—First Step.—Incision of the Sac.—The incision is made parallel to the long axis of the body, although in some cases the direction of the blood vessels may be respected, by changing the course to an angle. As to length it should overlap the boundary of the orifice at each end. The incision is made slowly in order to avoid wounding the viscera, which too frequently are found adhered to the inner wall. As the knife approaches the inner wall the incision is bailed bloodless so that the entrance into the sac may be made without injury to adhered omentum or intestines.

Second Step.—Breaking Down the Adhesions, Replacing

the Contents and Exposing the Outlines of the Orifice.—When the sac has been opened wide from end to end of the incision its inner wall is examined for adhesions of the omentum, which if found to exist are broken down, ligated with gut and cut off, while the stump is returned into the abdomen. The omental vessels always bleed copiously if not ligated, and instead of searching about for the vessels themselves, a tedious, impossible matter, the whole exposed part is ligated en masse. The next step is to expose the boundary of the orifice so that at least one inch of space around its edge is available for suturing.

Third Step.—Closing the Orifice.—This step begins by bringing the edges together as closely as the tensile strength of the gut admits, with as many through-and-through mattress sutures as are required. Contrary to expectations, the approximation of the edges will be found quite easy; no great amount of stretching will be required. After the mattress sutures the edges are brought into perfect apposition with interrupted sutures placed close together and in such a manner as to place peritoneum to peritoneum, the only tissue from which prompt union may be expected. The cicatricial tissue of which the boundary is composed will not unite, even if scarified.

Fourth Step.—Closing the Sac.—There will be some, although not much, redundant skin in the sac, to resect in order to make the flaps fit against the wall. But the mistake of resecting too much must not be made. The danger in this connection is overcome by first placing a row of mattress sutures along the level of the body and then cutting off the skin about an inch above them if that much exists. After the skin is thus resected a row of interrupted sutures is placed along the edge, except at one point which is left open for drainage.

Fifth Step.—Dressing.—A pad of cotton held against the wound with a number of tight wraps of strong muslin around the body to act in the double capacity of supporting the sutures as well as to immobilize the respiratory movements, is the required dressing.

AFTER-CARE.—On the third day the bandage is perforated at the level of the drainage orifice to facilitate evacuation of accumulated secretions. The temperature is taken in the expectation of septic complications, and if no fever develops the wound is not molested until the eighth day, when removal of the bandage and the skin sutures may be thought

advisable. When matters are proceeding well, the sutures may be allowed to remain some days longer.

SEQUELÆ.—(1) **Peritonitis** follows more frequently than any other complication. Its cause lies in unclean methods, especially unclean sutures, or possibly the unavoidable falling of hairs into the wound.

2. **Recurrence of the Hernia.**—The sutures may give way and again leave the intestines protruding into the subcutem, but if the skin sutures prove trustworthy, the subcutaneous cicatrization, especially if the supporting bandages are continued for some time, may accomplish as much as was expected of the buried sutures.

3. **Chloroform Pneumonia.**—The long duration of the anæsthesia, the enfeebled conditon from dieting and the natural exhaustive effects of the operation, combine to cause this sequel with unfortunate frequency. But as neither of these causes can very well be avoided this complication must be charged up as an expected contingency.

Operation for Inguinal Hernia in Females.

INDICATIONS.—In males bubonoceles descend through the internal abdominal ring into the tunica vaginalis, which constitutes the internal integument of the hernial sac. If the descent extends as far as the scrotum they are designated as scrotal hernia or oscheoceles, hence the difference between these two conditions is simply one of degree of descent.

In the female, whose inguinal canals are rudimentary and contain no peritoneal process, a bubonocele develops by the passage of intestines through the short canal, into the subcutaneous space beneath, dragging with it in its downward passage a fold of parietal peritoneum which normally seals over the internal abdominal ring.

Inguinal hernias of this variety occur frequently in bitches, but are rare in other domestic females. In the bitch they are the most common of all hernias, appearing in the form of large fluctuant masses which fill up the space between the last mamma and the thigh.

These hernias may contain intestines, omentum, a cornu of the uterus which may be gravid, and the bladder.

PRE-OPERATIVE PREPARATION.—The patient is dieted for some days and purged in order to facilitate reduction and to reduce the abdominal tension which would tend to tax the sutured orifice.

ANTISEPSIS.—The sutures used to close the orifice and the incision must be of the sterilized variety, the instruments should be boiled, the field shaved and cleansed, and the environs moistened to prevent loosened hairs from falling into the wound.

RESTRAINT.—The patient is anæsthetized and then secured in the dorsal recumbent posture, with the anterior part of the body inclining, and the hind legs spread apart as far as possible.

TECHNIQUE.—An incision is made through the skin along the long axis of the sac, without at first cutting the peritoneum which lines it. The peritoneal sac is then dissected free from the skin as far up as the level of the orifice. The sac is then incised and examined as to the character of its contents. Bloated intestines are collapsed by aspiration, the gravid uterus is emptied of its fœtuses by Cesarean section, the bladder, if distended, is catheterized or its contents as-



FIG. 184—Inguinal Hernia in a Bitch.

pirated with the trocar and canula. Attempt is then made to reduce the contents by taxis, failing in which kelotomy may be found necessary. The kelotomy, when found necessary, is performed at the anterior extremity of the orifice in order to escape the large vessels that traverse in close proximity to the posterior commissure.

The sac is ligated close to the orifice with several wraps of catgut and then cut off. The stump is pushed into the abdominal cavity and the orifice sutured over it, with three or more mattress sutures to close the orifice, and a continuous suture to approximate the edges. The excessive skin previously constituting the sac is trimmed and then sutured with silk from commissures to center, leaving an opening for drainage.

AFTER-CARE.—Bandages are difficult to apply to this region and if applied they are equally difficult to retain in position to do any useful service. It is, therefore, as well to

simply dust the region with boric acid and leave the wound exposed. Subcutaneous infection, which is difficult to prevent, is usually harmless. The buried sutures are not removed but the cutaneous ones are removed in eight days or as soon as they become loosened.

SEQUELÆ.—1. **Peritonitis** following the operation is due to infection with sutures, hands or instruments,—seldom to post-operative infection. Its appearance is ushered in by fever, malaise, etc., three to five days after the operation was performed. The treatment should consist chiefly of antiseptic irrigations of the subcutaneous cavity, in fear the hot-bed of the infection is located therein. Internal administration of quinine is also helpful.

2. **Recurrence of the Hernia.**—The expected healing of the orifice may fail to occur. After the sutures have absorbed it may reopen and allow the intestines to again descend.

CHAPTER VIII.

LITHOTOMY.

DEFINITIONS.—**Lithotomy** is the incision of the bladder for the abstraction of calculi therein. In animals, the incision is usually made into the urethra, where it becomes superficial above the arch of the ischium, hence the correct designation should be **"urethrotomy,"** or, in order to better explain the objects of the operation, **"urethrolithotomy."** **Lithotripsy, lithuresis,** or **lithotrity** refer to crushing of calculi by means of the **lithotrite**—a crushing forceps specially devised for the purpose. **Litholapaxy** refers to the special operation of pulverizing calculi with the lithotrite and then evacuating the fragments by irrigation or suction.

INDICATIONS.—Vesical calculi occur in all of the domestic mammals. They are, however, most common **in the ox** and **in the dog.** In the **equine species** they are noted for their relative infrequency.

The operation for their removal is indicated as soon as they become incompatible with the health of the urinary organs by obstructing the flow of urine or by provoking inflammation of the tissues they press upon. They may sojourn for years without exciting any suspicion of their existence, but may at any time flow into the urethra and at once cause total obstruction, or they may gradually provoke changes in the walls of the bladder that are finally announced by a more or less pronounced distress in urination.

Although the bladder is the usual seat of their development, calculi may be found forming at any part of the urinary channel from the pelvis of the kidney to the meatus urinarius. Hence they may be **renal, ureteral, vesical or cystic,** or **urethral,** either by reason of having developed in these several organs or by having changed positions, from a higher level in the urinary tract. Thus a renal calculus may become ureteral, vesical or urethral by being carried downward with the current of urine.

The operation of removing calculi from the urinary tract does not modify the disease (lithuria) which causes their formation and is therefore not a curative procedure. It only rids the urinary tract of a harmful element and leaves the disease unchecked against recurrence. In dogs and in oxen the

removal of a pea-like calculus from the urethra is usually followed sooner or later by the descent of another one which necessitates reiteration of the operation, and when the bladder is evacuated of all of its calculi more will form. In the horse, the few calculi encountered are usually single bodies of considerable size, and since the formative process is undoubtedly slow, recurrence is not likely to occur during the

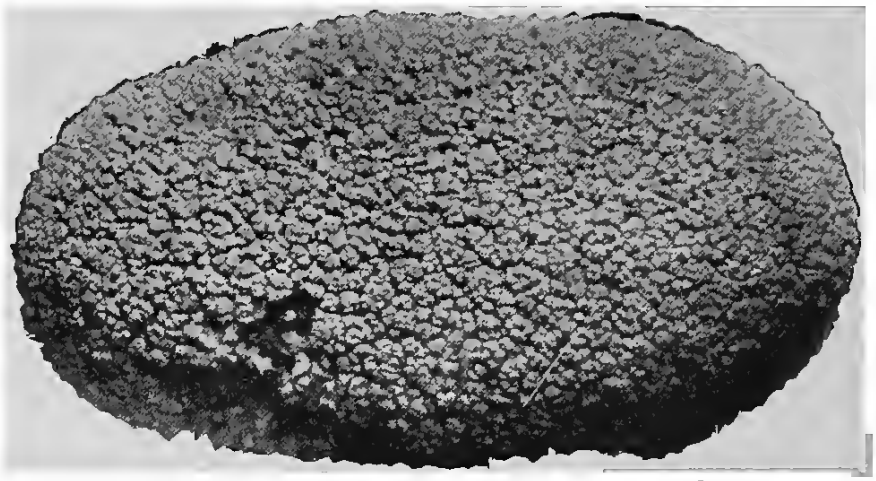


FIG. 186—Cystic Calculus Removed from a Gelding.

few remaining years of the patient's life. In the ox and dog, on the contrary, calculi sometimes develop rapidly; within a few months the urinary tract may become choked with them from pelvis to meatus.

OPERATION IN HORSES.—The removal of calculi from the bladder of horses is somewhat difficult on account of the great distance from the ischial arch to the bladder. The

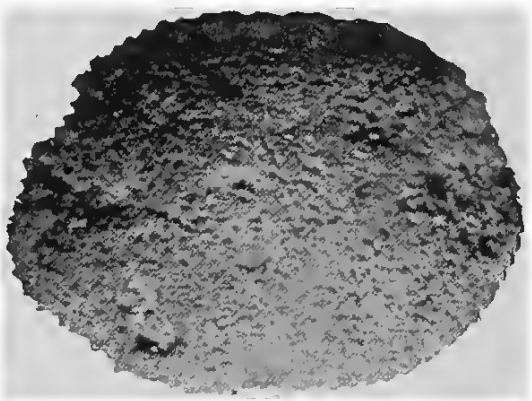


FIG. 187—Calculus Removed from a Gelding.

operation can, however, be successfully performed even against a stone of enormous volume, and with minimum danger to the patient, if the following special technique is carefully carried out.

RESTRAINT.—Lateral recumbent restraint with profound anæsthesia is required. The anæsthesia must be pro-

found throughout the entire operation, but especially during the abstraction of a stone whose size necessitates perfect relaxation of the urethral wall. The contraction of the strong urethral muscle against the stone prevents successful abstraction.

INSTRUMENTS, ETC.—

1. Scalpel.
2. Dissecting forceps.
3. Artery forceps.
4. Lithotomy forceps.
5. Lithotrite (if needed).
6. Evacuator (if needed).
7. Catgut, silk and needles.
8. Antiseptics.
9. Catheter.

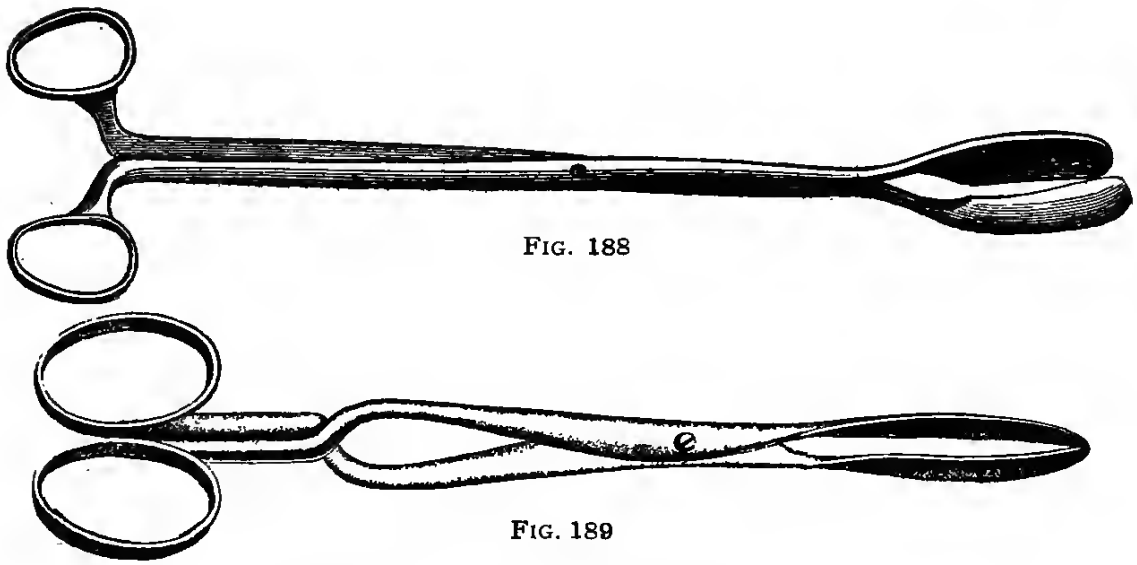


FIG. 188

FIG. 189

FIGS. 188 AND 189—Lithotomy Forceps.

First Step (Urethrotomy).—The catheter is passed into the bladder to facilitate incision of the urethra.

The incision is made two inches long from the anus downward, so that the urethra is approached from above rather than from behind. It is made in the median line and the following integuments, which are distinct membranes, are divided consecutively: The skin, the superficial perineal fascia, the deep perineal fascia, the accelerator urinæ muscle, and the urethral mucosa. As the urethra pitches forward at this point, the incision into it is almost horizontal.

Second Step.—Extraction of the Stone.—The catheter is now withdrawn, and a pre-operative estimate of the dimension of the stone having been made, a forceps of the proper size is passed into the bladder and fixed upon the stone with

the assistance of the right hand in the rectum. When a firm hold has been taken, the forceps are rotated to and fro or even turned one complete revolution to assure against a possible pinching of the vesical mucous membrane. The withdrawal now begins by pulling firmly backward upon the for-

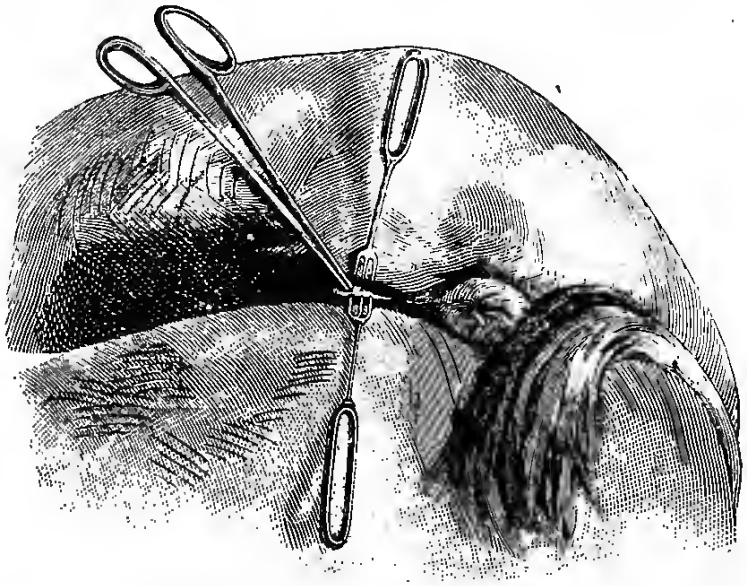


FIG. 185—A Urethrotomy for Removal of Cystic Calculi

ceps. If the stone is a small one no trouble is encountered in effecting an immediate delivery, but if its dimensions tax the caliber of the urethra, the latter must be carefully "peeled" forward as the backward traction continues. The peeling process is effected with the fingers or with the handle



FIG. 190

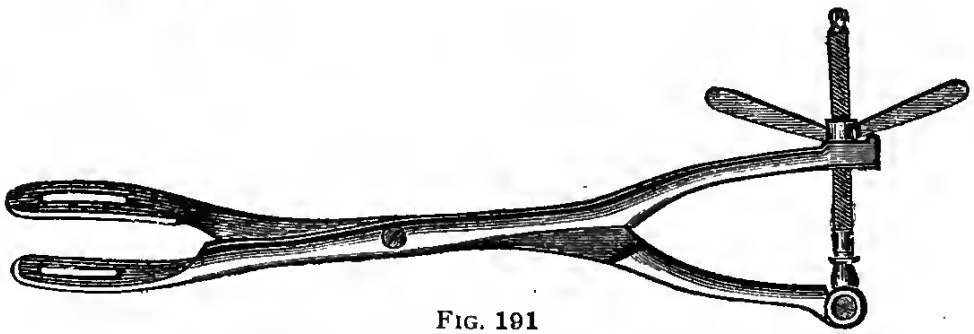


FIG. 191

FIGS. 190 AND 191—Lithotrites.

of a scalpel, and is patiently continued until the largest diameter of the stone is reached, at which moment it is found suddenly released. The speed with which this can be done will depend largely upon the character of the stone's surface. If

rough it may require considerable time and much patience, but if smooth the work is a matter of but a few moments. During the execution of these manipulations it is important that the anæsthesia be so profound as to eliminate all reflexes that would tend to provoke contractions of the urethral muscles.

The feat is not a difficult one when the incision has been made as described in Step I, but if made at a lower level the extraction of large stones without previously crushing them is either impossible or else inflicts irreparable injury.

Modifications of this technique may be found necessary, where the stone is large and the animal small. In this event pulverization and evacuation by irrigation or suction (litholapaxy) may be necessary. This is done by introducing the lithotrite into the bladder and then patiently pulverizing the stone piece by piece until it has been reduced to small fragments, which are then washed out by forcible irrigation,

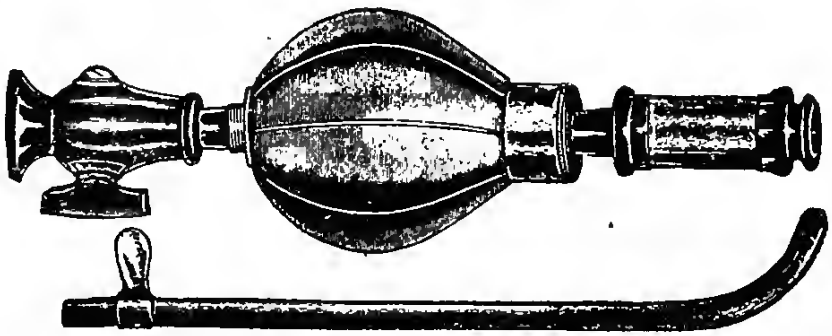


FIG. 192—Ultzmann's Evacuator for Litholapaxy.

or else by use of the evácuator,—a special instrument which abstracts the detritus by suction. (Fig. 192.) The fragments may also be removed one after the other with the forceps.

The crushing of stones in the bladder is, however, often impossible on account of their flint-like hardness which resists any instrument small enough to be introduced into the bladder of a horse through an urethral incision.

Third Step.—Suturing the Wound.—Although it has been the custom to leave the incision to slowly heal without closure, more recently it has been demonstrated that suturing shortens the period of convalescence, and forestalls complications. Between the two methods of suturing the wound and of treating it as an open one through which the urine is voided until spontaneous closure occurs some weeks or even months later, the author recommends the former, which coincides with the conclusions of White, who has performed many such operations upon dogs.

The urethra is closed by interrupted catgut sutures arranged close together; then the space intervening between the urethra and the deep perineal fascia is packed with iodoform gauze, the end of which is left to protrude from the inferior commissure of the fascia and cutaneous incisions, each of which (three in all) are sutured separately, the fascia integuments with catgut and the skin with silk.

AFTER-CARE.—The iodoform gauze is renewed daily with as little molestation of the sutures as possible, and the patient is kept standing to prevent injury of the wound by the movements of lying and rising. At the end of eight days the silk sutures are removed.

ACCIDENTS AND SEQUELÆ.—1. **Vesical and Urethral Hæmorrhage.**—In the extraction of a large and especially a rough stone, lacerations of the delicate and highly vascular mucous membrane through which it is pulled with more or less force, and copious bleeding seem inevitable. It is, however, not serious and may be abandoned to spontaneous arrest. The greatest harm resulting therefrom is that of masking the work of suturing the urethral incision. The blood gushes forth over the edges of the wound and thus causes considerable annoyance until the urethra is entirely closed. The coagulum in the bladder may sometimes be a temporary obstruction, but as it is soon liquefied and voided, little harm results.

2. **Cystitis.**—The chronic cystitis caused by the sojourn of the calculus is always excited into renewed activity by the operation and may produce serious pelvic pains manifested by harmful tenesmus.

The condition is managed by irrigation of the bladder once daily with hot antiseptic water, phenol one per cent, and by the internal administration of urinary sedatives: belladonna, saw palmetto, copaiba, etc.

3. **Urinary Fistula.**—This sequel, when the urethra is not sutured, is one of choice, and is not regarded as a serious matter, since the incision will eventually heal. On the other hand, if the sutures fail to bring about an immediate closure by healing, the discharge of urine through the incision may be looked upon as a decided misfortune, in that instead of the parts being healed entirely in ten days, several months may elapse before the patient can be discharged as a cured subject. Furthermore, urine often excites an annoying local irritation by dissecting its way subcutaneously into the region of the sheath.

The accident, is, however a rare one if asepsis prevailed

during the operation, and if the incision is sutured according to the specified directions.

OPERATION IN MARES.—In the mare the removal of a vesical calculus is much more simple and is attended with but little danger. It may even be performed in the standing position by means of the slings, twitch, and breeding hopples. The recumbent position with general anæsthesia is, however, preferable.

Technique.—The forceps of appropriate size are introduced into the bladder through the urethra, fixed to the stone with the aid of the right hand in the vagina, and then drawn upon firmly. A long, probe-pointed bistoury is then introduced flatwise into the urethra, so its blade overlaps the anterior part of the stone. As the forceps are drawn backward the blade is turned against the urethra, which is slit forward as far as is necessary to release the stone. In other words, the urethra is incised forward and the stone drawn backward, simultaneously, until the delivery is successfully effected. No after-care is required; the wound heals rapidly. The only untoward effect is a disturbance of urination in the form of frequent attempts to empty the bladder.

OPERATION IN DOGS.—In dogs, the prepubic operation should be selected on account of the small caliber of the urethral tract. The bladder is reached through a median line celiotomy, toward which the bladder is drawn with forceps. The incision through the walls of the bladder is made at the highest accessible point. Before proceeding to deliver the stone some pains are taken to arrest the bleeding, which is always more or less copious on account of the inflamed and thickened condition of the walls. The stone is removed with the forceps and the incision closed with Czerny sutures of No. 1 catgut. The abdominal incision is closed in the usual manner recommended for laparotomies.

The practice of temporarily fixing the bladder, at the incision, to an adjacent wall in order to protect the sutured parts against contraction that would prevent healing, has been adopted by White in the performance of these operations.

CHAPTER IX.

SPECIAL AMPUTATIONS.

AMPUTATION OF THE PENIS.

INDICATIONS.—This operation is indicated in all of the domestic mammals and sometimes in wild animals held in captivity. The conditions necessitating its performance are **paraphimosis, gangrene of the free end, hypertrophy of the prepuce, chronic erections** and **neoplasms.**

1. **Paraphimosis** is an indication for the operation only after every attempt to return the penis into the sheath has failed. In the acute swellings which so often physically obstruct the retraction of the organ into the sheath cavity, the operation is not hurriedly resorted to, but on the contrary it is postponed for a long time in hopes that treatment aiming to preserve the penis will eventually prove successful. Even in those states which clearly are due to paralysis of the retractor muscles, internal, hygienic and topical treatment must first have failed before the organ is sacrificed to amputation. These recommendations apply to all animals except those whose low value precludes prolonged medical attention. In stallions, bulls, favorite dogs and even valuable geldings, the operation should be delayed indefinitely, during which time constant effort is made to effect a cure. Although in cheap animals immediate relief may sometimes be demanded of the practitioner, there is seldom ever an excuse for an undue hasty decision to amputate the penis of valuable charges.

The **absolutely incurable paraphimosis** is, therefore, the only one that calls for amputation. When the incurability is, however, positively established by weeks or even months of unsuccessful treatment, it is the only available remedy. Moreover, it must not then be delayed, because the flopping, pendulent penis is always exposed to injuries which complicate matters if amputation should finally be decided upon. Again, early amputation may sometimes be prudently recommended where there are reasons to suspect that the long, careful, diligent treatment that paraphimosis often requires, will not be faithfully carried out to a successful issue. Under such circumstances amputation may as well be decided upon at once. (Treatment see page 252.)

2. **Gangrene of the penis** occurs in dogs and oxen from incarceration of the free extremity by the prepuce or sheath. The free end becomes swollen from some cause or other and then finds the sheath orifice too small to readmit it. The strangulation accentuates the swelling and gangrene of the exposed part supervenes. In horses gangrene of parts of the glans and prepuce sometimes follows paraphimosis due to enormous œdematous swelling that interferes with the circulation but the marked elasticity of the sheath protects them against extensive gangrenes that destroy the entire exposed portion by transverse pressure. But the most for-



FIG. 193—Chronic Paraphimosis.

midable gangrenes of the penis occur from freezing. The penis is accidentally protruded on the cold floor or ground during sleep, and thus becomes fatally frozen.

In all of these various forms of gangrene, amputation is essential, as self amputation by sloughing off of the dead portion at the line of demarcation is always followed later by stenosis of the urethra, and generally there is obstruction to the flow of urine while the sloughing process evolves.

In gangrene of the penis amputation is postponed until the extent of the destroyed tissues can be determined, so that

the seat of section can be located safely in the healthly tissues above, and in order to prevent unnecessary loss.

3. **Hypertrophy of the Prepuce.**—The prepuce of the horse very frequently becomes enlarged by the formation of an abundance of connective tissue within its folds. Injuries from copulation, bruises and prolonged œdema are the most common causative conditions. In geldings or worthless studs, amputation of the penis is the safest remedy, while in useful stallions ablation of the prepuce must first be attempted. (See page 467).

4. **Chronic erection** is a somewhat rare cause of paraphimosis in an incurable form. The penis becomes hard along its entire extent and despite the administration of anaphrodisiacs and cold applications covering a long period, the erection persists for weeks and even months. The penis protrudes from six inches to one foot from the sheath, and the prepuce becomes slightly œdematous. It occurs in geldings as well as in stallions and no form of palliative treatment tends to effect a cure. Amputation of the protruding portion is the only remedy.

5. **Neoplasms.**—As a point of predilection for neoplasms the penis of animals stands in the first rank, and very frequently the growths are malignant. Epitheliomata frequently invade the penis, the prepuce and the sheath, often implicating all three simultaneously, and unless ablation is practiced early they sooner or later develop into serious and then fatal tumors. If recognized early ablation of the growth itself is sufficient, but often they are neglected until the widespread involvement necessitates the sacrifice of the entire free end of the penis, and not infrequently the involvement is too extensive for successful intervention.

RESTRAINT.—The operation requires dorsal recumbent restraint and profound anæsthesia. Local anæsthesia is insufficient and to attempt the operation without any effort to prevent pain is both cruel and dangerous from fatal shock. The casting harness is by far the best restraint although the operating table will answer providing it is arranged to admit the operator to the ventral surface of the abdomen.

If the harness is used the patient is tied as for inguinal operations, castrations, etc., and on the table the uppermost limb is drawn upward.

ANTISEPSIS.—The ordinary rules of antiseptic methods should prevail. The only special precaution to take is that of submitting the dirty rugæ of the sheath and of the penis above the proposed line of amputation to an exceptionally good washing first with plenty of soap and hot water and

then with a strong antiseptic solution. The skin of this field is very filthy, and as the wound is one that on account of its position, can not be submitted to much after-care, it must at all hazards be kept from being unnecessarily infected during the amputation.

INSTRUMENTS REQUIRED.—1. Scalpels, two or three, exceptionally sharp ones. The dissection of the urethra from the penis itself, which is hereafter recommended, necessitates the use of very keen edged knives.

2. Dissecting forceps.
3. Artery forceps.
4. Needles and strong braided silk.
5. Muslin bandage one and a half yards long.
6. Catheter.

TECHNIQUE.—First Step.—Adjustment of the Tourniquet.—The penis is drawn out as far as possible and held firmly by an assistant and the muslin bandage, rolled into a loose cord, is applied around it at the level of the sheath orifice. The bandage is applied in the form of a double-half hitch, drawn very tight and then secured by a firm double knot. The protruding ends of the bandage now serve as a hold to keep the penis out in a perfectly exposed and controllable position.

Second Step.—Dissection of the Urethra.—Beginning at the meatus, leaving the normal urethral termination unmolested, the urethra is carefully dissected out as far back as the proposed point of section. The first incision to this end is a line through the skin from the point of section to the meatus, exposing the urethra along the entire part to be amputated. The incision is then carried around the red meatus, releasing it from the surrounding skin. The catheter is inserted into the urethra as far as the tourniquet, to facilitate the dissection, which is now continued from before backward until the point of section is reached. In dissecting the urethra care is taken not to cut into it here and there, as might easily be accidentally done if some pains are not taken to prevent, and equal care is taken not to leave any of the surrounding penal tissues attached to it. No part of the cavernous body which surmounts the urethra superiorly should be left attached to the dissected urethra. When the dissection has been completed, if properly done, only the mucous membrane and its surrounding muscular coat should be included, for if a part of the cavernous body is attached to it and can not as a consequence be ligated, troublesome bleeding is sure to follow the completion of the amputation.

Third Step.—Amputation.—The amputation, which is ef-

fected transversely with the scalpel, includes the skin and all of the penis except the dissected urethra, which is left entire. The amputation must always be made some distance from the tourniquet, to prevent the latter from prematurely slipping over the stump. The ecraseur may be used to amputate instead of the scalpel, but serious hæmorrhage may occasionally result therefrom. The sinuses of the cavernous body do not yield like blood vessels to the crushing effect of the ecraseur and may therefore bleed copiously after its use.

Fourth Step.—Hæmostasis.—Bleeding is preferably prevented by ligating the stump. The stump, excluding the urethra, is ligated by transfixing it through the center one-half inch behind the section, and tying each half separately, or by multiple ligatures if the stump is very large. Another very effectual method of ligation consists of first placing a tobacco-pouch stitch loosely around the stump, then weaving a second strand through the exposed loops, and then drawing the two as tight as possible. The first prevents the second strand from slipping off and the two together effect a perfect and a safe hæmostasis. These ligatures may be applied either before or after the amputation.

Searing the stump with a hot iron is also an effectual method of controlling the flow of blood, but the cauterization must be thorough. Slight cauterization will not answer.

Fifth Step.—Removal of the Tourniquet.—When assured that the ligation or the chosen method of controlling the flow of blood is safely completed the tourniquet is untied and the stump allowed to retract into the sheath. The urethra, which always contracts several inches towards the stump, is left hanging out of the sheath orifice.

AFTER-CARE.—The sheath is irrigated daily with an antiseptic solution by means of a large syringe, a fountain syringe or injection pump, until about the tenth day, when sloughing of the ligated end leaves no further demand for treatment. The hanging urethra gradually shrivels up or sloughs off by sections until it has finally taken its place, safely opened, at the new end of the penis.

SEQUELÆ AND ACCIDENTS.—The only untoward sequel is **stricture of the urethra,** which universally occurs if precautions to prevent it are not taken. Ordinary amputations which make no provisions to prevent strictures are absolutely unsuccessful, and amongst the various methods employed or described in veterinary literature the author has found none so universally preventive as the one described above,—that is, dissecting the urethra from the meatus to

the seat of amputation and allowing it to hang pendulent from the sheath while healing of the stump proceeds. The cause of stricture in almost every case lies in the marked elasticity of the urethral tube which, if cut off at or even near the stump, contracts behind the seat of amputation and allows the cicatrix to form over its end. By leaving a long portion to protrude, the shrinking up, sloughing off and healing of the urethra keeps pace with the healing of the stump, so that when the latter has entirely cicatrized the former is still protruding far enough to prevent its incarceration within the stump cicatrix.

Stricture of the urethra supervening amputations occurs at about the second week of convalescence, although in some cases where certain precautions to prevent were taken, it may be delayed for one month to six weeks. The patient will be noticed to urinate with some difficulty. The stream will become smaller and smaller until only drops are voided during the almost constant efforts to empty the fast-filling bladder. Later the bladder will become enormously distended, and by pressure upon the rectum the symptom changes into an attempt to defecate; the urinary signs almost entirely disappear. Upon examination of the stump the urethra, just behind the cicatrix, will be found fluctuant from distention with urine, and urine may be flowing drop by drop from the sheath.

The treatment, in order to be successful, should begin early, for after the bladder has been severely stretched for days fatal results may follow its successful evacuation. The first step to take in attempting to make a new permanent meatus is that of emptying the bladder with the trocar and canula passed into it through the rectum. (See cystocentesis page 68.) This precaution is necessitated by the danger of casting an animal whose bladder is so enormously full, and in order to prevent fatal shock where the bladder has been full for some days this rectal evacuation must be done with a canula of small caliber. When the bladder has been thus emptied the patient is cast, the penis drawn out from the sheath and an incision made into the end of the urethra. To prevent recurrence of the stricture, which is often impossible, the incision should be not less then one inch long, and a soft rubber tube four inches long should be inserted into it and retained by sewing the end to the surrouding skin. After ten days the tube is removed, and if at the end of ten days more the stream is becoming gradually smaller and smaller, indicating recurrence, it is reinserted for another similar period.

The accidents of the operation are **hæmorrhage** and **shock.** The former is prevented by effectual ligation of the stump and latter by anæsthesia. Bleeding from the cavernous body is a troublesome one, as the contractility, which in vessels assists in spontaneous hæmostasis, is absent. The openings (sinuses) in this body do not close automatically like those of blood vessels. Bleeding from the cavernous body, although very slight, may continue incessantly for hours and even days.

Note.—The above technique, while intended chiefly for the horse, will apply with trivial modification to the other domestic animals. In no case should the operation be performed without taking ample precautions to protect against stricture.

Amputation of the Tail.

SYNONYM—Docking.

INDICATIONS.—The operation of caudal amputation is sometimes necessitated by disease and sometimes, in the horse, to prevent the dangerous habit of grabbing the lines. Under any other circumstance the operation, in most commonwealths, is illegal, and is otherwise a pernicious practice that should not be countenanced nor practiced by veterinarians. These facts, however, do not warrant its omission from works on veterinary surgery. It would be quite as logical to omit arsenic from the materia medica because it might sometimes be administered with criminal intent, or stramonium because it has sometimes been give to disguise the heaves; or, again, cocaine because it is sometimes administered to "dope" the thoroughbred. The moral duty in caudal amputation is to perform the operation when legal and to urge its discontinuance for illegal purposes.

The impression amongst coach-horse fanciers that the docked tail portends the absolutely correct appointment for the heavy harness horse has prevailed for years, and still prevails as strongly today, but the lawmakers of the various commonwealths of almost the entire civilized world, in their wisdom, have voiced the sentiment of the populace by proclaiming against the practice of docking except when the operation is actually necessary to the horse's welfare.

In the horse, docking is necessitated for various diseased conditions, notably, **tumors** of the tail. In white horses melanotic growths located some distance from the root can best be treated by amputation above the part affected. Then there is **necrosis of the tail** from various causes, especially the

practice of allowing tails to remain tied up for several days, that often requires prompt amputation to save the patient's life against systemic infection. And finally, the habitual **"rein grabber"** is at once made a safer driver by shortening the tail to eight or nine inches after having been submitted to a thorough myotomy of the depressors.

In the dog, there is little excuse for the operation, except here and there, for **serious injuries** which threaten the integrity of the organ by gangrene, and occasionally as a rapid method of dealing with the **refractory sore of the tip** that rebels against every other known treatment. In the latter event the tip of the tail becomes sore from lashing it against solid objects, (walls, post, etc.,) and despite the most ingenious contrivances to prevent constant injury therefrom, the wound is kept irritated and bleeding for months until the once trivial abrasion becomes a very formidable

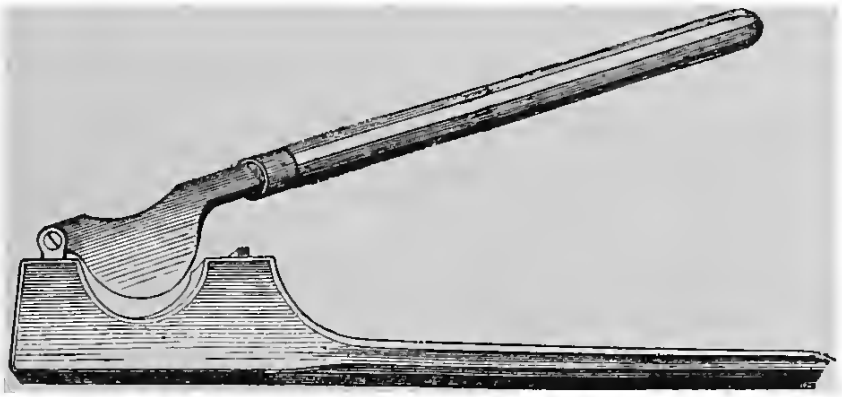


FIG. 194—Docking Shears.

lesion. The occurrence is chiefly in great Danes and bull terriers having a rather unnatural penchant for wagging the tail almost continually, and although the fancier may deplore the disfigurement, docking is by far the most effectual intervention.

In sheep, docking is practiced almost universally. It is customary to dock male lambs in large herds in order that the wethers may be more easily distinguished from the ewes. In the small herds the excuse given for the practice is that docking improves the general appearance and at the same time prevents accumulation of burrs or feces upon the tail wool.

In bovines, the operation is performed only for injuries of sufficient seriousness to threaten untoward complications. Freezing of the end in extreme cold climates ,and injections of black leg vaccine occasionally produce threatening conditions necessitating amputation.

RESTRAINT.—The operation is performed in the standing position with the aid of the twitch, and side-line to elevate one of the hind legs. The dog is simple muzzled and held by all four legs. The bovine is placed in the stanchion with the hind legs hoppled.

INSTRUMENTS.—

1. Docking shears. (Fig. 194.)
2. Special firing iron.
3. Forge.
4. Cord tourniquet.
5. For small animals, common scissors.

TECHNIQUE.—First Step.—Application of the Tourniquet.—The hair is parted transversely about one inch above the proposed seat of amputation. The hair above the part and

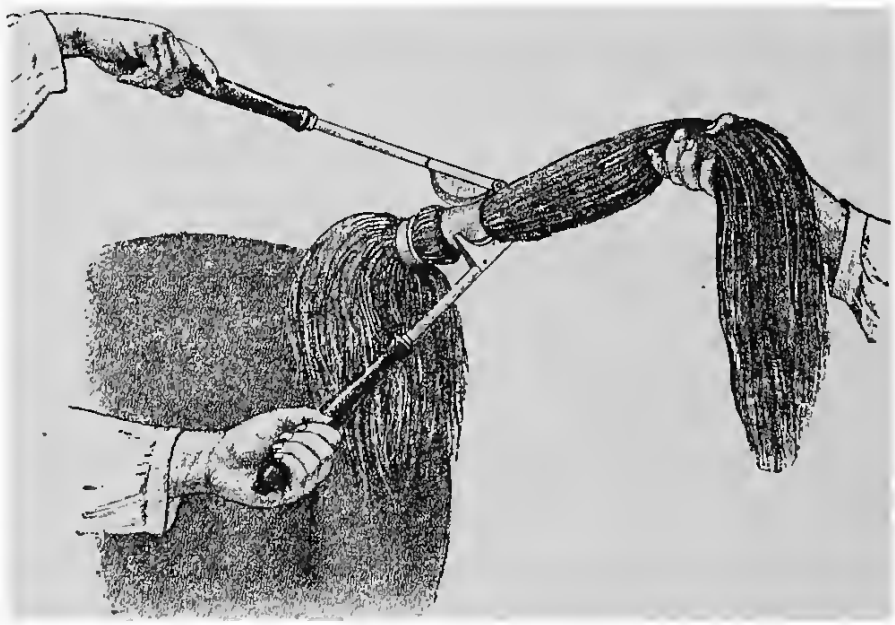


FIG. 195—Amputating the Tail with Shears. (Bayer.)

the tail below it is held by an assistant while the operator encircles the tail with a double-half-hitch of the cord, which is then drawn as tight as possible and secured by a double knot against slipping loose. The ends of the cord are then passed once around the tail above, to keep the hanging hairs from overlapping the seat of operation. A second transverse part is then made in the hairs at the proposed seat of amputation and the hanging hairs above it are tied up against the stump with the same cord ,or with another one which is wrapped several times around the tail to prevent any annoyance from hairs.

Second Step.—The Amputation.—The assistant holds the tail on a straight line with the vertebral column with both hands, one on each side of the seat of amputation, while the

operator, after carefully adjusting the shears, snips it off at one forceful stroke. To prevent resistance it is important that the knife make a clean, unfaltering sweep through the entire tail at the first attempt.

It is not necessary to search for an intervertebral articulation through which to make the amputation: on the contrary, section through a segment is more desirable, because the exfoliation of the end of the segment will be more rapid than if the bisection had been made through an articulation.

Fourth Step.—Hæmostasis.—The tail is then pushed up-

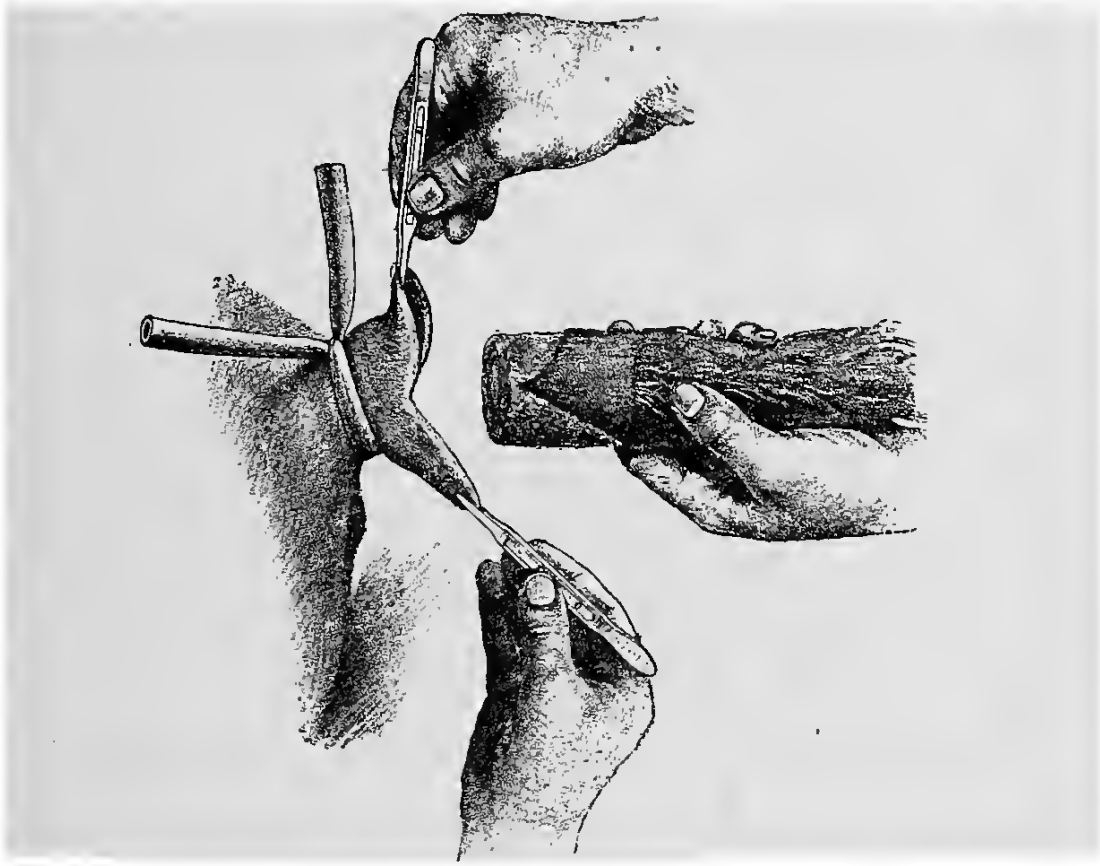


FIG. 196—Amputation of the Tail by the Dovetail Method. (Bayer.)

ward with one hand and the end thoroughly seared with the hot iron. The searing is effected by simultaneously pressing and rotating the iron against the stump until the soft tissues surrounding the bone are burned into a perfectly smooth surface. The stump may then be sprinkled with a little rosin, which is melted into the scar with the hot iron.

The tourniquet is cut off or untied and the patient kept under surveillance ten to twenty minutes, to detect possible bleeding from the middle coccygeal artery.

THE DOVETAIL METHOD OF AMPUTATION.—This method, while the most surgical one, is tedious and dif-

ficult and is much more prone to end in annoying complications than the simple shears and hot iron method, although it has the advantage of leaving a haired stump instead of a hairless cicatrix.

To perform this operation well the tail must be submitted to a good disinfection which, on account of the hairs, is difficult of execution, and the patient must either be placed in the recumbent position of else the tail well cocainized.

The tourniquet is applied as described in Step 1, and then, after completing the disinfection, two lateral flaps one and a half inches long are made of the skin and muscles. The amputation is effected through an inter-vertebral disc located well upward, so that the bone stump does not extend between the flaps, which are then sutured with a continuous suture.

The bleeding is prevented by allowing the tourniquet to remain taut for two hours, at which time it may be safely removed. The sutures are removed at the end of eight days, and in the interval the patient should be kept in the standing position to prevent contamination of the wound from the stable floor.

As caudal amputations in the routine of country practice are rather few, and the equipment required to perform the shears and hot iron methods somewhat costly, the dovetail method may be deemed the most desirable, notwithstanding the greater safety of the former. By providing against pyogenic infection during the operation, and by administering a preventive dose of antitetanic serum three days after, untoward sequalæ will be few.

SEQUELÆ.—1. Tetanus is a very common complication of docking. The infection generally is traceable to some mishap occurring during the operation. After the amputation has been effected and before the searing has been sufficient to close the wound the patient may fall and soil the stump upon the floor or ground and as tetanic spores are very resistant to extreme heat the searing process creates a favorable environment for their propagation. Or, the skin of the tail at the seat of amputation may be harboring the microbes, which by resisting the burning process, find beneath the eschar the sheltered environment essential to their pathogenicity.

The facts that sterilization of the seat of operation is a difficult task to accomplish effectually, and that post-operative infection is always possible, render preventive inocu-

lation with anti-tetatnic serum particularly advisable after every caudal myotomy.

2. **Secondary Hæmorrhage** follows insufficient cauterization. It is generally observed from ten to twenty minutes after removal of the tourniquet and unless arrested considable blood will be lost before the flow ceases spontaneously. It is therefore advisable to watch the patient during the first half hour for this accident and to meet this possible accident the hot iron should be kept in readiness.

3. **Exuberant Granulations.**—If the tissues underlying the eschar become infected, exuberant granulations will precede cicatrization. The bony stump is seen protruding through their center and until its exfoliation is complete, little headway can be made toward healing the wound. Mild astringents pending the casting off of the bone and stronger ones after this event has occurred will be the only treatment necessary.

When the operation has been properly performed as regards thorough cauterization and thorough pre-operative cleansing, the cicatrizing process proceeds without apparent reaction and is almost complete when the eschar falls off at the end of three weeks.

CAUDAL AMPUTATION IN OTHER ANIMALS.—The hot iron cauterization following snipping off of the stump by means of shears or other instrument strong enough to cut through the tail at one suddent stroke, is by far the best method of amputation in all animals. The operation is finished at once; there is no after-care required, and the eschar is the best coating imaginable against infection of the healing stump, which on account of its location, is continually exposed to dangerous contaminations.

However, when the dovetail method is deemed desirable, it, too, may be performed upon the other domestic animals.

Amputation of the Tongue.

INDICATIONS.—There are two indications for lingual amputation in the horse, namely, **lacerations or contusions** threatening its integrity and incurable **tongue lolling.** In the former, reparative surgery is always preferable whenever there is any chance of conserving the injured organ, but when gangrene is imminent there is no other choice. The operation is, however, postponed until the line of demarcation reveals itself so that the section can be located in the sound tissues above.

For **tongue lolling** (See Vol. 1). other methods of correcting the habit are first tried, and when they have failed, if the habit is thought sufficiently annoying, about five inches of the free end is amputated. The success in this case is universal, and the loss gives the patient only temporary inconvenience in prehension. The greatest objection to the operation is the fact that a horse with an amputated tongue will thereafter be pronounced unsound and is therefore less valuable.

RESTRAINT.—The recumbent position is essential. General anæsthesia, while decidedly helpful, may be substituted by a careful submucous cocainization.

INSTRUMENTS, ETC.—

1. Scalpel.
2. Dissecting forceps.
3. Two or three artery forceps
4. Needle and thread.
5. Tape tourniquet.

TECHNIQUE.—The tape is applied around the tongue above the proposed seat of section. In order to place it high enough to effect a high amputation the frænum is snipped and the tape slipped into the breach. A thread is then passed through the tip to serve as a hold with which to draw out the organ to a convenient position. The amputation is effected by the dovetail method, with a superior and an inferior flap. The first incision to this end is a circular one extending from the middle of one border over the dorsum to the middle of the opposite border. The incision is at once carried backward toward the tourniquet until one-half of the substance of the tongue is sectioned. The tongue is then turned over and a similar flap made with the under half. If the tourniquet has not already slipped off it is removed and an examination made for spurting vessels which may or may not appear. Despite the fact that the lingual artery is always divided, bleeding is generally too trivial to require any special attention. The edges are sutured with a continuous suture.

AFTER-CARE.—No attempt is made to apply local treatment to the stump; the antisepsis is left to the cleanliness of the mouth. Wet feeds are substitued for dry, and grass, in season, is given in preference to coarse hay. In eight days the suture is removed.

SEQUEL.—There is nothing dangerous about lingual amputations, and the wound, despite the motility of the organ, heals well under the influence of good nourishment

The only untoward effect is the inconvenience to prehension and this, fortunately, is transient.

MODIFICATIONS.—Whenever the tongue is badly lacerated the dovetail amputation may be substituted by a simple transverse section of the remaining shreds, and if copious bleeding supervenes it can be easily controlled either with forceps or by hot iron cauterization.

TRIMMING THE EARS OF DOGS.

SYNONYM.—Amputation of the concha; cropping.

DIFINITION.—Trimming the ears is an amputation of the posterior portion and the free end of the concha, practiced in certain breeds of dogs, for no other apparent purpose than that of satisfying the caprice of fanciers.

INDICATION.—The operation is practiced on bull dogs, bull terriers, Boston terriers, skye terriers, great Danes, and sometimes on black-and-tans. Other breeds, fortunately, escape. The ethics to respect in regard to conchal amputation is debatable. The practitioner is confronted on one side by a moral duty to a dumb brute, and on the other by an urgent demand from the expert cynologist and by the prevailing custom. If the veterinarian refuses to perform the operation it will, nevertheless, be performed by others, less qualified and generally much more brutal. It is the author's custom to discourage the practice as much as possible by emphasizing its brutality, and to perform it only at the demand of the obdurate fancier.

The operation should never be performed before the subject is four and a half months old. The preferable age is six months, and in dogs with limber ears it should be postponed until the age of nine to ten months, according to the development of the conchal cartilage. Splendid results can also be obtained on mature dogs, regardless of the age, provided the erection of the ears is fairly pronounced beforehand.

Trimming the ears is also sometimes necessitated when the concha has been deformed by injury.

Investigation among the leading veterinary practitioners of America and Europe, including those who practice canine medicine as a specialty, show that the operation is quite generally performed without thought of offering any apology therefor. It is nevertheless an illegitimate procedure, and described here for the benefit of those who elect to perform it.

RESTRAINT.—Large dogs are secured on the operating table and anæsthetized, while small ones are simply muzzled and held by an assistant sitting upon a low stool. In medium-sized dogs, two assistants are required, one, sitting upon a stool, holding the body between his knees, and the head with both hands, while the other holds the fore-legs with one hand and the hind ones with the other.

Delahanty, a dog fancier of some note, has invented a special table for the purpose, which affords, par excellence, the

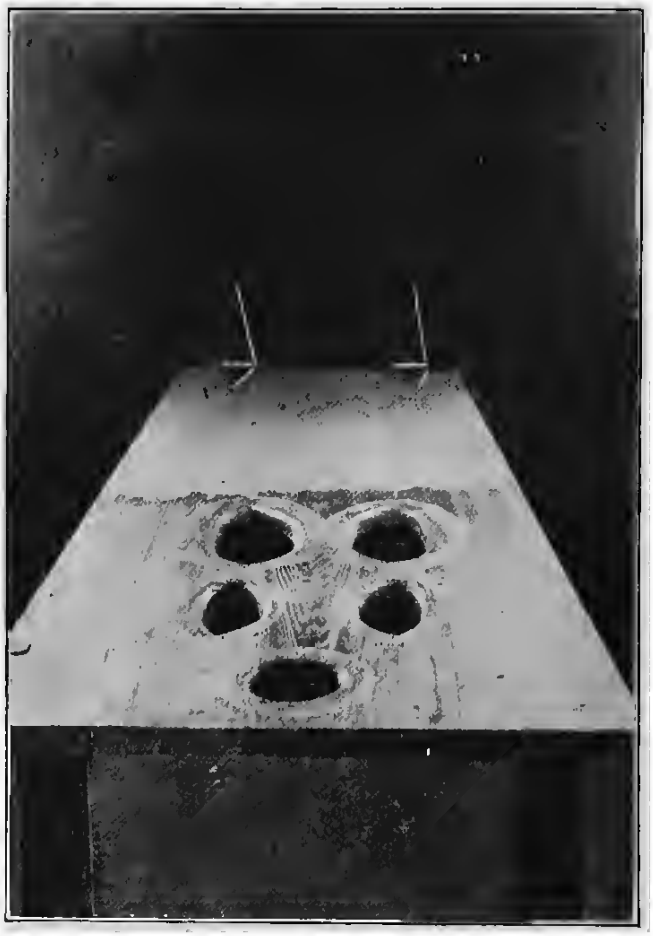


FIG. 197—Delahanty's Table for Trimming Ears.

best restraint for this operation. It consists of an ordinary smooth pine board two feet wide and about four feet long, in which five ovoid holes are made, one for each of the four legs and one anteriorly for the nose. The dog is secured by dropping the legs into the holes and tying them together beneath. The nose is tied with a tape muzzle with which it is drawn through the front hole and there held firmly. This exposes the poll and ears toward the operator and holds the head more securely against movements than any of the other means of restraint for this purpose. (Fig. 197.)

INSTRUMENTS.—

1. Scissors.
2. Artery forceps.
3. Special ear-clamp, (not absolutely essential).

TECHNIQUE.—First Step.—Marking the Length.—The two ears are pinched together with the fingers and stretched upward to the center of the poll, where the anterior edge of both is marked by **one** snip of the scissors to assure uniformity of length. The direction of the snip should correspond to that of the proposed line of amputation of which it becomes a part.



FIG. 198—Trimming Ears with Delahanty's Table.

Second Step.—The Amputation.—The tip and posterior border of the right ear is held in the left hand while the amputation is effected with two or three strokes of the scissors, cutting in the downward direction toward the base of the concha. The shape of the line of amputation in its downward course, which determines the desired design of the trimmed ears, varies from a straight one, to one deeply incurved, according to the breed of the subject and also possibly according to the wishes of the fancier. The left ear, which is somewhat more difficult to trim accurately, is marked out with the

amputated flap of the right one, whose bloody edges trace the proposed line of amputation. Here the left hand supports the base of the concha while the amputation is effected with strokes of the scissors that should correspond in length to

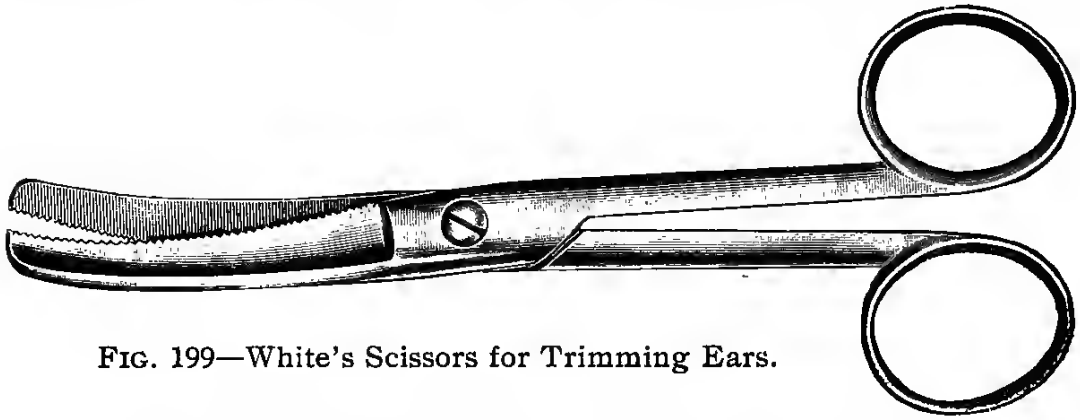


FIG. 199—White's Scissors for Trimming Ears.

those made on the opposite side. The posterior edge and tip may be given moderate support by an assistant to good advantage especially when the concha is frail and floppy.

The use of clamps of various designs is helpful to the



FIG. 200—Trimming Ears with Clamps.

novice. but since ears vary in size and shape, no one design will answer. When these are used they are applied to the ear at the proposed line of amputation, which is effected by cutting along the lesser curvature with the scalpel.

Third Step.—Hæmostasis.—There is always some bleeding from one, and sometimes from two vessels, which spurt quite copiously. These should be at once picked up with the hæmostat and twisted.

AFTER-CARE.—Beginning with the second day, as cicatrization proceeds the ears are submitted to a pulling process daily, to prevent distorting constrictions (kinking) and this should be continued until healing is complete.

In the long, sharp cuts of bull terriers it may be necessary to provide supports in the form of splints. These may be constructed of pasteboard or starched cloth (a shirt cuff)



FIG. 201—Ear Clamp.

cut so as to extend from the tip of one ear down to the poll across the head and then up to the tip of the other. It is held in place with common glue or LePage's liquid, which, when dry, will adhere firmly to the hair, and may be still further fortified against falling off by wrapping the ear and splint with adhesive plaster. If the splint is not stiff enough to remain in the upright position the two tips of the splint may be united with a suture extending across the head. To prevent the dog from molesting the appliance the claws of the fore-legs are covered with bandages.

CHAPTER X.

ABDOMINAL OPERATIONS.

ENTEROTOMY AND ENTERECTOMY.

DEFINITIONS.—**Enterotomy** is the surgical incision of a bowel, while **enterectomy** signifies the excision of a section. **Enterorrhaphy** is the suturing of an intestinal incision. **Intestinal approximation,**—a name frequently used in intestinal operations,—refers to the reunion of the cut ends with sutures or other appliance; and **intestinal anastomosis** indicates the joining of one part of the intestinal tube to another.

INDICATIONS.—The indications for these intestinal operations in veterinary surgery are found chiefly, not entirely, in the ailments of small animals,—cats and dogs. In the large animals they are rarely ever executed successfully, but in the small species, on the contrary, they are now performed with great regularity and with entirely satisfactory results. In view of the possibilities of modern antisepsis the practitioner of veterinary surgery can no longer dodge these operations on any pretense, once a diagnosis has been made with reasonable certainty of its correctness. When a foreign body or immovable fecal matter constitute an otherwise incurable obstruction, the plain duty of the practitioner is to operate promptly. If any damage to the intestinal walls succeeds the intervention **enterectomy** followed by simple **enterorrhaphy** completes the procedure, but if the tube has become unviable or necrotic from pressure, then **enterectomy** and **approximation** or **anastomosis** becomes necessary, according as the lesion indicates.

The principal indications, named in the order of their importance and frequency of occurrence are:—**Foreign bodies lodged in the bowels.** 2. **Coprostasis,** generally constituted of agglomerated bone fragments. 3. Intussusception. 4. Volvulus. 5. Intestinal strangulation. 6. Dilatations.

1. Foreign bodies found in the intestines of domestic animals vary with the species. Those common in carnivora are intestinal worms, marbles, coins, pins, hair-pins, corks, sponges, rags and sticks of wood; in bovines, bezoars, hair-

balls, calculi, clay, rags, wood and rubbish in general; in equines, sand, clay and calculi.

While these objects often sojourn for some time in the stomach, and may even remain there, they usually escape into the intestinal tract and then gradually work their way toward the rectum, whence they are voided with the feces, unless arrested at some point along the course. Although they may be found at any point between the cardiac portion of the stomach and the rectum, their course is generally unchecked until they reach the sphincter ani. However, only those which accidentally lodge between the stomach and the rectum are herewith concerned; rectal obstruction requires no intestinal incision.

2. **Coprostasis** may occur at any part of the intestinal tract, although the colon and rectum of carnivora and the floating colon of solipeds is the most common seat of fecal stasis. In dogs the desiccation of feces is a common occurrence, and generally the arrested mass is constituted of bones, sticks, etc, agglutinated with dry fecal matter. A long section of the tract may be thus affected.

3. **Intussusception and volvulus,** common enough, are seldom diagnosed in time for successful intervention.

4. **Intestinal strangulation** coexists with hernia, especially oscheocele. It is recognized by serious colic and local pain in the hernial sac. This indication demands prompt intervention to forestall inevitable gangrene, and when upon exposure the incarcerated bowel is found either gangrenous or unviable, the only possible chance of recovery lies in enterectomy and approximation. Although there are no substantiating data to offer in defense of these recommendations, as far as they apply to the equine species, their consecration by usage seems unnecessary in view of the hopelessness of the situation under any other routine of treatment.

5. **Dilatations and strictures** are found in aged animals and a suspicion of their existence is created by recurrent attacks of obstinate colics. The exact nature of the lesion is determined only at the operation.

RESTRAINT.— Perfect recumbent restraint and profound anæsthesia answers best for intestinal operations, although now-a-days local anæsthesia is sometimes entirely depended upon for such operations in human beings. The intestines are not sensitive organs, as was once supposed. On the contrary they can be handled, cut and sutured without inflicting any excruciating pain. By cocainizing the ab-

dominal parietes, skin, muscles, etc., through which access to the cavity is gained, operations of considerable magnitude can be performed without pain. In dogs several grains of morphia given hypodermically some twenty minutes before injecting a weak solution of cocaine between the different layers along the line of incision, will produce an anæsthesia under which intestinal operations can often be performed with a measure of success. And finally, spinal cocainization. which, however, has not as yet been adopted as a standard method of anæsthesia in animals, should answer well for intestinal work.

INSTRUMENTS, ETC.—Besides a full set of dissecting

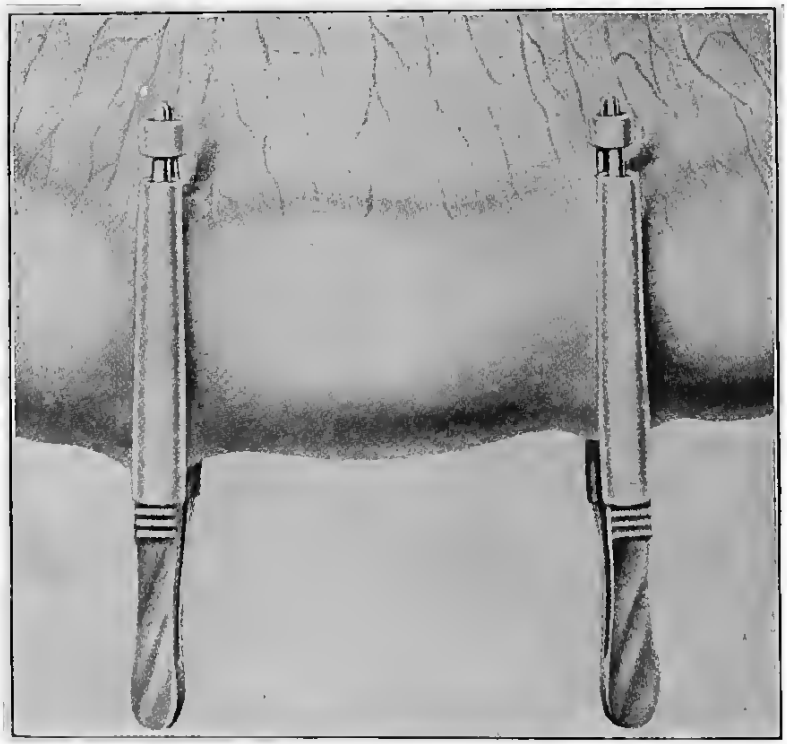


FIG. 202—Regulation Bowel Clamps in Position.

instruments, scalpel, thumb forceps, hæmostats, there must be included a number of round needles, curved and straight ones, previously threaded with chromatized catgut of the proper size, needles, forceps, rubber gloves, antiseptic solutions, razor, clipper, scissors and a pair of bowel clamps. In lieu of the latter Cecil French recommends a pair of common hair-pins, which he holds in place with artery forceps.

ANTISEPSIS.—The antisepsis of intestinal operations must be thorough in every detail. The room, first of all, should be clean and free from flying dust; the surgeon and assistants clean of person and fomites; the patient's body,

especially upon and about the surgical field, should be submitted to a cleansing process of exceptional thoroughness; the antiseptic solutions should be made of sterile water and contained in clean white-enameled basins; the sponges or cotton pledgets used for bailing must under no circumstances be of doubtful purity; the instruments and needles must be well boiled; and finally the asepsis of the sutures must be absolute.

While operating, all parts of the body except the surgical field are kept well covered with sterilized cloth (towels) to prevent the exposed viscera from resting upon unclean parts, and especially to prevent them from becoming contaminated with shedding hairs which are always legion at best.

The wearing of rubber gloves, while not absolutely necessary, is helpful in preventing infection, and in view of the fact that the surgeon must generally occupy himself with the task of handling, securing, and cleaning up the patient just before the operation, the omission of gloves seems sinful when much depends upon a successful result.

Strong antiseptics are uncalled for, except possibly to rinse the skin after it has been clipped, shaved and washed; elsewhere asepsis, and not antisepsis, is depended upon.

TECHNIQUE.—First Step.—Laparotomy.— The abdominal incision made for intestinal operations upon small animals need not vary as to position under any circumstance. It can be uniformly located across the umbilicus parallel to the linea alba, from which position every abdominal organ can be either inspected or palpated fruitfully. The incision may vary in length according to the size of the patient or nature of the lesion. An incision one and a half to two and a half inches long is generally ample, and it should be located so that five-eighths of its length overlaps the umbilicus anteriorly. By thus extending the incision well forward perfect access is gained to all of the abdominal organs, from the diaphragm to the pelvis.

The incision is made a little to one side of the linea alba, where the tissues are better nourished. The skin is first incised by one carefully drawn stroke, then the underlying muscles are divided down to the peritoneum, which is incised either with a probe-pointed bistoury, cutting outward, or else with the scalpel protected with a grooved director. When the patient has been dieted there is little danger of accidentally cutting an intestine, but often in diseased conditions requiring operative intervention the intra-abdominal

tension presses the bowels into the incision, bulging the peritoneum in such a way as to render its incision more hazardous.

Second Step.—Search for the Lesion.—The incision gives access to all of the abdominal organs. The retractors are applied to the wound and attempt is made to locate the abnormality by inspection. If found, the part affected is drawn out through the incision where it can be submitted to the required surgical treatment. If, on the other hand, inspection proves futile, then the entire alimentary tract within the abdominal cavity, beginning with the small intestines, is palpated with the index finger. Failing in this, the bowels are drawn out through the incision little by little until the

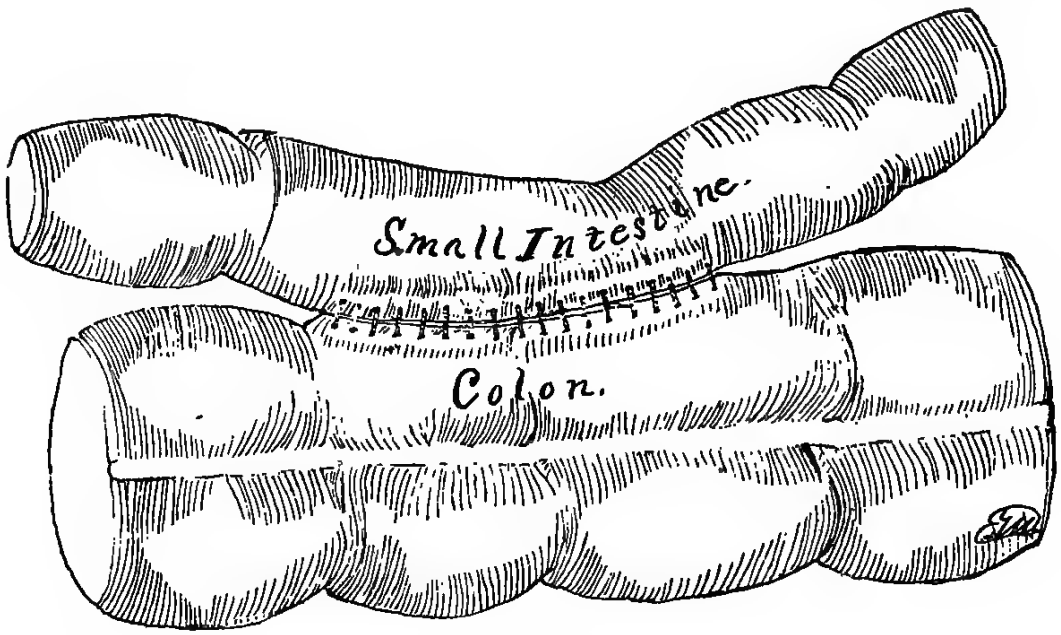


FIG. 203—Lateral Anastomosis.

lesion is found. By first drawing out the small intestines the cæcum, the colon and the stomach can then easily be brought out and exposed to inspection. When the lesion is suspected of being in the stomach, this organ may be first palpated and then drawn through the incision for further examination. The handling of the viscera in this manner is entirely without danger of serious results if gently replaced in the order of their withdrawal.

Third Step.—The Operation Proper.—In enterotomies of the small intestines the incision is made longitudinally, while in the large bowels transverse incision is preferable, and when serious dilatations exist the resection of an elliptical piece to reduce the size may be found advisable. In enterectomies, which in animals is performed only upon the

small intestines, the bowel is cut through transversely in the healthy part on each side of the lesion.

The first step in the execution of such procedures is to return all of the viscera into the cavity except the part to be operated upon, and then prevent them from constantly pushing through the incision by temporarily sewing it up with one or two interrupted sutures until the work is completed and the repaired portion is ready to be returned.

In ordinary enterotomies for the removal of foreign objects an incision is made just long enough to allow the object to be pressed through, but such incision should be made in adjacent healthy parts and not directly over the object where local inflammation caused thereby may interfere with healing. Closing the incision with a Czerny-Lembert suture of catgut completes this part of the procedure.

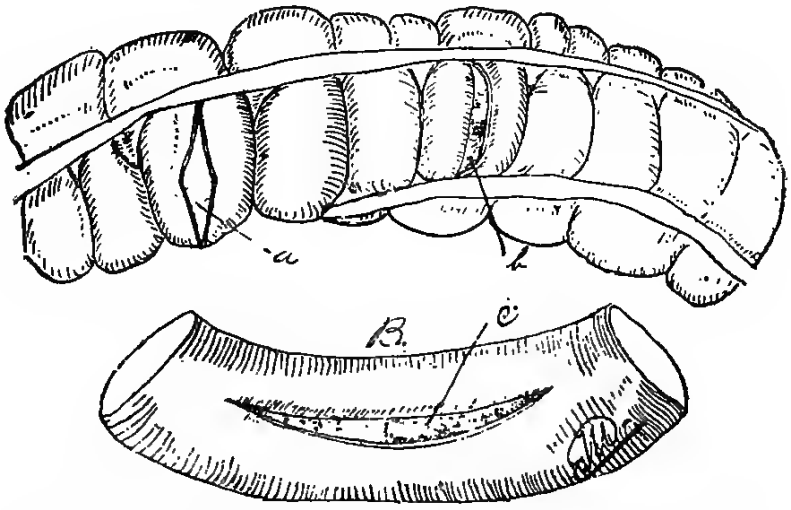


FIG. 204—Enterotomy. *A*, *B*, Transverse Incision. *C*, Longitudinal Incision.

Enterectomy is much more complicated and necessitates first the application of the clamps on each side of the lesion, one-half of an inch from the proposed lines of incision. Next the nutrient vessels supplying the part between the clamps are isolated with the view of ligating only those which supply the part to be excised. The nutrition of the adjacent portions must not be impaired by promiscuous ligation, because good nourishment will be needed to assure healing of the approximated ends. The establishment of collateral circulation will not come to the rescue soon enough.

The clamps being applied and the vessels ligated with catgut the exclusion of the diseased section of bowel including the mesentery within the ligatures may then be executed

by simply making a transverse section one-half of an inch from each of the clamps. The ends are then approximated and united by Czerny-Lembert sutures of catgut.

The Czerny series is first completed around the entire circumference of the bowel; then, without removing the clamps, the Lembert series is placed, leaving the stitch untied until all have been inserted. They are then all tied consecutively except one on each side of each protruding end of the clamps, which are left open to allow the withdrawal of the clamps which, save the protruding ends, are buried by the infolded edges of the bowel. The clamps are then withdrawn and the remaining four stitches are tied.

Fourth Step.—Replacing the Sutured Intestine and Closure of the Incision.—The intestine thus reunited is now replaced in the cavity after removal of the temporary sutures in the abdominal incision, which is then closed by means of the "removable buried suture." (See page 106.)

AFTER-CARE.—In order to arrest all peristaltic movements which would prevent union, the patient is given, per os, several doses of laudanum at different times during the first forty-eight hours after the operation, and the function thus suspended must not be revived for twelve days, at which time a laxative is administered. Only small amounts of liquid food are allowed during this interval, and the allowance of solid food must be limited until the end of the third week.

When such operations are not emergent the administration of opiates should precede them.

SEQUELÆ.—1. **Shock** is is a common occurrence in intestinal operations. It follows immediately the revival from the anæsthetic and is manifested by rigors, coldness of the periphery, whining, weak pulse, inability to stand, and pallor of the visible mucous membranes. The treatment consists of the administration of ammoniacal stimulants, subcutaneous injections of normal salt solution, and above all the application of a taut abdominal bandage.

2. **Peritonitis** supervening three to four days after the operation indicates errors in asepsis. Its occurrence may necessitate drainage of the wound to evacuate septic products. Internally quinine, iron, and nux vomica are indicated.

3. **Perforation** of the intestinal tube through failure of the approximated ends to unite after enterectomy, or of the incision of enterotomy, is the most serious mishap, and in animals is generally fatal owing to the improbability of success from a second operation.

RUMENOTOMY.

SYNONYM.— Gastrotomy.

DEFINITION.—Rumenotomy is the surgical incision of the rumen, for the purpose of evacuating harmful contents. As the operation includes abdominal incision it should, correctly speaking, be known as **laparo-rumenotomy,** or laparo-gastrotomy.

INDICATIONS.—The operation is performed chiefly in oxen; rarely in the smaller ruminants. The conditions necessitating surgical invasion of the rumen are (1) **overloading** with foods that undergo an active fermentative process. (2) **impactions** without fermentation which cause suspension of rumination, and (2) the presence of **foreign bodies,** which ruminants are prone to ingest.

1. **Overloading** of the rumen with succulent grasses, new hay, frosted fodder, soft, unripe corn, swill, garbage, etc., devoured more or less ravenously, is a frequent cause of a threatening, serious abdominal bloat requiring instantaneous relief that can only be afforded by prompt evacuation. In these events the content of the rumen is a churning, bubbling, fermenting mass that can not be evacuated with the trocar and canula, sufficiently to make any appreciable impression upon the intra-abdominal tension, as only a limited amount of gas and ingesta will gurgle from the canula. The administration of antiferments, carminatives, antacids and purgatives is generally futile because, in the emergency due to the accentuating seriousness of the condition, they either fail to exert any beneficial effect or else come to the rescue after the viscera have suffered irreparable damage. The only safe procedure is timely evacuation by rumenotomy. The intervention should be an early one; before the patient is in a dying condition. Delayed rumenotomies are usually unsuccessful.

2. **Impactions.**—The rumen sometimes becomes overfilled with drier contents than the foregoing, from overfeeding and lack of exercise, from inactivity of the rumen due to debilitating diseases or influences; from an insufficient water allowance, or from any of the innumerable circumstances and conditions that cause suspension of rumination.

In these instances the rumen is impacted one-half full, two-thirds full or even to the upper zone with relatively dry ingesta constituted chiefly of the rough forage feeds (hay, fodder, etc) mixed sparingly with the small-grain feeds (corn, peas, wheat, rye, brewer's grain, etc.)

At times the impaction is the cause of the indisposition, while at other times it may only be an effect. In either case, however, it constitutes a serious condition that must be promptly corrected in order to save the patient's life. Here again, timely intervention by rumenotomy is essential to the best results, as delayed operations are usually futile.

3. **Foreign Bodies.**—Besides harboring single harmful objects, such as pointed pieces of iron, wire, or wood, the rumen often becomes the receptacle for foreign objects that accumulate gradually, such as strings, binder-twine, leather findings, sponges, bones, hairs, et. al.

The sojourn of such bodies in the rumen often escapes ante-mortem discovery, although they frequently produce a lasting indisposition that should at least create a suspicion of their existence. Sharp objects may penetrate the diaphragm and cause intra-pleural or even intra-pericardial abcess, while accumulated particles, by constant pressure upon the floor of

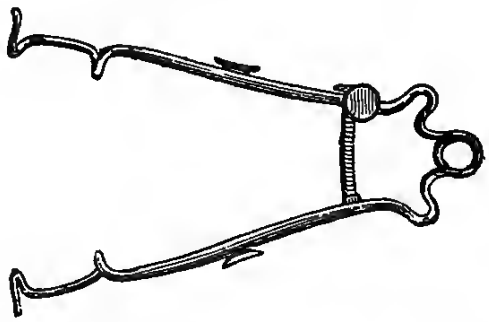


FIG. 205—Spring Retractor for Rumenotomy.

the rumen, cause circumscribed necrosis of its wall. In either instance a fatal ending is inevitable, unless removed before a serious morbidity has evolved therefrom.

In these cases, as in the preceding, early intervention is essential.

RESTRAINT.—The patient is restrained in the standing posture, by means of the stanchion to hold the head, by ropes to prevent decumbency, and by hopples to protect the operator against injury from kicks. In certain emergencies when the patient is down, dying, the crude rumenotomy, consisting of simply thrusting a large knife into the rumen to effect an immediate evacuation, may be performed in the recumbent position, but as soon as the patient is safely out of danger of immediate death the more methodical operation is continued in the standing position.

ANTISEPSIS.—The prevailing impression that cattle are not susceptible to septic complication following abdominal invasion is erroneous, and is the cause of numerous failures in

this and other abdominal operations. Except when instantaneous relief is needed to forestall impending death, rumenotomy should be performed under the strictest possible antisepsis. The field should be shaved, well washed and disinfected and the environs well moistened to prevent flying of loosened hairs. The instruments, and especially the needles and sutures, must be aseptic.

INSTRUMENTS, ETC.—

1. Scalpel, and probe-pointed bistoury.
2. Dissecting forceps.
3. Artery forceps.
4. Spring retractor.
5. Two strong tenacula or tumor forceps.
6. Needles, catgut and silk.
7. Collodion.
8. Antiseptics.

TECHNIQUE.—First Step. Abdominal Incision.—The incision through the abdominal wall is made five inches long, midway between the external angle of the ilium and the last rib, beginning about two inches below the transverse process of the lumbar vertebræ. The incision may be vertical or oblique, preferably oblique, so that all of the abdominal muscles are not cut transversely. The skin and muscles are incised with the scalpel and the peritoneum with the probe-pointed bistoury after it has been perforated inferiorly with the former.

Second Step.—Rumenotomy.—The spring retraction is now adjusted to the incision and the rumen incised in the same direction as the abdominal incision, but the length of the incision should be about one inch shorter. In order to prevent the flow of ingesta into the peritoneal cavity from the very beginning, the rumen is first punctured with the scalpel at that part occupying the middle of the abdominal incision. In acute bloat as the contents gush out with great force, the index finger is immediately hooked into the perforation thus made, and the rumen drawn out as far as possible (four inches or more) where it is held until the flow ceases from the gradual diminution of the abdominal tension. It is important not to make this perforation too long, because sudden evacuation may provoke shock that will manifest itself after the operation is completed.

The abdominal tension having now been relieved, the tenacula are hooked into each edge of the perforation and the incision enlarged upward and downward to the prescribed length.

Third Step.—Removing the Contents.—The contents are then removed, handful by handful, until the rumen is **entirely empty.** The prevailing practice of allowing a part of the contents to remain is inimical to the best results, and should be discontinued. If the hand is large the incision may be made longer than the prescribed four inches, and matter can be further facilitated by oiling the hand and arm to overcome, in part, the friction from the rough mucous membrane of the rumen over which they must travel so often before the enormous mass is removed.



FIG. 206—Rumenotomy. Drawing the Incised Rumen through the Abdominal Incision.

When the operation is performed for the removal of single foreign bodies or accumulated particles previously mentioned, the hand is passed into the rumen, arm's length, and a search made for them.

Fourth Step.—Rumenorrhaphy. — The edges of the wound in the rumen are now cleansed of all adhering particles and then sutured with a Czerny-Lembert of catgut. The Czerny suture alone may answer, but to secure more certain healing the Lembert should be added.

The practice of leaving the wound wide open and depend-

ing upon the adhesion of the contacting peritoneal surfaces to prevent diffuse peritonitis and upon the slow process of cicatrization to finally close the resulting fistula after several months, has rightly been discontinued.

Fifth Step.—Suturing the Abdominal Incision.—The muscles and skin are closed with removable buried sutures or single interrupted ones. A small orifice, which is packed with gauze, is left open inferiorly for drainage.

Sixth Step.—Dressing.—The edges are dusted with iodoform and then coated thickly with collodion.

AFTER-CARE.—Feeding with only limited quantities of liquid food is essential, for if rumination is immediately stimulated by the ingestion of solids the contractions of the rumen will prevent all chances of primary union of the incision.

At the end of eight days the sutures in the skin are removed and the wound submitted to treatment indicated by its condition.

SEQUELÆ.—1. **Perforation of the Rumen** is the most common and the most formidable untoward complication, and while not necessarily fatal, many animals die therefrom, and the patient is always in a more or less critical state of health until cicatrization has finally closed up the breach. When the sutures fail to accomplish their purpose and perforation results there is no other choice than that of allowing the healing process to take its own course.

2. **Hæmorrhage.**—More or less profuse bleeding sometimes occurs into the peritoneal cavity after the wounds have been closed, but as the accident is seldom noticed except on post-mortem when the patient has died from other causes than the hæmorrhage itself, no treatment is ever administered.

3. **Peritonitis.**—Local peritonitis always ensues, and usually results in adhesions of the rumen to the parietes about the region of operation. Diffuse peritonitis, which always results fatally, follows unclean surgery, especially in debilitated subjects.

4. **Shock** is common when the disease for which the operation was performed was of too long standing. Bloats of several hours' duration and necrosis of the rumen from foreign bodies are among the conditions which, when relieved, end in post-operative collapse and death after a few hours. The state is prevented in acute bloat by slow evacuation of the rumen, and in the more chronic conditions by timely intervention.

Aspiration of the Stomach of Horses.

DEFINITION.—A method of evacuating the contents of an overloaded stomach by means of a stomach tube and force pump.

INDICATIONS.—The indication for the operation is the so-called case of "acute indigestion" induced by over-eating. The gastric content is transformed into a semi-solid, fermenting mass that causes serious distress, manifested by colic, bloating and eructations of gas. The disease is often fatal and is always more or less refractory to medical treatment. The administration of antacids, antiferments and purgatives often fails to afford relief until the stomach has suffered irreparable damage and the patient has become exhausted from the long duration of the pain and distress, and severe cases may end fatally in a few hours, or even less, despite the best medical treatment. These facts at once show the wisdom of immediately evacuating the stomach in all cases of ordinary severity and to rely upon medical treatment only in the exceptionally trivial ones. The relief is instantaneous, the cure is perfect and the stomach is protected against damage that would predispose to subsequent attacks. In short, aspiration should be adopted as the standard treatment of acute indigestion, because besides being effectual, it harmonizes with the trend of modern therapeutic ideals. It removes the cause without ceremony.

RESTRAINT.—The operation is performed in the standing position. The head is supported at a convenient height by an assistant. As the patient is already in great pain twitching is unnecessary; and besides the twitch would interfere with the entrance of the tube into the nares.

INSTRUMENTS, ETC.—1. A nine-foot stomach tube.

2. A pump equipped with a nozzle to which the stomach tube can be easily attached and removed.

3. Plenty of water in pails.

The tube should be marked at two points; one 16 inches, and one 5½ feet from the end. The first indicates the distance to the pharynx, the second the distance to the stomach.

TECHNIQUE.—First Step.—Passing the Tube into the Stomach.—The **nasal route** is the preferable one, although some practitioners prefer the **oral route.** The disadvantage of the former is occasional epistaxis provoked by inflicting injury to the nasal mucosa while passing the tube through the nasal meatus, while the latter is objectionable on account

of the opposition the prolonged sojourn of a speculum always provokes.

The tube, previously well oiled, is held in the left hand about fourteen inches from its end and passed into the lower commissure of the left nostril. As the end approaches the anterior extremity of the inferior turbinated bone it is depressed with the index finger of the right hand to direct its course into the inferior meatus. Should it deflect upward into the middle meatus it will pass over the posterior nares instead of into the pharynx, and will be blocked completely

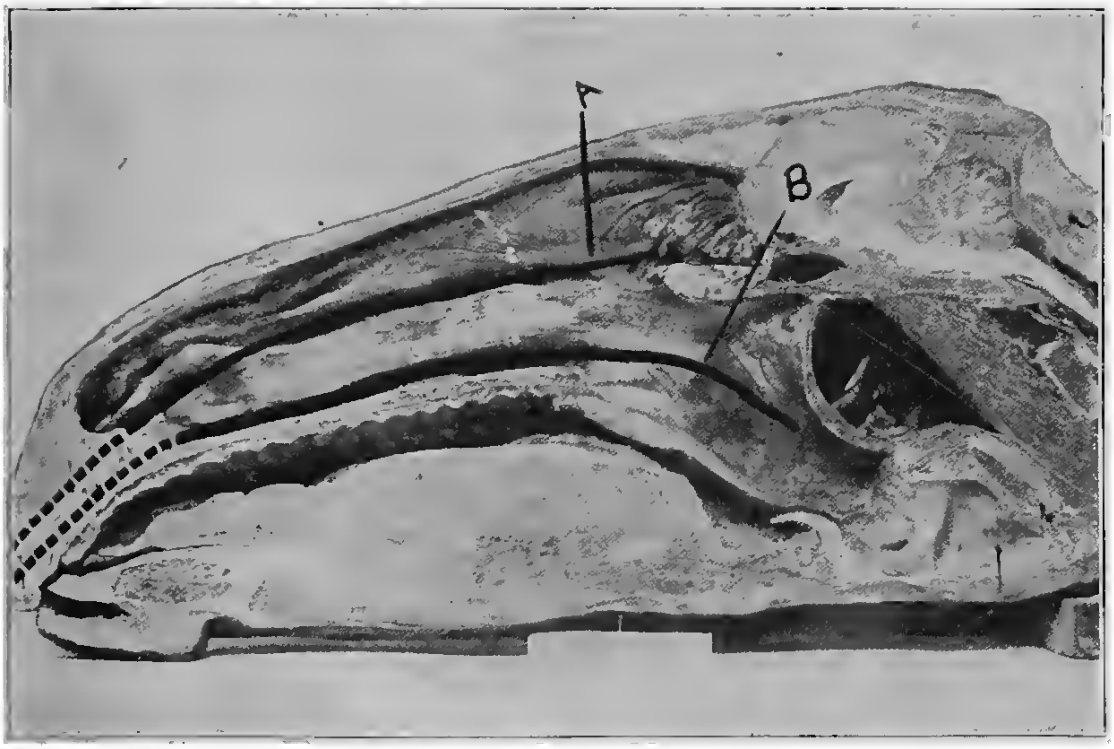


FIG. 207—*A*, Tube Passed in the Middle Nasal Meatus is Seen Blocked by the Ethmoid Bone. *B*, Tube Passed into Inferior Meatus Deflects Downward into the Pharynx and Backward toward the Œsophageal Infundibulum.

against further progress. **The precaution to pass the tube into the inferior meatus is the first important step of the procedure.** As it passes through the nasal chamber all force is avoided and injury from a sudden jerk of the head is prevented by holding the head firm. When the tube has reached the middle of the pharynx, indicated by the sixteen-inch mark on its surface, the fingers of the right hand are placed against the throat while the left grasps the tube four inches from the nostril. In this position an act of deglutition is patiently waited for. It may come almost as soon as the end of the tube enters the pharynx, or some moments may

elapse before any effort to swallow is attempted. If no attempt to swallow is made, after some moments the tube is moved gently forward and backward so as to make an impression of its presence upon the pharyngeal walls. When the fingers of the right hand feel the very first impression of an act of deglutition by the forward movement of the throat, the tube is quickly pushed forward the four inches intervening between the left hand and the nostril. The end of the tube in the pharnyx thus meets the œsophageal infundibulum on its upward movement and thereby passes safely into it. **This manipulation is the secret of the successful introduction of tubes into the stomach of horses.** If ignored by simply pushing the tube onward without ceremony, the end will usually drop into the larynx and then pass downward through the trachea into the bronchi before the unfortunate diversion is discovered. The successful introduction of a tube into the œsophagus requires the assistance of an act of deglutition.

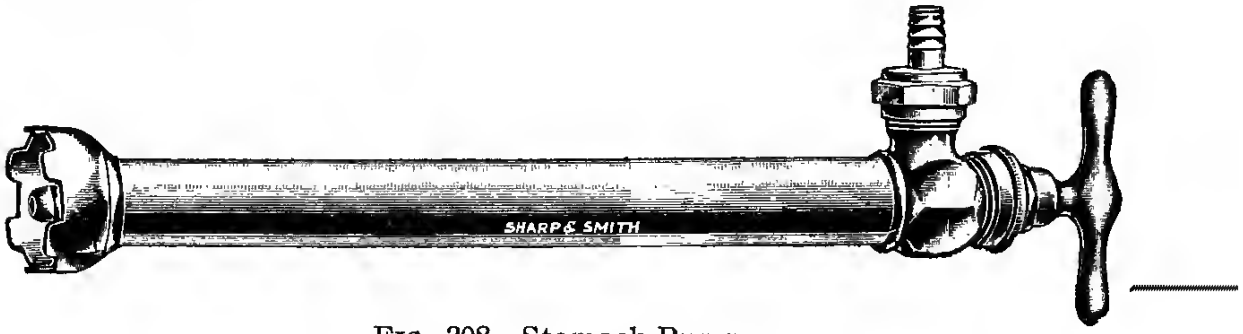


FIG. 208—Stomach Pump.

When the tube has entered the œsophagus, it is quite rapidly swallowed. It requires only a little assistance of the left hand to push it onward foot by foot with each act of deglutition.

As it approaches the stomach, the gurgling of escaping gas and the sour odor of fermenting ingesta give positive assurance that it has not passed into the air passage, which accident is indicated by soft blowing sounds, synchronous with the exhalations, heard at the outside end of the tube.

The entrance of the tube into the stomach is generally announced by an outward gush of semi-liquid chyme or the escape of considerable gas. In the absence of this occurrence, as for example when the tube is inserted for some other reason than the treatment of acute indigestion, its entrance is determined by the approach of the five and one-half foot mark to the nostril, allowance being made for variations in the size of the patient.

Third Step.—Siphonage and Irrigation of the Stomach.—

As above stated the invasion of the cardiac compartment by the tube is immediately announced by a gush of chyme and gurgles of gas. The tube, however, is soon blocked with solid particles which arrest the flow. These are dislodged by driving the obstruction into the stomach with a few spurts of the pump, which then allows another quantity of chyme to discharge. Each time the flow ceases the pumping is repeated, and then alternate pumping and siphonage is continued as long as any of the chyme can be thus encouraged to flow out. When the flow ceases entirely by this process, quantities of water (a gallon or two) are alternately pumped into and drawn from the stomach until the major portion of the contents has been abstracted, and dilution has



FIG. 209—Tube for Stomach Pump.

arrested the fermentation in the coarser particles that could not be withdrawn through the tube.

At first the intra-abdominal pressure forces the contents out, but when the pressure has been diminished by evacuation of gases and chyme it must be restored by repeatedly filling the stomach with water, which, upon being drawn off each time, brings out a certain amount of solid ingesta. Later, as the intra-abdominal pressure becomes normal, the water flows into the intestines and further aspiration becomes impossible, but by this time the stomach and contents have been submitted to a lavage that has effected a thorough cure of the disease.

Fourth Step.—Administration of Medicaments Through the Tube.—Before the tube is withdrawn a quart of raw linseed oil containing one ounce of aromatic spirits of ammonia is pumped into the stomach as a diffusible stimulant, antacid

and purgative. If, however, purgation is deemed unnecessary, two ounces of alchol in a quart of water should be substituted.

Note.—The water injected should be warmed to about 110° Fahr. The practice of dissolving sodium chloride in the water, recommended by Phillips, is helpful, but the total amount of salt injected should be limited to less than a pound. A larger amount, in addition to the large quantity of water that finds its way into the intestines, frequently provokes excessive purgation on the following days.

Some notice should be taken of the amount of water injected in excess of that withdrawn, by injecting from one pail and withdrawing into another, in order to prevent overfilling the alimentary tract unconsciously.

SEQUELÆ AND ACCIDENTS.—1. **Epistaxis** sometimes occurs from wounding the Schneiderian membrane with the tube. The accident occurs while the tube is being introduced or withdrawn, and is prevented by passing it safely and slowly into the inferior nasal meatus, and by avoiding force in withdrawal. A jerk of the head while the end of the tube is invading the middle of the nasal fossa must be provided against, and if the progress is blocked by curling of the tube in the pharynx the use of force will bend it in the nasal meatus and thus injure the turbinated bone.

Epistaxis is never serious but it is always exceedingly annoying and is certain to create anxiety that can not be easily dispelled. The bleeding is seldom profuse and requires generally no special attention, although cold baths over the nasal region and the administration of ergotin hypodermically may be prudent.

2. **Super-purgation** induced by injections of large quantities of water and predisposed by the weakened condition of the intestinal walls, although rare, sometimes supervenes. It is prevented by limiting the amount of water injected to less then five to six gallons. The treatment consists of withholding water and the administration of nux vomica and alcohol in repeated medicinal doses. Opiates seem harmful.

3. **Mechanical Pneumonia** is not usually due to the operation itself, but to the inspiration of regurgitated chyme. and serious bloating may ensue before relief can be afforded. It follows the neglected case, and the case treated by drenches during the sojourn of the gastric tension, but sometimes is caused by unconsciously passing the tube into the bronchi.

4. **Failure to Pass the Tube into the Œsophagus.**—De-

spite everything, the end of the tube may persist in passing into the larynx instead of into the œsophageal infundibulum. The prevention of this annoying circumstance lies largely in abiding by the recommendations laid down in step 1. The stiffness of the tube is also an important factor. If too limber it drops too sharply after passing through the posterior nare and thus glides over the superior surface of the epiglottis into the glottis. The texture of the tube should be sufficiently firm to prevent bending in the pharynx.

CHAPTER XI.

CHOKE.

RADICAL OPERATION AGAINST CHOKE IN SOLIPEDS.

DEFINITION.—A method of washing out œsophageal impactions by means of the stomach-tube and force-pump.

INDICATIONS.—This radical intervention against choke in horses is indicated as a last resort after the more simple methods have failed. Choke in horses is best described as an impaction of the œsophagus with masticated food;—hay, oats, corn, etc. It is often predisposed by a dilatation in the thoracic portion of the tube, due to previous impactions. When food is arrested en masse in the œsophagus of horses the walls are stretched, weakened and then permanently dilated, leaving a cavity that is prone to overload at any time. Dry feed is devoured too rapidly for the defective œsophagus to handle. In the first few attacks the cure may be spontaneous from the contractions of the walls and the copious flow of saliva swallowed, or it may respond to such simple remedies as drenching, washing out with a stomach tube, or the administration of eserine or arecoline hypodermically; but when repeated attacks have produced a dilatation of considerable size and the dilated cavity becomes impacted with feed, a more radical interference becomes necessary.

Formidable chokes are seen chiefly in old horses which have suffered from minor attacks during previous years. On account of the tendency to spontaneous cure the first few attacks may have escaped notice.

In the management of choked horses the practitioner must be governed largely by the age and history. In young animals there is no urgent demand for radical intervention, as the mass will usually dislodge spontaneously, even after sojourning two days or more, if all feed is withheld and abundance of liquids are swallowed or forced into the œsophagus. On the other hand, in older animals, especially those presented with a history of previous chokes, operative relief must not be postponed beyond the first twenty-four hours.

RESTRAINT.—The operation is performed in the stand-

ing position, with the twitch to the nose and cocaine solution injected into the seat of operation.

INSTRUMENTS, ETC.

1. Scalpel.
2. Dissecting forceps.
3. Artery forceps.
4. Rubber stomach tube, nine feet long.
5. Force pump with attachment to fit the stomach tube.
6. A piece of tape one foot long.
7. Needles and silk sutures.
8. Clipper and razor.
9. Antiseptics.

TECHNIQUE.—First Step.—Exposing the Œsophagus in the Middle Third of the Cervical Region.—After a space of two inches wide and four inches long, in the jugular groove about the middle of the left side of the neck has been clipped, shaved and disinfected, an incision four inches long is made over and parallel to the œsophagus through the skin and underlying muscles. The dissection is continued until the finger can be easily hooked around the œsophagus, in the center of the incision.

Second Step.—Passing the Stomach Tube.—The stomach tube, previously oiled, is passed into the œsophagus by way of the left nostril until its buried extremity reaches the impaction.

Third Step.—Ligating the Œsophagus.—The tape is passed around the œsophagus where it has been exposed in the depths of the cervical incision, and tied firmly with an easily released bow-knot. The object of the ligature is to prevent flooding the air passages with the water pumped into the tube to dislodge the mass.

Fourth Step.—Washing Out and Aspirating the Impacted Mass.—The pump is now attached to the tube and water is slowly pumped into it until the intra-œsophageal tension, determined with the finger below the tape, is sufficient to force the water through the mass and yet not sufficient to threaten rupture of the weakened walls around it. As the tension diminishes by the downward dissemination of the water the pumping is resumed and the tension is eagerly guarded to forestall possible rupture. If the water fails to flow downward it is syphoned out by disconnecting the tube from the pump. The syphoned liquid will disclose the character of the impacted mass, which is now dislodged by alternate pumping and syphonage until the water finally flows freely downward into the stomach. The success or

failure of the operation depends upon the judgment displayed in preventing rupture while washing the mass down, or the patience displayed in the slow process of syphoning it outward.

Fifth Step.—Treatment of the Wound.—The tape is untied, the stomach tube withdrawn and the wound closed with interrupted sutures, after dusting it well with iodoform. A drainage orifice may be provided at the lower commissure.

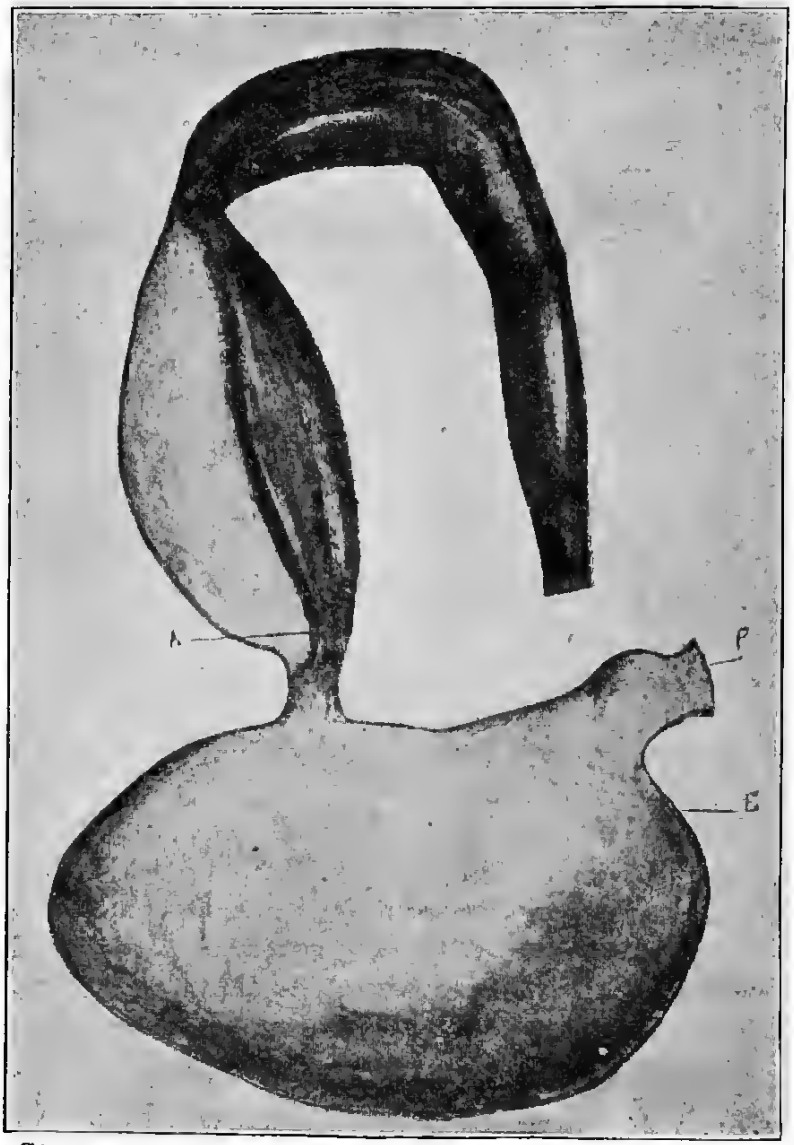


FIG. 210—Stomach and Œsophagus Showing a Large Dilatation of the the Latter.

AFTER-CARE.—The patient is allowed only liquid diet for some days, and then, when the grain and hay ration is resumed, provision must be made to prevent rapid eating. The grain may be fed by spreading it out over a wide surface upon the clean floor, and the hay placed in an almost inaccessible place, a closely fitted rack. This mode of feeding should be continued until the walls have recovered from the influence of the attack.

SEQUELÆ AND ACCIDENTS.—1. **Rupture of the œsophagus** at the seat of impaction is a common accident, when poor judgment is displayed in the use of the pump. It is manifested by an almost immediate appearance of a state of collapse that ends fatally in a few hours.

2. **Recurrence of the choke** is also common, but this can in no way be attributed to the effect of the operation. On the contrary, the operation would tend to prevent recurrence by coming to the rescue of the weakened walls. Recurrence indicates a serious incurable dilatation.

PROCEDURES AGAINST CHOKE IN RUMINANTS.

INDICATIONS.—In ruminants choke presents an entirely different proposition from choke in solipeds. Here the obstruction is generally a solid object lodged on account of hurried ingestion. The obstruction is as frequently cervical in the ruminant as it is thoracic in solipeds, on account of the anatomical disposition of the œsophagus in the two species. In solipeds the lumen diminishes toward the stomach, while in the ruminant it is trumpet-shaped inferiorly.

The treatment of choke in ruminants consists of a number of radical efforts to dislodge the obstruction and ends by sending the subject to the slaughter house if all of them fail.

The routine is as follows:—1. Attempt to move the object into the pharynx, whence it is removed manually. 2. Attempt to push it into the stomach with the probang. 3. Attempt to slice it into small pieces with a fine tenetome passed into it from without. 4. Œsophagotomy.

TECHNIQUE OF ŒSOPHAGOTOMY.—The operation can only be successfully performed in the cervical region. The field over and around the protrusion is cleansed and the œsophagus exposed by a longitudinal incision, overlapping the obstruction superiorly. The œsophagus is incised just above the obstruction, and not immediately over it. At first only a very small incision is made over the anterior part of the object, through which the nature can be determined. If found to be a vegetable or other substance that can be cut into pieces, it is reduced into fragments and removed piece by piece with forceps. On the other hand, if it consists of a more solid body the incision is enlarged anteriorly and the object squeezed or drawn out through it.

The incision is closed with a number of removable buried sutures of catgut (see page 106) and the skin with inter-

rupted silk sutures arranged to provide drainage at the lower commissure.

AFTER-CARE.—The success of the operation depends largely upon the length of the incision. When it is found possible to remove the object through a small incision the operation is but a trivial matter, but on the other hand if the incision is long, and especially if the local inflammation provoked by the sojourn of the object in the œsophagus is acute and verges upon gangrene, the chances of successfully closing the incision permanently are indeed meager. **An œsophageal fistula** will develop despite everything.

The patient is allowed only liquid diet for seven days, and that in such limited quantities that rumination will cease. Healing of a sutured œsophageal incision in ruminants is impossible if its forcible contractions are not in some way prevented.

Operation for Choke in Fowls.

SYNONYM.—Ingluviotomy.

INDICATIONS.—In fowls, choke takes the form of impaction of the ingluvies (crop) with grains, corn, peas, oats, etc, that may sometimes end fatally if not relieved. The condition is diagnosed by a general malaise, and palpation of the craw, which stands out prominently. The economic importance of operation is small except in selected individuals reserved for special purposes. Frequently during the author's career, prize cocks and pullets, pit cocks, homer pigeons, pet fowls and parrots, presented for treatment have been found suffering with this condition, and in every case the evacuation of the contents by incision was successful except where the walls of the crop were found gangrenous when incised.

TECHNIQUE.—The operation is preceded by plucking the feathers from the surface of the crop and disinfection with mercuric chloride solution. A longitudinal incision is made on the median line about two inches long, varying with the size of the patient. The cutaneous incision immediately exposes the impacted sac which is then opened by an incision somewhat shorter then the former. The contents are removed by pressure, the cavity washed out and then closed with interrupted silk sutures, dusted with iodoform and painted with collodion.

AFTER-CARE.—The patient is made to subsist upon a limited semi-liquid ration of mush for one week, at which time the cutaneous sutures are removed.

CHAPTER XII.

MISCELLANEOUS MINOR OPERATIONS.

OPERATION FOR HOOF CRACKS.

INDICATIONS.—Hoof-cracks or sand-cracks, as they are usually called, are classified according to position into **toe-cracks** when located anteriorly and **quarter-cracks** when situated in the quarters. They are **complicated or uncomplicated** according to whether or not they extend into the sensitive laminæ or the coronary cushion.

Natural thinness of the wall, brittleness of the horn, contraction of the hoof, dropping of the sole (pumice foot) and certain definite conformations are so many predisposing states which leave the wall susceptible to fracture under the influence of more or less violence in the form of severe traction or hard pounding. There are, however, numerous toe-cracks, especially in the hind feet of draft horses, that develop in the absence of any perceptible predisposing influence, apparently from sheer violence. Predisposition, as a cause of hoof-cracks, is more influential in quarter-cracks than in fractures at the toe. The most formidable hoof-cracks, however, although not the most common, are those caused by a diminished production of horn at an isolated spot on the coronary cushion, due to previous disease or injury. The tread of a sharp calk, a necrotic inflammation, a quittor or any wound that destroys a part or all of the coronet at a definite spot, often results in the outgrowth of a "through and through" seam, because the production of horn from the injured point does not keep pace with the growth from the parts immediately adjacent. This variety of hoof cracks is either incurable or else will yield only to a special treatment hereafter mentioned. (See after-care.)

As regards surgical treatment, hoof-cracks should be divided into two classes, viz.;—(1) Those in hoofs having an integral coronary cushion, and (2), Those in hoofs whose coronary cushion possesses a local defect. The former will yield to treatment, whilst the latter, owing to a serious loss of coronary substance, may be incurable. In the selection of cases for operation the condition of the coronet is, there-

fore, of capital importance, and when the defect therein is extensive, there is little chance of success from any method of treatment. On the other hand, in cracks of purely accidental origin in fairly good feet whose coronary cushions have suffered no local damage, operative intervention is usually successful.

The object of hoof-crack operations is to start a sound (uncracked) growth of horn from the coronet by destroying the spot in the cushion where the separation of the horn-fibers begins. To this end various methods are practiced, the simplest of which is the burning of a tranverse fissure through the hoof at the uppermost end of the crack, followed by blistering, clamping of the crack, and special shoeing. That this simple procedure is often successful, even without

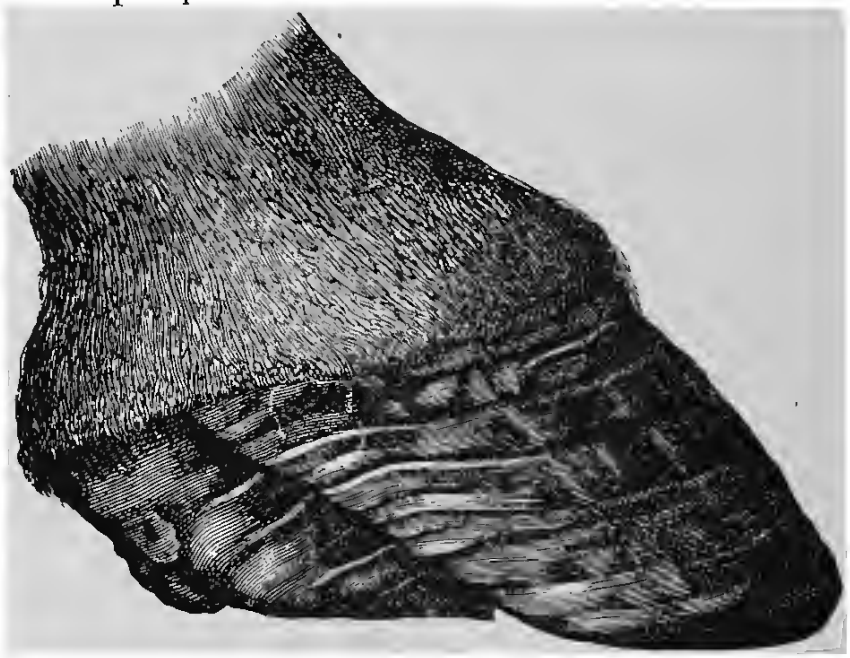


FIG. 211

incapacitating the horse for work, is not denied, but the failures are too numerous to warrant its general adoption.

RESTRAINT.—The recumbent position on the operating table and cocaine anæsthesia of the plantar nerves, is the preferable restraint, although with the aid of plantar cocainization and the twitch it is possible to perform the operation in the standing position, especially if but one foot is affected. In bilateral cases, the work is very tiresome in the standing posture and the opposition provoked is inimical to the best results.

ANTISEPSIS.—In order to be successful it is necessary to forestall infection of the surgical wound by pre-operative, operative and post-operative antisepsis. Infective inflammation, while not especially dangerous, prolongs the period of

convalescence and often causes an annoying claudication. The field about the coronet must therefore be clipped and shaved, rinsed with mercuric chloride solution 1-500 and then bathed for some moments with alcohol. The instrument must be sterilized.

TECHNIQUE.—First Step.—A rubber tourniquet is wrapped around the metacarpus to prevent bleeding; a V-shaped piece of hoof is removed along the crack from the coronet downward about two inches for toe-cracks and one and a half inches for quarter-cracks. In toe-crack the base of the V extends about one inch on either side of the crack;



FIG. 212

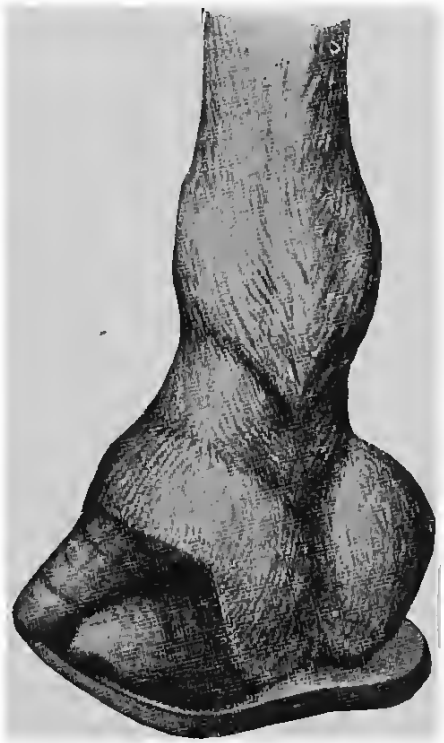


FIG. 213

FIGS. 211, 212 AND 213—Forms of Incurable Hoof Cracks.

that is to say, it is about two inches wide across the top. For quarter-crack this dimension should be only about one inch long, in order to conserve to the quarter as much weight-bearing strength as possible.

The piece is removed by cutting the two grooves from above downward completely through the wall and then prying it off with a strong chisel or special forceps constructed for that purpose. By removing the piece as a unit instead of paring it off with the hoof-knife the laminæ and coronary cushion are left clean without any mutilation.

Second Step.—Destroying the Focus of the Crack in Coronary Cushion and Laminæ.—With the horn thus stripped off the involvement of the sensitive structure is plainly seen.

The crack may be seen to extend deeply into the coronary substance and completely through the sensitive laminæ to the periosteum. Sometimes the existence of small exostoses along the crevice announces a previous involvement of the os

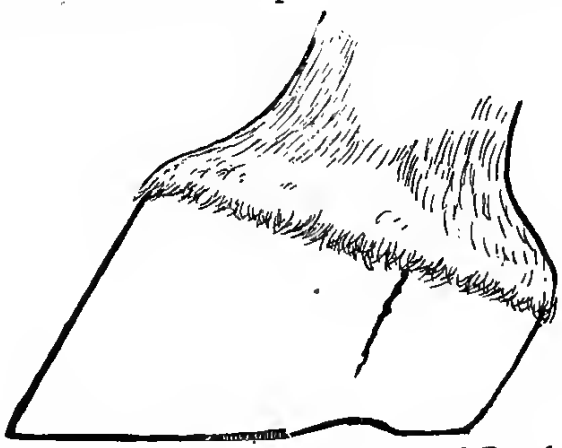


FIG. 214—Form of Curable Hoof Crack.

pedis itself, and in acute cases sloughing of the laminæ and exfoliation of a segment of bone is a common occurrence.

The aim in this step is to remove harmful elements and then to shave off the coronary cushion uniformly along the

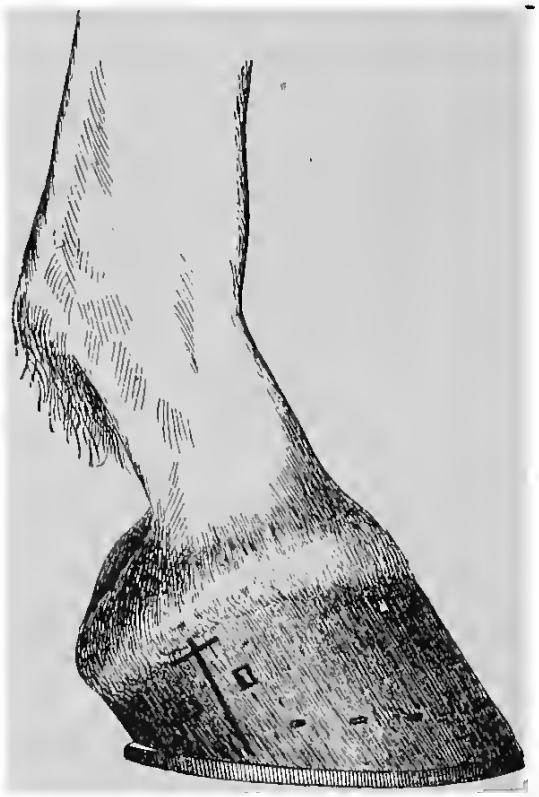


FIG. 215—Farrier's Simple Procedure against Hoof Cracks.

whole exposed portion, as deep as the crack extends into its substance, so that the hoof will thereafter grow out as a unit. The laminæ are trimmed slightly along the crevice, especially of its black, dirt-containing portions.

Third Step.—Dressing.—The exposed tissues are then treated to a strong antiseptic, covered with cotton and bandaged taut to prevent bleeding. The most effectual antiseptic

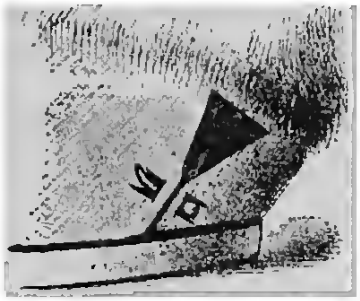


FIG. 216—The Author's Operation Complete.

treatment consists of painting the raw space with tincture of iodine and then dusting it liberally with pure iodoform.

AFTER-CARE.—The bandage is removed every twenty-

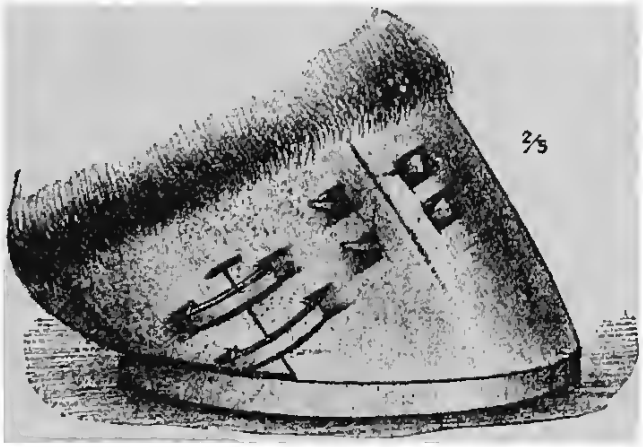


FIG. 217

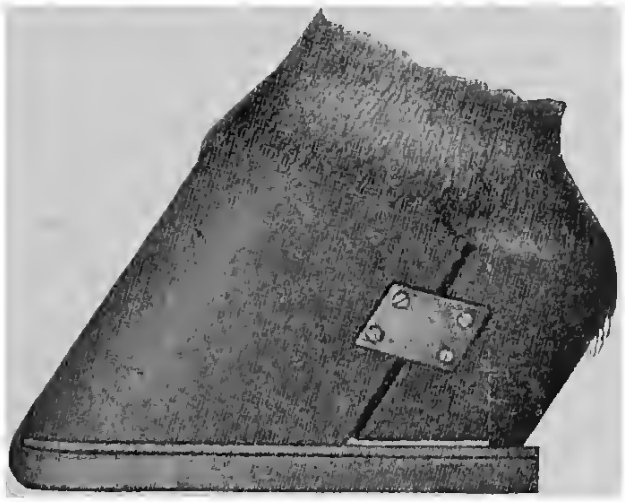


FIG. 218

FIGS. 217 AND 218—Forms of Clamps.

four hours and the same treatment applied until the growth of horn covers the whole V-shaped area.

The success met in preventing a recurrence of the crack

will now depend upon paring off the new growth as soon as a crack appears in it and when there has been a previous damage to a spot in the coronary cushion that retards the production of horn thereat, the horn at each side of the damaged spot must be pared frequently so that the whole will grow evenly. Four to six weeks' idleness is advisable.

SEQUELÆ.—Infective Inflammation.—If such an operation is performed without regard for antisepsis a serious infective inflammation supervenes, and results in annoying lameness, the growth of troublesome granulations, and generally failure of the whole enterprise. Although rare,

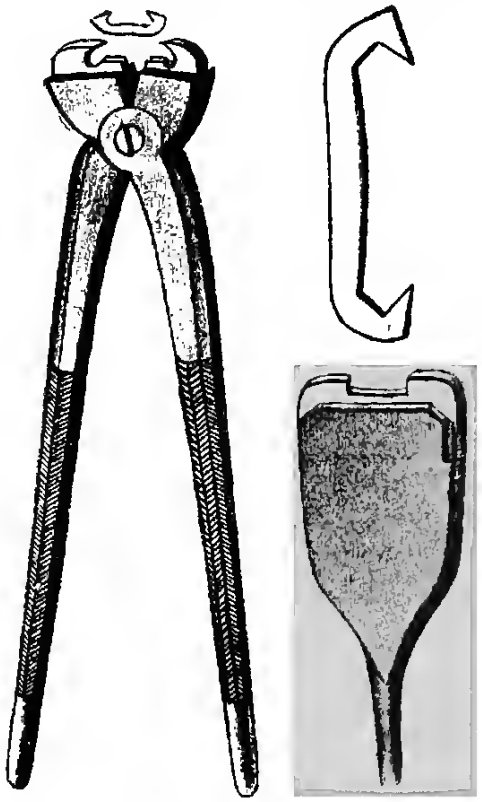


FIG. 219—Clamps and Pincers.

it is possible for such inflammation to implicate the underlying tendon and bone, and even end fatally.

2. **Recurrence of the Crack.**—As the operation does not help the predisposing cause recurrence at any future time is common. The hoof may be too weak, too deformed or too brittle to withstand the strain to which it is submitted, and if protection by special shoeing does not prevent re-fracture of the horn, the condition may be given up as hopeless.

SHOEING AND CLAMPING.—For toe-cracks the bar shoe, fitted to support some weight at the frog, is the best. The shoe should be nailed tight with four nails on each wing and two at the toe, and in addition, three toe-clips should be

turned up, one at the center of the toe and one on each side to serve as immobilizing clamps. It is also essential to clamp the crack just below the apex of the V-shaped excavation with plate, clamp or shoe nail. The latter gives the best service, as well as being the easiest to apply.

For quarter-cracks a bar-shoe with a light bar that does not touch the frog is the preferable one. The bearing should be uniform throughout the entire circumference of the wall. The practice of removing any part of the pressure from the affected quarter by paring away the wall so that it does not contact the shoe, is exceedingly harmful. Friction between the edges of the crack is increased thereby instead of being diminished. The wall lying posterior to the crack, if not supported, moves with each step and thus maintains a state of irritation along the crack; and besides, it tends to cause fracture of the new growth above. The shoe should be nailed tightly and if possible a special nail should be driven behind the level of the crack for the purpose of producing perfect immobilization of the part. In addition, clamping may be practiced, but as the wall of the quarter is often very thin, care must be exercised to avoid injury to the sensitive laminæ. The brass plate, fastened with short screws, is the safest method of clamping quarter cracks.

Operation for the Cure of Slit Ears.

INDICATIONS.—The conchal cartilage of horses and oxen are sometimes accidentally slit from contact with sharp objects, and where animals run at large slitting is often practiced for the purpose of identification. The demand for curing the disfiguration comes as soon as such animals are offered for sale or fall into the hands of fastidious owners. In the case of valuable horses the permanent obliteration of such damaging blemishes is always a matter of serious moment.

When the breach is accompanied with loss of substances the permanent union of the edges is not always possible, but when the solution of continuity is but a simple incision the following intervention seldom fails:

RESTRAINT.—The operation can only be performed in the recumbent position. It is quite a long, tedious procedure, to which any horse will object by movements of the head that would interfere with its proper execution.

INSTRUMENTS, ETC.—

1. Scalpel and scissors.
2. Dissecting forceps.

3. Artery forceps.
4. Small curved needle and silk suture.
5. Razor.
6. Antiseptics.
7. Collodion.

TECHNIQUE.—First Step.—Preparation.—The ear is shaved within and without about one-half inch from each edge of the breach and then submitted to a thorough scrubbing with antiseptics.

Second Step.—Preparing the Edges.—The cicatricial tissue along the edges is trimmed off with the scissors or scalpel, thus exposing the two layers of skin and the cartilage between them. The cartilage along each edge is then excavated from between the two layers of skin to the depth of

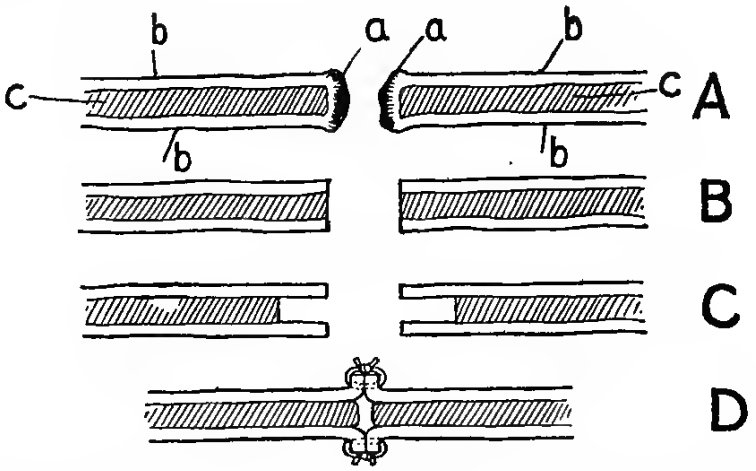


FIG. 220—Schematic Diagrams of the Author's Operation for Slit Ears.
A—*a*, *a*, Scar Tissue. *b*, *b*, *b*, *b*, Skin. *c*, *c*, Cartilage.
B—The Edges Denuded of the Scar Tissue.
C—The Cartilage Excavated beyond the Edges of the Skin.
D—The Skin Flap Sutured.

about three-sixteenths of an inch from the skin margin, thus leaving two skin flaps on each side which can be united to each other separately.

Third Step.—Hæmostasis.—The subcutem of the concha contains several large veins that may be divided in the course of the above dissection, the bleeding from which must be arrested before proceeding with the next step. Otherwise the space intervening between the two sutured flaps will fill up with a harmful clot, and the flow of blood through the sutured edges will delay the application of the adhesive dressing. The bleeding is met by searching for the vessels and then twisting them with hæmostats. The capillary oozing, which sometimes persists stubbornly, is allowed to stop spontaneously before the suturing is attempted.

Fourth Step.—Suturing the Edges.—The edges of the skin of each side are united to each other separately (Fig. 220). The suturing begins on the internal surface owing to the fact that the convexity renders the edges of skin rather inaccessible after the external flaps have been closed.

The suturing is effected by means of closely placed interrupted sutures adjusted so as to positively prevent infolding of the edges, which accident would prevent union. The external flaps are then united in the same manner.

Fifth Step.—Dressing.—The part is rinsed with an antiseptic solution, dried, dusted along the sutures with iodoform, and then coated over with several thick layers of collodion.

AFTER-CARE.—If the patient shows any inclination to rub the ear against the manger, it is tied on the pillar reins. No dressing is required until the eighth day, at which time the collodion is teased off and the sutures inspected. If union of the edges seems safe they are removed.

McQueen's Operation for Conchal Hæmatoma.

DEFINITION.—A method of applying sutures through the concha for the purpose of obliterating the sac and encouraging cicatrization of traumatic sanguineous sac of the ear.

INDICATIONS.—The ears of both the dog and the cat are susceptible to the development of an exceedingly refractory sanguineous or serous sac located upon the internal and sometimes on both sides of the concha. It is caused by violence that provokes the accumulation of blood or serum beneath the perichondrium, and since cartilage is little inclined to undergo any active regenerative process the sac persists by re-filling as often as the contents are evacuated, until finally a marked distortion of the cartilaginous tissue results. Repeated evacuation by aspiration or lancing with or without antiseptic irrigations, is seldom successful, and spontaneous recovery is rare. Injections of tincture of iodine, adrenalin, and strong astringents have been recommended, but the results are seldom satisfactory. The method of McQueen, herewith described, is the most effectual treatment against this obstinate condition:

TECHNIQUE.—The hair covering the area affected is clipped and shaved internally and externally, and the surface is washed with a potent antiseptic. The content of the sac is then evacuated through a liberal incision located at the most dependent part. Then a series of interrupted sutures

arranged in the form of a leaf are passed through the ear so as to bind down the separated perichondrium against the cartilage. The sutures are tied rather loosely to prevent sloughing. (Fig. 221.)

White's method consists of an incision of the whole sac longitudinally, and the insertion of one or two through-and-through sutures on each side, one quarter of an inch from the edges. He further treats the parts beneath the edges with tincture of iodine. Deformation of the concha from this method is rare in dogs, but is frequent in cats.

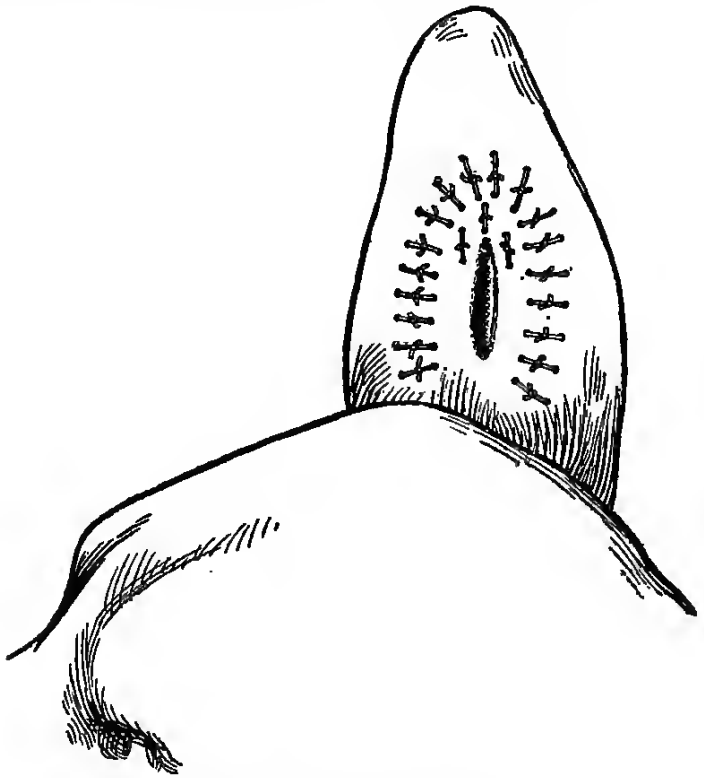


FIG. 221—Arrangement of Sutures and Incision in McQueen's Operation for Conchal Hæmatoma.

AFTER-CARE.—The after-care consists of squeezing out the fluid that accumulated amongst the sutures, protection of the ear against self-inflicted injury by the application of a hood, and the removal of the sutures at the end of eight to ten days.

ABLATION OF SHOE-BOILS.

INDICATIONS.—The hygroma of the elbow whose walls have hypertrophied into a permanent neoplasm under the influence of constant injury, can be removed only by total ablation. So long as the walls are thin and the enlargement is constituted largely of a sac, lancing, antiseptic irrigations,

and protection against further injury is usually successful, but after the growth has hardened and the sac has been almost obliterated by encroachment of the hypertrophied tissue, the deformity will persist despite any kind of palliative treatment. A hardened shoe-boil may diminish in size by accidentally escaping injury for a long time or from the constant protection of a "shoe-boil roll," or by preventing decumbency; but a part of the growth always remains, ever ready to suddenly enlarge under the least provocation until ablation is practiced.



FIG. 222—Typical Specimen of Shoe-Boil.

While a shoe-boil is undergoing transformation from a temporary soft enlargement to a permanent hardened body, the wisdom of radical intervention may be doubtful, since so many of them disappear from simple treatment; but as soon as the permanency of the growth is established beyond doubt, ablation may be insisted upon as positively the only cure.

RESTRAINT.—The operation can be successfully performed only in the recumbent position, and for the ablation of the larger specimens general anæsthesia is advisable. Ex-

ception may be made of very small growths whose entire surroundings could be anæsthetized with cocaine solution.

INSTRUMENTS, ETC.—

1. Scalpel and scissors.
2. Dissecting forceps.
3. Artery forceps, several.
4. Tenacula (two) or two tumor forceps.
5. Thermo-cautery.
6. Needle and braided silk sutures.
7. Razor and clipper.
8. Antiseptic solutions.

ANTISEPTICS.—Ordinary antisepsis, indicated for dissections in general, is essential. This includes sterilization of the instruments, cleansing of the field and disinfection of the hands.

PRE-OPERATIVE PREPARATION.—The cleansing, shaving and disinfection should precede casting, and as this is being done the proposed lines of incision to make the resection of an elliptical section of skin (see step 1) are marked out by snipping the skin here and there along the course with the scissors. This is necessitated by the changed relation of the skin to the growth when the patient is recumbent. If this trivial matter is not respected the sutured incision, when the horse regains the standing position after the operation, may be found to be markedly oblique instead of vertical.

TECHNIQUE.—First Step.—The Cutaneous Resection.—An elliptical piece of skin is resected perpendicularly across the whole growth, following the lines previously marked out. The width of the section must vary according to the amount of redundant skin that will result from the dissection, and it must in addition include within its area all of the orifices of fistulous tracts the growth may contain.

Second Step.—Dissection of the Growth.—The growth is then grasped with the tenaculum or tumor forceps and drawn up firmly by an assistant as the skin is carefully dissected loosely around the entire surface. As the growth is composed largely of hypertrophied corium the separation can only be done by sharp dissection which is carried as near to the epiderm as possible. A thick flap is avoided, but care must be taken not to "button-hole" the flaps as the dissection proceeds.

Spurting vessels encountered are "touched up" with the thermo-cautery or twisted with the hæmostatic forceps.

When the dissection has reached the base of the growth

its remotest boundaries are sought in order that every vestige of the hypertrophied tissue be removed. Beginning above, the growth is then detached from the elbow to which it is attached by loose areolar tissue. At this point of the dissection, the nutrient vessels, if observed, are ligated, but if they escape notice the ligation or torsion follows the ablation.

Third Step.—Hæmostasis.—The success of the operation depends much upon the thoroughness with which the bleeding is controlled before the flaps are united by sutures. To simply suture the flaps and then leave the cavity to fill up with a large blood clot destroys the chances of success. The bleeding is patiently combated with forceps, ligatures and



FIG. 223—Wound Properly Sutured after Ablation.
(Bayer & Frohner.)

the thermo-cautery and then after waiting some ten minutes for the appearance of a secondary bleeding from vessels previously unobserved, the wound may be closed.

In tractable horses the suturing may be done in the standing position to excellent advantage, an hour or even more after the ablation has been completed. The bleeding has then ceased and the accumulation of a clot in the cavity is prevented.

Fourth Step.—Suturing.—The flaps are drawn together by two sets of sutures.—a set of mattress sutures about three-quarters of an inch from the edges and continuous sutures to complete a perfect approximation. At the lower end a drainage orifice is provided and is packed with gauze.

Fifth Step.—Dressing.—The sutures are treated with a dusting of iodoform and then covered with collodion.

AFTER-CARE.—The patient is made to suffer the discomfort of remaining in the standing position for at least twenty days, and under no circumstance must this feature of the after-care be omitted or neglectfully performed. Lying down, even for a moment, will eliminate all chances of success. To relieve the patient from fatigue as well as to assure against accidental decumbency slings, after the first week has past, are an excellent safeguard. The mattress sutures are removed on the sixth to the seventh day and the continuous sutures some days later. If at the time of their removal the union seems frail or imperfect at any part the breach is mended with well adjusted interrupted sutures.

The drainage orifice is kept open by daily renewals of the gauze packing and by moderate injections of hydrogen peroxide.

SEQUELÆ AND ACCIDENTS.—1. **Shock** is a common sequel of operations upon very large shoe-boils, performed without anæsthesia. The loss of blood and the pain of a long, tedious dissection is a trying ordeal to which even the most vigorous animal may succumb. The prevention lies in the administration of chloroform and in rational hæmostasis, during as well as after, completion of the dissection.

2. **Failure of the flaps to unite** is the chief misfortune, since the wound must then undergo a slow process of cicatrization as an open wound that often ends in the formation of a new growth quite as large and always much more unsightly than the original one. The cause of this accident may be sepsis, inadequate drainage, stitch suppuration, decumbency, or unusual movements of the leg from walking, fighting at flies, etc. With these causes provided against, union always occurs at the proper time and the internal cicatrization is practically complete at the end of twenty days.

The treatment of this accident consists of re-suturing the edges after having trimmed off the granulations they now contain. In the restive horse that seems destined to move despite all usual means of prevention, a leg brace that will immobilize the carpus, by thus limiting the elbow flexion, is often helpful. When re-union is found impossible on account of the swollen condition of the flaps, open wound treatment is the only recourse. The wound is then treated frequently with strong astringent washes (zinc sulphate ten per cent.) and the standing position maintained until cicatrization has well advanced.

HUGHES' OPERATION FOR BOG-SPAVIN.

DEFINITION.—Ligation of the vena saphena above and below a bog-spavin, for the purpose of diminishing the size of the fluctuant tumefaction.

INDICATION.—Bog-spavin belongs to that class of synovial distentions that are predisposed by lack of support of the capsule. The stimulation of synovial secretion incident to severe exertion, rheumatic diatheses or aberrations of growth and development, cause the capsular ligament of the tarsus to bulge between the tendon of the flexor metatarsi and the internal straight ligament, a triangular space unsupported by any structure except the elastic common integument. This space is traversed diagonally by the large vena saphena, which, if slightly varicosed, adds to the size of the enlargement.

By ligating this large vein a clot forms within its walls, which, after undergoing the usual transformation into a firm connective tissue thrombus, produces a substantial support to the distended capsule, and generally a marked diminution in its size.

The exact value of this operation has not been determined by sufficient experience to warrant its absolute adoption in the treatment of bog-spavin. Hughes, however, recommends it highly and even claims that it cures the lameness that sometimes accompanies old bogs by incarcerating within the ligature the one or sometimes two internal saphenic nerves that follow the course of the vein. The fact, however, that this nerve is little concerned in supplying sensation to the tarsal structures leaves the theory somewhat unsupported.

RESTRAINT.—The operation can be performed in the standing position by the aid of the single side-line to raise the opposite leg, and local cocainization of the two small fields of operation. The recumbent position on the operating table with the addition of cocaine anæsthesia is preferable.

INSTRUMENTS, ETC.—

1. Razor and clipper.
2. Scalpel and dissecting forceps.
3. Aneurism needle, or common full curved needle.
4. Sterilized catgut.
5. Antiseptics.

TECHNIQUE.—Two spots, one on the course of the

vena saphena **above the internal malleolus** of the tibia, and one at the point where the vein **traverses the cuneiform,** are clipped, shaved, cocainized subcutaneously and disinfected. At each of these points, beginning at the uppermost one, an incision is made over the vein three-quarters of an inch long, and after dissecting the skin loose from around the vein a catgut ligature is slipped around it by means of the aneurism needle or the simple full curved needle. Before tying the ligature the undermost point is treated in the same manner; then both are tied with double surgeon's knots and a crucial stitch placed in each of the cutaneous incisions, which are then dusted with iodoform and coated with collodion or clay dressing.

AFTER-CARE.—The cutaneous stitches are removed in eight days, which is the first interference the wounds, if properly made, will require. The catgut absorbs and therefore requires no further attention. The horse is ready for work in twenty days.

SEQUELÆ AND ACCIDENTS.—There are no special known sequelæ of the operation, although it would only be reasonable to suspect that **embolic conditions** might sometimes follow unexpectedly, as sometimes happens after the ligation of large veins. Accidental incision of the vein while dissecting it out may occur, but beyond delaying matters for a few moments while adjusting the forceps no complications result.

Evacuation of the Guttural Pouches.

The guttural pouches are sometimes, although rarely, the seat of a purulent accumulation which manifests itself by more or less dyspnœa and by a nasal discharge that becomes conspicuous during mastication and during exertion. The accumulated product, at first liquid, becomes desiccated by its long sojourn in the dependent part of the pouch, and on account of the constant churning to which it is subjected by the movements of the jaws it becomes rolled into spherical bodies resembling whitish marbles. Recently the author found the right guttural pouch of a horse impacted with oats. Its evacuation can be effected by two methods, **hyo-vertebrotomy** and **staphylotomy,** the former of which is the preferable one.

Hyo-vertebrotomy is performed in the lateral recumbent position under general anæsthesia. The parotid region is clipped, shaved and disinfected, and an incision made through

the skin along the posterior border of the inferior maxillary and just anterior to the border of the wing of the atlas. It is intended that the incision should approach the pouch between the jaw and the anterior border of the parotid gland, where it can be safely carried inward without danger of cutting any of the large vessels for which the region is noted. The cutaneous incision, to gain a good view of the tissues underlying the skin, should be no less then four inches long and held apart with retractors, as the subjacent dissection proceeds. The incision of the tissues beneath the skin may be much shorter; one inch long is sufficient. It is carried inward with the border of the parotid posteriorly and to the thick edge of the jaw anteriorly, in plain view. As the round stylo-maxillaris muscle comes into view anteriorly just beneath the edge of the jaw, the pouch is already open; the finger can be pushed into it, and when distended with purulent products these immediately flow out. The evacuation is effected by pressure, spooning and irrigation. Subsequently, drainage is provided by keeping the incision plugged with

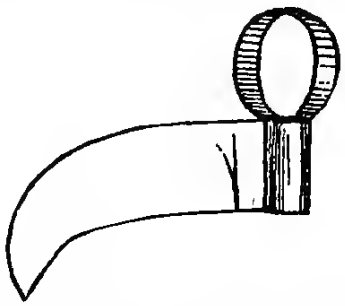


FIG. 224—A Pattern of Simple Staphylotomy Knife.

gauze. Antiseptic irrigations of the pouch with peroxide of hydrogen and mercuric chloride, followed later with astringent washes of zinc sulphate three per cent., should be continued as long as the orifice can be kept open; but as the catarrh of the mucous membrane is not always cured, recurrence of the trouble may be expected sooner or later.

Staphylotomy as applied to surgery of the guttural pouches does not refer to incision of the pouch itself, but to slitting the velum for the purpose of admitting the hand into the pharynx with the ulterior object of incising the pouch. The operation is the invention of Wyman, who, in company with the author, performed it for the first time in 1898 on a large draft horse suffering from an impaction of the left guttural pouch with a quart or more of desiccated pus. The patient, which on account of dyspnœa was incapacitated, returned to work after three weeks of post-operative convalescence, but continued to cough and dis-

charge at the nose for several months, at which time all trace of the subsequent progress was lost. So far as the author has been able to determine the operation has never since been performed except for experimental purposes upon horses not affected with any condition requiring its performance, hyo-vertebrotomy being apparently more popular when needed, on account of its relative simplicity.

The operation must be preceded by intubation of the trachea with a tracheotomy tube, to prevent suffocation from the hand while it sojourns in the pharynx, and from the contents of the pouch which discharge into the pharynx when the incision is made.

The lateral recumbent position with the muzzle turned upward is the operative position required. General anæsthesia is also demanded to provide against movements of the head at the critical moments.

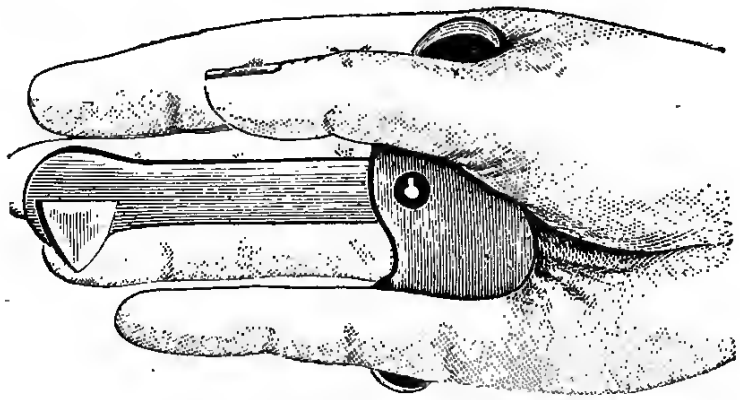


FIG. 225—Method of Introducing Knife into the Pharynx in Staphylotomy.

The mouth is opened as wide as possible with a ratchet mouth speculum. The hand, armed with a special knife consisting of a short, hook-shaped blade and a flat ferrule that fits ring-like on the tip of the index finger, is forced, cone shaped, through the fauces, until the blade can be hooked over the posterior border of the velum, when it is drawn slowly forward, incising the velum from behind forward until its course is arrested by contact of the knife against the palatine bone.

Without removing the hand the pouch is incised obliquely from above downward and forward, by an incision about one inch long, which, if deemed necessary, may be enlarged by forcing the fingers into it. Vessels are thus pushed aside instead of being severed with the knife.

The hand is now withdrawn to lay aside the knife and then re-introduced to bring out the contents handful by handful. If the larynx has been filled by the discharges, these

are flooded through the nasal chambers by a gush or two from a twenty-four ounce syringe through the incision in the trachea made for the trachea tube.

Operation for Tympany of the Guttural Pouch

In colts, the eustachian tube is sometimes possessed of a congenital defect, which, although admitting air freely enough into the guttural pouch, blocks the outward flow in the manner of a valve. The condition, which is sometimes bilateral, presents itself in the form of a more or less voluminous compressible tumefaction of the parotid region. If lanced the air escapes, but as soon as the wound has healed the trouble recurs.

The operation against this serious trouble consists of hyo-vertebrotomy, previously described, and the obliteration of the incriminated eustachian tube with a long bistoury. After access to the pouch has been gained by hyo-vertebrotomy, the head is extended and the long, curved, probe-pointed bistoury is passed through the tube from pouch to pharynx. A careful downward sweep completes the operation. Permanent results depend upon permanent obliteration of the tube. If the wound heals without having disarranged the valve-like mechanism responsible for the trouble, the operation will prove unsuccessful.

Operation Against Retention Cyst (Atheroma) of the False Nostril.

The integument forming the superior boundary of the false nostril of the horse is often the seat of a uniformly characteristic retention cyst about the size of a walnut, constituted of a well defined membranous wall enclosing a gelatinous, creamy or caseous substance.

When submitted to simple evacuation by lancing, the sac refills within a relatively short time, and if attempt is made to destroy the secreting membrane by injecting strong caustics a threatening, acute, local reaction supervenes. Several injections are required. The skin sometimes sloughs through; finally the cicatrization is exceedingly slow, and the patient becomes keenly sensitive about the head.

The only prompt curative treatment is total excision of the sac, by peripheral dissection, which should be carefully executed without evacuating the contents or accidentally snipping the skin boundary.

The cutaneous incision is made over the cyst parallel to the axis of the false nostril. To facilitate access to the entire circumference it should overlap the enlargement above and below, and be held apart with the retractors. Hæmostats are applied to spurting vessels, which are numerous, and when the dissection is complete a painstaking hæmostasis is effected by torsion and then by packing the cavity firmly but not tightly with iodoform gauze. The cutaneous incision is then closed by three mattress sutures one-half inch from each edge, and interrupted sutures placed close together along the margin. These are clothed with collodion.

Twenty-four hours later the packed cavity is incised with-

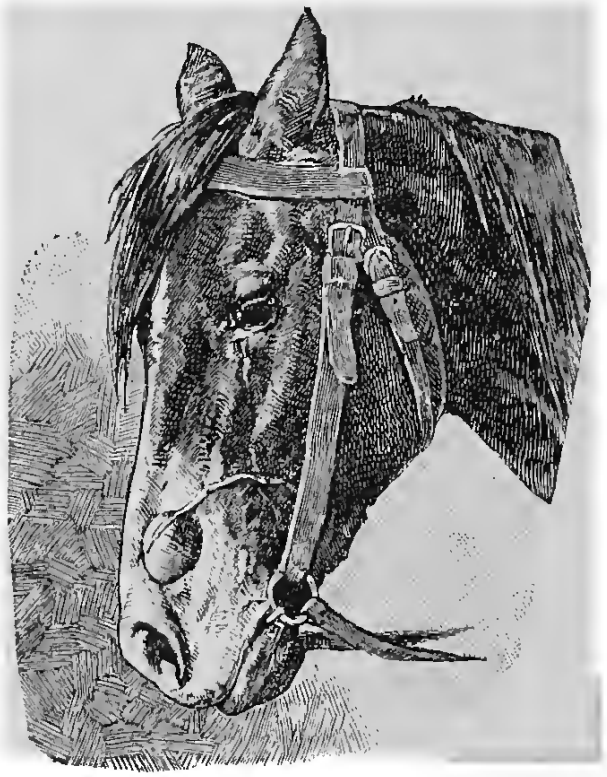


FIG. 226—Atheroma of the False Nostril. (Bayer.)

in the false nostril and the gauze removed; or the gauze may be pulled into the new incision with the forceps and allowed to sojourn another day, at the end of which time a good drainage orifice requiring no further attention will have been provided. The sutured incision heals by primary union and the cavity which discharges its secretions into the nostril cicatrizes rapidly.

OPERATION FOR ANAL ATRESIA

Anal atresia is only amenable to surgical correction when the blind extremity of the incomplete rectum approaches the anus. If the rectum is wanting entirely, as is often the

case, or if it extends only partially through the pelvic cavity, there is no help. It is only when the skin alone remains imperforate that surgical relief can be successfully afforded. The

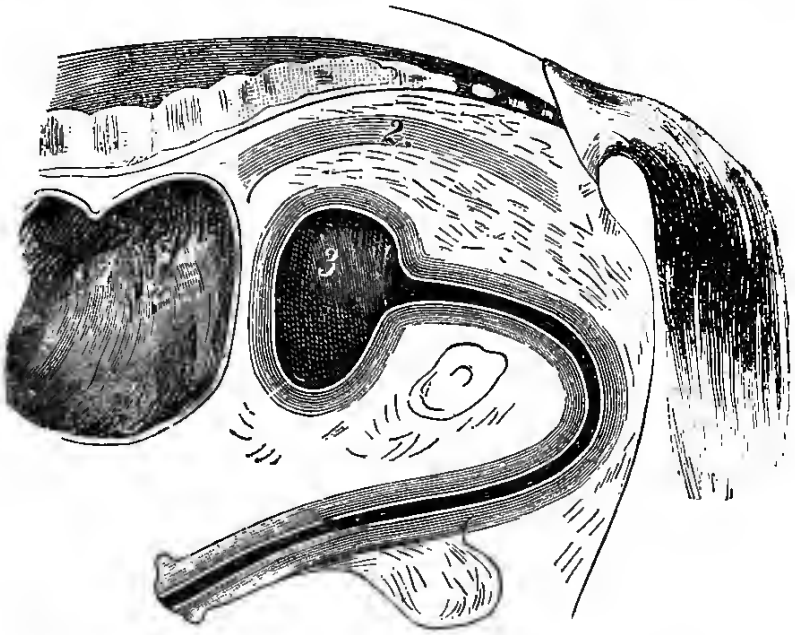


FIG. 227—Inoperable Anal Atresia. (Bayer.)

congenital defect exists in variable degrees of extensiveness. The rectum may end in the vagina, in the bladder, in the urethra, or at the meatus urinarius by various cloacal ar-

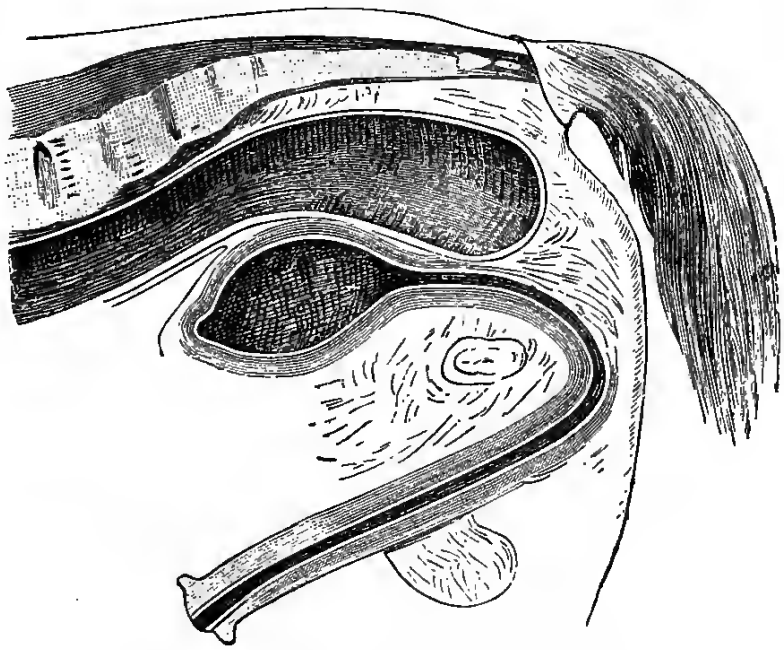


FIG. 228—Operable Anal Atresia.

rangements; it may end in a blind extremity at any point in the pelvic cavity with impervious connective tissue intervening between the blind end and the undeveloped anus; it may

be non-existent, the intestinal tube terminating with the colon; or it may terminate in a blind end adjacent to the anus. The latter is the only operable one in animals.

If the malformation is discovered at birth intervention is postponed until the rectum becomes more conspicuous by filling up with feces and intestinal gases two or three days later. Often the defect is not noticed at all until straining to defecate attracts attention, and not infrequently the subject dies and is disposed of without the nature of its trouble having been determined. This is particularly the case with sucklings receiving little individual attention, as pigs, pups, and kittens.

In males the perineum is a smooth surface with little to indicate where the anus should be, while in females the vagina serves as a guide for making the artificial perforation.

The technique consists of first excising an elliptical piece of skin and then searching for the rectum through the adjacent connective tissue by dissection with scalpel and thumb forcep. If after thus excavating to the depth of one to one and a half inches no trace of the blind end is found, the case may be given up as hopeless. On the other hand, should the end be encountered it is incised vertically, evacuated of its contents and cleansed and then approximated with the edges of the cutaneous incision by means of a continuous suture **without the least disturbance of its surrounding attachments.** If the distance between the skin and rectum is too great to effect the approximation by stretching it may be dissected loose and then drawn upon with forceps until the edges meet. It is rare, however, that this latter intervention ends favorably.

Operations Against Prolapse of the Rectum.

Rectal prolapse may be **partial** or **complete.** When a part of the rectum becomes tumefied from injury the swollen part may protrude through the anus in the form of a rounded glistening mass that is more or less pedunculated from pressure of the sphincter ani. The proper procedure against this form is to administer a laxative, feed with soft, succulent feeds, return the mass manually and then administer frequent copious enemata to soften the stools. If the protrusion recurs only at the time of each act of defecation the manual replacement is repeated as required until the volume of the swelling has diminished. After two or three days, however, if the protrusion is extant, excision of the tumefied part by

ligation becomes necessary. This is accomplished by weaving a tobacco-pouch suture of braided silk into the mucous membrane around the peduncle, drawing it taut, and then amputating the growth a safe distance from it. The subsequent behavior of the wound will depend entirely upon preventing injury from harsh feces by administering frequent enemata of plain water, three or four times daily.

In complete prolapse, which in fact is a real intestinal invagination, entirely different intervention is required. Here too, however, attempt should first be made to replace and retain the displacement, which sometimes meets with flattering success. The author once restored a mare to perfect health by the following proceeding: A dose of chloral

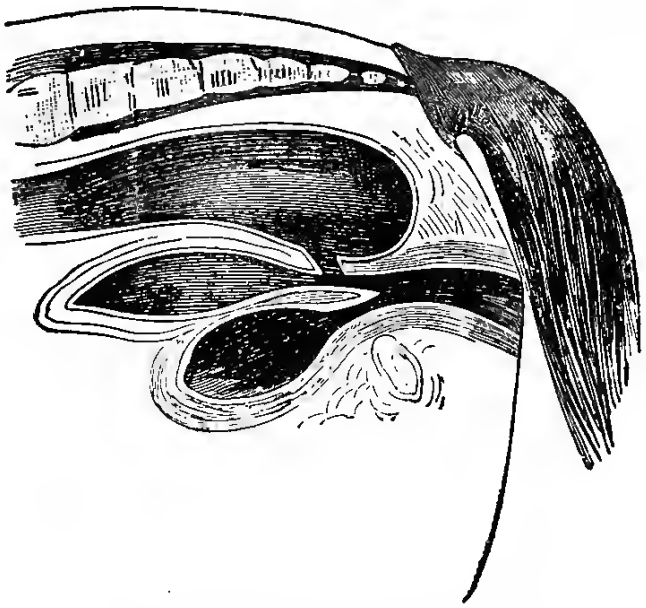


FIG. 229—Anal Atresia with Cloacal Arrangement between Rectum and Vagina (Incurable).

hydrate (twelve drams) was administered in a drench. The protruding rectum was washed with a mixture consisting of cocaine hydrochlorate, one per cent. and morphia hydrochlorate, three per cent., after having emptied the rectum with a copious enema. The prolapse was then replaced and a strong tobacco-pouch suture was woven deeply around the anus, drawn fairly taut, and tied with a bow-knot. After two hours two ounces of laudanum were administered in a drench. During the succeeding two days the suture was untied at intervals of six to twelve hours and the rectum evacuated with enemata. Subsequently the suture was abandoned entirely, but the enemata were continued thrice daily for a week. The cure was permanent. Several similar procedures on small animals have been equally successful,

but as this method is often contra-indicated on account of gangrene, approaching gangrenous states, and especially owing to uncontrollable straining, amputation is often the only possible recourse.

The technique is as follows: The patient is secured and anæsthetized; the rectum is drawn out so as to expose a healthy zone in front of the prolapsed portion; a series of interrupted sutures are placed around the whole circumference **as near the anus as possible,** and an amputation effected with the scissors one inch behind them.

In order to include every part of the circumference in the sutures the following plan of suturing may be adopted. The

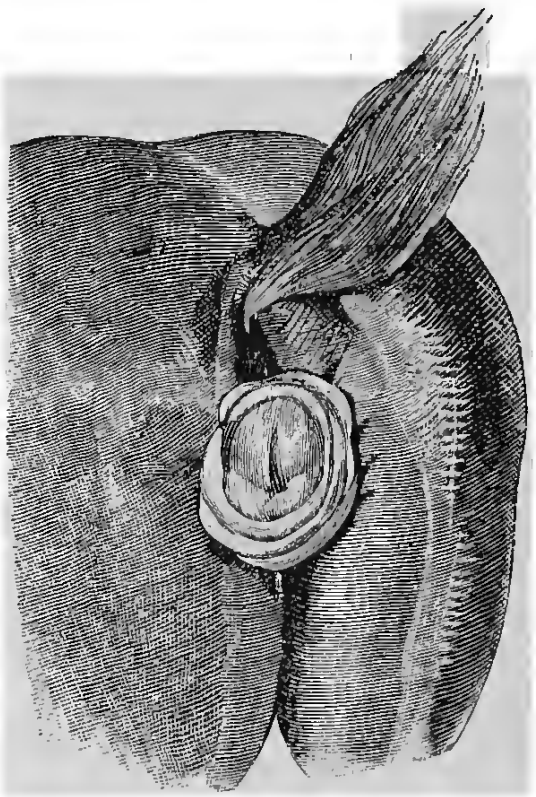


FIG. 230—Prolapse of the Rectum. (Bayer.)

needle is armed with a double thread and passed from within outward leaving the ends dangling from the lumen. A second needle similarly armed is then passed in the same direction one-half inch from the first one, the four threads are then cut from the needles and one of them from the first needle is tied to one from the second, first internally and then externally. This leaves a tied stitch between two loose untied threads. A third needle, armed in the same manner, is then passed in the same direction and the same distance from the second and immediately cut off. Then the free thread from the second stitch is tied to one of the threads of the third and so on until the whole circumference is sutured. The free

thread of the first stitch which was left dangling is utilized to complete the last one.

The very best subsequent management of the patient so operated upon consists of the administration of frequent copious enemata of warm water to prevent harsh friction from dry feces. Laxatives, drenches and succulent feeds are also helpful in the same direction. The sutures require no further attention.

The success depends upon whether or not the sutures succeed in maintaining the continuity of the rectum until union by healing is safely effected. In large animals recoveries are rare, on account of the impossibility of immobilizing



FIG. 231—Complete Prolapse of the Rectum. (Bayer.)

the sutured rectum against the movements incident to defecation. The artificial suspension of all intestinal movements by the administration of opiates, which brings a measure of success to similar operations in human beings, is not practiced in animals, on account of the certainty of provoking fatal intestinal complications thereby.

OPERATIONS AGAINST PROLAPSE OF THE VAGINA.

Like prolapse of the rectum this abnormality may be **partial** or **complete.** The **partial** form, which is common in dogs, is treated in the same manner as that of the rectum. Attempt is made to replace and retain it by simple means, and when this fails ablation by ligation and amputation is

practiced, care being taken not to engage the meatus urinarius.



FIG. 232—Prolapse of the Vagina in the Bitch.

In the complete form, which exists chiefly in the larger animals, replacement and retention are usually successful. The



FIG. 233—Method of Retaining a Prolapsed Vagina in the Cow.

technique consists of cleansing, manual replacement and then retention by means of quilled sutures applied to the vulval

orifice. Two pieces of soft but firm rubber tubing about five inches long, and braided silk, are employed for this purpose. Simple stitching of the vulva, packing the vagina with gauze or similar substances, the application of rope trusses of various designs, are so many more or less popular methods of accomplishing the same purpose.

When the prolapse recurs despite these efforts, amputation, as in prolapse of the rectum, is indicated. The operation is performed in precisely the same manner as in prolapse of the rectum, with the one exception that care must be exercised not to engage the urinary channel.

Replacement and Retention of Uterine Prolapse.

Prolapse of the uterus occurs chiefly in cows and mares. It is a post-partum accident whose cause has never been satisfactorily explained, but whose nature places it in the category of tubular invaginations. At the beginning it is uncomplicated by any pathological condition of the organ itself, but owing to the weight of the hanging mass the circulation is soon impaired and on account of its exposure to cold, to the filth of the litter and to the excrement that is certain to be voided over its surface, serious complications are sure to arise, unless immediately restored to its normal position.

The success of treatment depends, therefore, upon prompt reposition. The chances of recovery diminish with the duration of the prolapse, although they may also be influenced by the nature of the exposure.

TECHNIQUE.—The first step of the treatment is to remove the afterbirth without resorting to any force to detach it from points to which it adheres firmly. Shreds are left attached by trimming them closely rather than to wound the mucous membrane by tearing them loose. Particles of litter and dirt are removed with the fingers and the excrement on its upper surface may be moderately wiped off with a moist sponge. Further, no cleansing at this stage should be attempted, because washing with water, no matter how applied, provokes straining that will defeat the purposes of operation, and besides causing the ejection of more feces is more apt to wash infectious matter into the recesses of the relaxed mucous membrane than to wash dirt out. **In fact, this cursory cleansing is indispensable to the success of the operation.**

The next step is to reduce the size of the protruding mass

by wrapping it tightly from fundus to vulva with a long muslin bandage after the fashion of Esmarch, which, in addition to compressing it into a smaller body, facilitates handling of its slippery surface.

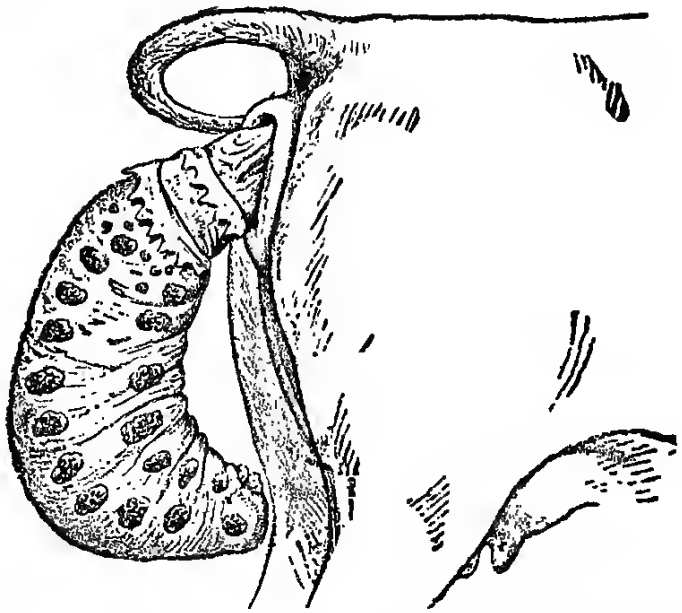


FIG. 234—Prolapse of the Uterus in the Cow (Lateral View).

The replacement is now effected by pressing forward as fast as the bandage is unwrapped from the vulva backward. (If the protruding mass is small the bandaging may be superfluous.)



FIG. 235—Uterine Prolapse (Rear View).

After the organ has successfully fallen into its normal position, and the patient has been induced to rise it is irrigated with abundance of hot water which may, to advantage, contain a small amount of sodium chloride (one

per cent.). The irrigation is continued until the clearness of the reflux indicates that all the dirt has been washed out. The irrigation may be made more perfect by washing the walls of the uterus with a sponge or palm of the hand as the water is being pumped into it. Straining at this stage usually indicates that something is wrong; probably the inversion is not completely corrected at every part. In this event walking exercise will tend to straighten matters out.

RETENTION.—Various methods may be employed to prevent recurrence from straining. Packing the whole uterine cavity with sterilized cheese-cloth or towels, a method recommended by Martin, is given as an exceptionally successful expedient. Among the methods of adoption, however, which seem to be the most popular with veterinary

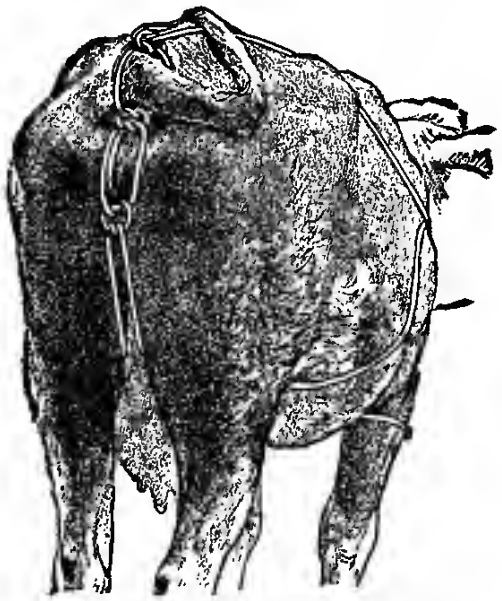


FIG. 236—Method of Retaining a Prolapsed Uterus in the Cow

practitioners, is the application of a rope truss that encircles the neck, the chest and the abdomen, passes backward on each side of the mammæ and over the pudendum, where three knots are tied, one below the vulva, one below the anus and one above the root of the tail, whence the two strands pass forward over the shoulders to be tied in front of the sternum.

AMPUTATION OF THE UTERUS IN PROLAPSE (VAGINAL HYSTERECTOMY)

When the various methods usually employed to retain an inverted uterus have failed, or when the organ, by reason of its exposure, has become irreparably damaged, amputation becomes necessary. It is however, always, a **dernier resorte.**

It may be employed in any of the animals, but is utilized to the best advantage and with the greatest measure of success in the cow. In mares the mortality is high; in fact recovery is very rare, while in cows favorable results are frequently obtained. In dogs prolapse requiring amputation does not often occur, and when the uterus does require ablation it is removed by prepubic abdominal section.

The operation of amputation of the uterus is an exceedingly simple procedure, performed as follows: The fundus of the protruding bag is incised and the hand inserted in search of a possible concurrent prolapse of the bowels. When



FIG. 237—A Method of Retaining Uterine Prolapse in the Mare.

this complication has been excluded, or, when extant, the bowels have been returned in the abdomen, a rope the size of a lead pencil and about a yard long or more, after being well disinfected and soaped to facilitate tightening, is double-half-hitched around the neck of the mass at the vulval orifice, and drawn tight by all the power of two men, one at each end of the rope. To still further expedite the pulling the ends of the rope may be equipped with wooden handles. The traction upon the rope should be slow and constant, allowing plenty of time for the tissues to yield to the pressure. When finally drawn as tight as possible the rope is secured with a knot and an amputation effected with the scalpel no less then four

inches from the ligature. The stump is then replaced and retained against straining by packing the vagina with gauze and stitching the vulval orifice. This dressing is removed in twenty-four hours, after which gentle irrigation of the vagina with hot antiseptic solutions once a day completes the treatment.

Death from shock several hours after the operation, or from peritonitis later, may be anticipated.

OPERATIONS FOR ENTROPION AND ECTROPION.

These inward or outward deflections of the eyelids are seen chiefly in dogs, the former being the most common. Although generally attributed to cicatrization of pre-existing traumas or inflammations, the cause is usually by no means plain. In fact the abnormality seems to develop independently of any perceptible lesion. In horses, however, both entropion and ectropion, can always be traced to the cicatrization of a definite injury to the eyelids, an incomplete laceration, a through-and-through laceration, a contusion, or a surgical wound necessitated in the ablation of a tumor.

Operative treatment, the only cure, is indicated as soon as the condition is discovered and should be given before the cornea has sustained serious injury from the inflammation provoked.

Operation for Entropion.—The operation consists of a simple excision of a section of skin, of melon-slice shape, with its concavity toward the ciliary border, and about one-quarter of an inch from it, followed by approximation of the edges with interrupted silk sutures. The excision is made adjacent to the most inverted part, the scalpel and thumb forceps being employed for the purpose. The wound thus made must be of sufficient width to bring the lid into slight eversion when drawn together with the sutures, otherwise slight inversion will recur. Failure to entirely correct the inversion may often be turned into success by excising the hair follicles along the most inverted portion. (See Trichiasis, p. 454.)

Operation for Ectropion.—This operation is not always successful, but usually partially corrects the defect. It is performed by excising a triangular section of skin adjacent to the everted portion of the lid, and then bringing the two lateral edges together so as to fold up the skin along the base. In addition an elliptical piece of the conjunctiva may be excised. The cicatricial tissue formed during the healing of this peculiar wound builds a support for the flopping eyelid,

while the cicatrization of the conjunctival wound tends to assist by drawing the edge inward. Resection of the conjunctiva alone, which is usually mentioned as the classical operation for ectropion, has never, in the author's hands, been successful.

Operation for Trichiasis.—When only the lashes fold against the cornea the best intervention is summary excision of the hair-follicles without previous ceremony. This feat is executed by making a deep incision along each side of the eyelashes, beveled so that the bottoms will meet under the hair roots, and this effects a permanent destruction of the entire row of hairs by completely up-rooting it in situ.

Operation Against Cold Abscess of the Shoulder.

Draft horses, rarely the lighter classes, are susceptible to the formation of a formidable, slow-forming abscess in the depths of the muscles underlying that part of the collar-seat that receives the major portion of the draft. This is located just above the articulation at the point traversed by the mastoido-humeralis, which muscle is therefore most frequently involved. The evolution of this characteristic condition of horses is analogous to that of cold abscess in general. The initial focus develops a small abscess cavity while the surrounding connective tissue, at the expense of the muscular elements, forms into a more or less extensive fibrous mass (a new growth) that becomes permanent unless removed surgically. If left to run its course unmolested such an abscess usually shrinks up into a smaller permanent body, but its dormant pyogenic center will sooner or later become active again from the draft of the collar, and cause a recurrent phlegmasia more formidable than the preceding one. The remittent exacerbations each expand the fibrous zone until the region becomes deformed with a permanent sclerotic growth of enormous dimensions whose periphery permeates the muscular elements, root-like, in every direction. Or, the abscess may point after sojourning apparently unchanged for several weeks, shrink up as if almost cured, point again, and then finally, after several such stages, end the same as the course just mentioned.

That some of these abscesses sometimes are botriomycotic is not denied, but that the botriomyces is the specific agent of all of them has been proven erroneous by numerous bacteriologic examinations and experiments.

In the face of the certain unfavorable course these characteristic abscesses always run, prompt surgical intervention should be recommended in every instance. The only occasion for delay is the existence of peripheral œdema, which always subsides after several days.

The operation described below is universally successful only if performed during the earlier stages of the disease, for if the pyogenic process has ended and the permanent growth has already become well rooted, total ablation is the only help.

TECHNIQUE.—In fairly tractable horses it is possible to perform the operation in the standing position by aid of the twitch and side-line or stocks. The recumbent position is, however, always much more satisfactory, and is in fact, essential when a restive horse is to be dealt with.

The tumor is clipped, shaved and well washed with antiseptic water, after which a vertical incision, generally about four inches long, is made across its most prominent part. (If any fistulous tracts exist an elliptical resection including the orifices in the excised zone is substituted for the straight incision). The incision is then carried carefully forward through the sclerotic wall into the abscess cavity, which, on account of small dimensions, may sometimes be difficult to find. When the contents have been evacuated the major portion of the growth is excised from center toward the periphery on both sides of the incision by slicing it piece by piece with the right and the left sage knives, each for its respective side. The slicing is continued outward in both directions as far as the pure fibrous tissue extends, and is discontinued as soon as a predominance of muscular tissue appears in the foreground.

Following this enucleation, the cavity is well seared with hot irons until all bleeding is arrested. The searing should be a thorough one, but some care must be exercised not to needlessly burn the skin along the edges of the incision. Bleeding from the large vessels, sometimes cut in abscesses located near the jugular groove, should be arrested with forceps.

If any deep-seated bleeding that cannot be reached with the hot iron exists, it is controlled by packing, and if necessary by suturing the packing into the cavity.

Very little after-care is required. Dusting with a preservative powder (boric acid) to prevent putrefaction of the eschar and astringent washes after it has sloughed out, is the only treatment required. Cicatrization is rapid and the normal physiognomy of the shoulder is soon restored.

Procedure Against Serous Sacs and Hot Abscesses of the Shoulder.

In contra-distinction from the characteristic cold abscess previously described, draft horses are also frequently incapacitated for work by superficial lesions of no small importance. These are affections of young horses taxed with arduous labor for the first time, or of farm horses whose shoulders in the spring are tender after a winter's rest.

Serous sacs, sometimes erroneously designated as serous abscesses, are accumulations of blood serum in the subcutaneous space, due to bruising. They are located just above the level of the articulation at the lower part of the collar seat. They may be unilateral or bilateral and of a variable volume, first small and more or less diffused over a space as large as the hand, and then becoming conspicuous, fluctuant and tense from the outpouring of more serum. If the affected part becomes invaded with pyogenic microbes, a hot (acute) abscess results.

The importance of these apparently trivial injuries lies largely in the fact that they incapacitate horses for work at a time when their services are in great demand.

No matter what line of treatment is followed, it requires some time to restore the affected part to its normal condition, or even to a condition that will not immediately react against collar pressure. The skin having been detached and separated from its underlying relations by the fluid, will undergo a slow process of re-attachment from periphery to center, despite every effort to hurry matters. The following is given as the most effectual method of hastening a recovery:

TECHNIQUE.—After shaving and disinfecting a spot at the most dependent part the serum is aspirated with a **sterilized** needle without rubbing or kneading the parts in doing so. Friction, rubbing and kneading (manipulations that are naturally resorted to in hastening the aspirating process) are harmful, in that the out-pouring of a new quota of serum is thus provoked.

The affected zone is then covered thickly with antiphlogistine or similar product, which is allowed to sojourn for forty-eight hours to seventy-two hours, at the end of which time aspiration under the same aseptic precautions and gentle handling is repeated. If the fluid after the second operation has not diminished in quantity, a number of suc-

cessive aspirations and applications of the clay poultices will be necessary to effect a cure.

Note.—The success of this simple operation depends upon absolute repose of the affected area, and upon strict asepsis. If the sac is harshly handled in the operation, or if attempt is made to work the patient with a padded collar, the method is useless, because the sac, stimulated by injury, will refill, become painful and finally will require lancing.

Hot Abscesses of this superficial variety are analogous conditions with the exception that they develop under the influence of pyogenic infection,—a circumstance which at once suggests entirely different treatment. Small abscesses of this kind will cicatrize promptly after being simply lanced and evacuated, but when the sac is large and a wide zone of skin has been separated from the underlying muscles, healing will be slower than in the serous sac above described.

TECHNIQUE.—The very best method of encouraging a rapid restoration is to evacuate the contents through a small incision, irrigate the cavity with a weak but clean antiseptic solution and then apply a perforated, soft rubber drainage tube which is retained with a stitch or two at the incision. The tube, which should extend to the uppermost part of the sac, is retained about five days, at the end of which time the abscess cavity will have almost narrowed down to the space occupied by it. Thereafter the pus is squeezed from the tract from above downward twice or three times, until cicatrization is complete.

Note.—Delayed cicatrization of shoulder abscess is often due to meddlesome interference, e. g., injections of strong antiseptics and caustics, or packing with oakum, gauze, etc.

Procedures Against Cutaneous Hypertrophy of the Collar Seat (Bull's Eye Shoulder).

On the shoulders of work-horses there frequently develops a characteristic disc-like enlargement consisting of a loose, circular zone of thickened common integument upon whose surface is a central denuded spot averaging about one inch in diameter. The growth is naught but skin that has hypertrophied and then loosened by constant collar friction and pressure. In the center where the pressure is greatest the epiderm is destroyed and refuses to undergo sufficient regenerative activity to effectually re-clothe the breach against

subsequent collar friction. The hypertrophied zone will contract into a smaller body and the denuded zone will re-cover with epithelium, if adequate protection against pressure is provided or if the patient is given complete rest for several months, but as soon as work is resumed the same condition recurs until finally it becomes permanent.

This lesion, although by no means painful to pressure, requires prompt surgical intervention to prevent it from increasing into a larger and larger growth that will require an interference of proportionately greater magnitude, with possible permanent deformation of the collar seat.

Technique of Ablation by Dissection.—After washing, shaving and disinfecting the growth and its surroundings, an elliptical incision that includes within its outlines the denuded zone and adjacent scar tissue is made across the growth from above downward. The incision should overlap superiorly and inferiorly, better to expose the growth for dissection. The island thus isolated is then grasped and drawn upon firmly with strong grappling forceps as the skin is carefully dissected back on both sides to the shoulder level. The skin flaps are now drawn apart with tenacula and the forceps transferred to the uppermost part of the growth, whence ablation is effected by a downward dissection. When completed, if properly done, the bottom of the wound should be smooth and free from any part of the hypertrophied tissues.

After a few moments' waiting for the appearance of bleeding vessels which might require attention, the wound is closed with two sets of sutures:—(1st) quilled or mattress sutures loosely set one inch from the edges, and (2nd) closely arranged interrupted sutures along the margin. An orifice which is wadded with gauze is provided inferiorly for drainage and the suture line is painted with collodion. An hour or two after the wound has been sutured the blood clot, if any has accumulated, is squeezed out and the wadding re-applied into the orifice.

The wound heals by primary union and the patient is ready for the collar at the end of twenty-five days.

The operation is performed in the standing position with the aid of stocks, or preferably in the recumbent position. Effectual cocainization is, on account of the extent of the invasion, quite impractical.

Weber's Method.—After cleansing the field as above the ecraseur is passed over the growth, skin and all, and tightened so as to severely tax the strength of its chain. The skin around the entire peduncle is now incised through and

through about one-half inch outward from the chain. Usually this causes the inner edge of the skin to slip through the chain-loop, which thus spontaneously transfers the chain into the incision. The chain is again drawn tight and after waiting a few minutes for the tissues to yield to the pressure, the growth is at once cut completely off with the scalpel.

If the skin should refuse to slip through the loop when incised, the chain is loosened slightly and transferred into the incision, after which the operation proceeds as before mentioned.

Although the wound produced by this peculiar operation is a large one, often stretching over an area that is alarming, it heals with remarkable rapidity and always leaves a much smoother shoulder than ablation by dissection and suturing, and the resulting scar, while hairless, is less susceptible to collar injuries.

OPERATION FOR SITFAST.

Sitfast, a name consecrated by usage, refers to local, cutaneous dry gangrene, resulting from harness pressure. The constant pressure of a part of the harness or collar upon a circumscribed spot destroys first the epiderm and papillary layer of the skin and the slowness of the destructive process leaves ample time for the moisture to evaporate therefrom. If the pressure continues the process finally extends through the skin, a groove of demarcation forms around the circumference, infection enters the subjacent space, the mass falls out in a single, leather-like body, and then cicatrization proceeds. The evolution of this process is often very slow; a sitfast may sojourn without adjacent reaction for months, and as it is accomplished with considerable pain and tends to spread over a large area, excision (the only successful treatment) should be immediately effected.

TECHNIQUE.—After shaving the surrounding skin and disinfecting the field the edge of the sitfast is lifted up at one part by dissection in order to determine the depth of the dead elements. When this has been determined the dissection is carried around the entire circumference at the same depths and then evenly underneath. If upon lifting the part off ischemic zones are found to exist here and there, the excavation is made as deep as is necessary to bring a uniform capillary oozing over the whole surface. It is rarely ever necessary, except in old, advanced cases, to carry the dissection entirely through the skin.

The wound must be treated with mild antiseptic powders and astringent remedies avoided.

As the operation is attended with considerable pain, adequate restraint is essential.

Ablation of the Eye Ball.

The globe of the eye, including its closely attached appendages, sometimes requires ablation in horses, dogs, and oxen. The most common afflictions necessitating the operation are malignant neoplasms, serious infections supervening penetrant wounds and lacerations of the cornea, and forward dislocations of the ball from violence. The first two are encountered in all the animals, while the latter is exclusively an accident of dogs.

The operation is one that must not be too hastily employed for these several afflictions. It is a serious operation and sometimes ends fatally from intra-cranial complications, especially purulent cerebral meningitis. In view of this fact the possible benefits of simple procedures, such as enucleation of the contents of the globe, or excision of harmful portions alone, should be given first consideration. The major operation of excising the entire globe and attached appendages, from the ciliary margin to the optic foramen, must be reserved for serious conditions actually demanding it, the chief ones of which are extensive cancerous conditions of horses and oxen and incurable dislocations of dogs. In the treatment of growths, however, ablation may be prudently decided upon early on account of suspected malignancy, and in order to prevent the disease from developing into a diffused inoperable condition by encroaching upon the surrounding inaccessible structures. Since cancer of the eye, which is a very common affliction of horses and oxen, may develop rapidly from a small granular elevation on the conjunctiva to an enormous, cauliflower mass implicating all of the structures of the orbital cavity, the intervention must come early enough to head off the march of the disease in every direction, and in order to prevent recurrence every diseased part must be excised by liberal transgression into the healthy surroundings, even if the entire globe must be sacrificed.

When such growths have advanced into the surrounding tissues after already having destroyed the globe, they may be deemed incurable and the subject should be condemned for slaughter.

TECHNIQUE.—The operation is performed in the re-

cumbent position under profound anæsthesia. Local anæsthesia is not sufficient, and the strictest asepsis must be respected.

The eye is held open with strong silk threads stitched through the center of each eyelid.

An incision, encircling the entire eye is made through the conjunctiva, about one-half inch behind the ciliary margin, excepting at the canthi, where it more nearly approaches the border. After carrying the incision inward equally at every part so that the knife passes easily into the sub-conjunctival space, blunt dissection with the handle of the scalpel or with the index finger is continued backward toward the optic foramen until the globe hangs loosely in the orbit, attached only by its constricted peduncle. A double-half hitch of strong braided silk is now passed over the globe and fixed upon the peduncle about one inch from the foramen, or less if the disease extends beyond. It is drawn as tight as the finger tips can draw it, and then secured against slipping by adding a knot or two. The globe is then excised well in front of the ligature, leaving a funnel-shaped stump to prevent slipping.

The cavity is irrigated moderately with mercuric chloride solution, and then packed with antiseptic gauze, which is retained by tying together the two sutures used to separate the eyelids during the dissection.

In removing large growths which obstruct free admission into the cavity, each canthus may be incised outwardly to enlarge the orbital opening.

AFTER-CARE.—The wound must at all hazards be prevented from becoming infected, and the ligated stump from putrefying, by painstaking irrigations of hydrogen peroxide followed with liberal dustings of iodoform.

Radical Nail Prick Operation.

DEFINITION.—By "radical nail prick operation" is meant the evacuation of purulent synovia from the navicular sheath by removing a part of the plantar cushion and dividing the plantar aponeurosis.

INDICATIONS.—When a street nail pierces the side of the frog at the level of the navicular bursa and then penetrates through the perforans tendon (plantar aponeurosis) serious consequences usually ensue. The wound discharges purulent synovia, the patient falls sick, and unable to support weight on the affected leg for weeks and sometimes months,

often breaks down in the opposite fetlock and hock, becomes emaciated and bedridden and frequently succumbs to exhaustion after having successfully escaped the first stages of the indisposition.

Dependent upon the acuity of the infection, the cases vary in severity from the mild one that passes safely toward recovery without ever developing any more threatening

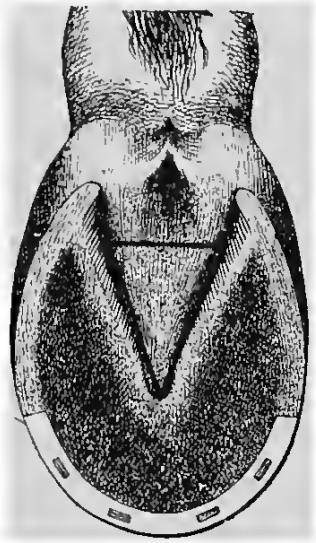


FIG. 238—Dark Line Indicates Position of Incision through the Frog.

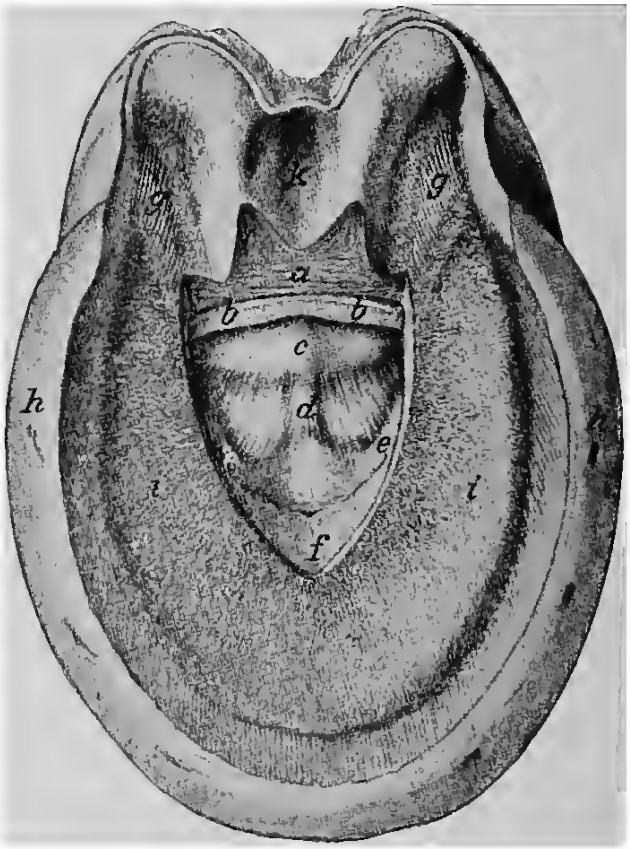


FIG. 239—The Resection Complete.
a, Anterior Wall of Frog after Excision.
b, *b*, Section of Perforans Tendon.
c, Navicular Bone.
d, Inferior Navicular Ligament.
e, *e*, Semilunar Ridge.
f, Exposed Part of Os Pedis.
g, *g*, Bars.
k, Remainder of Frog.
h, Shoe.

symptom than that of walking upon the toe for several weeks, to the severe case that ends fatally after eight to ten days of total disability and horrible suffering. Between these two extremes are all the intermediate ones, some of which make excellent recoveries from ordinary treatment after several months, while others are left permanently lame. The decision to submit a patient so affected to this operation (which is by no means a trivial intervention) must not be a hasty

one. The operation itself, almost universally, leaves the patient more or less permanently lame, no matter whether the condition for which it was performed was trivial or serious, because in sacrificing the navicular bursa, adhesions which form between the plantar aponeurosis and navicular bone, retain a persistent hyperæsthetic state for many months and finally end in deforming the foot and constraining the pedal articulations, for all time thereafter. In view of the fact, therefore, that the trivial cases and those of moderate severity, terminate quite as well, or even better without this intervention, it is evident that its usefulness is limited to the serious cases only. In fact it can be prudently recommended only where the life of the patient is in danger from pain, septic infection, advancement of the inflammation into the artic-

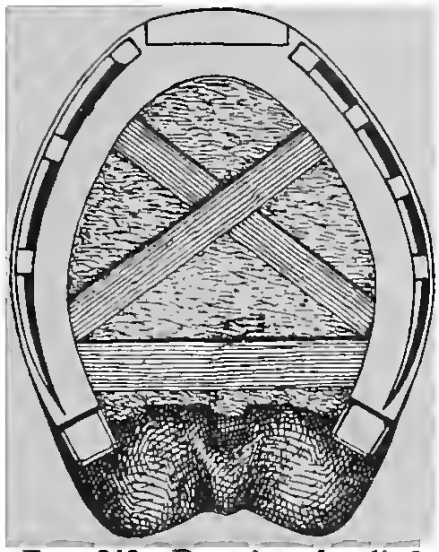


FIG. 240—Dressing Applied.

ulation or adjacent zones and exhaustion. In these events it is an emergent intervention of unquestioned value, as in every instance the threatening symptoms immediately subside. The fever drops, the accelerated respirations diminish, the appetite returns and the patient for the first time takes a good sound rest in peaceful decumbency. The claudication, however, does not immediately disappear. On the contrary, it may even accentuate. The patient, which before the operation may have supported some weight on the toe, supports no weight whatever for at least three weeks afterward, and then goes slowly onward to incomplete recovery.

TECHNIQUE.—The patient is placed in the recumbent position, the plantar nerves on both sides of the affected leg are cocainized, and a tourniquet is wrapped upon the cannon. If secured upon the table the affected foot should be undermost because the sole can then be made to face upward by

simply placing a padding beneath the leg. If the leg is uppermost the sole will face downward into an almost inaccessible position. If ropes are used the patient should be rolled into the dorso-lateral position so that the soles will face in an upward direction toward the operator.

After clipping the hair from the lower part of the leg and paring the horny sole and frog as thin as a wafer (which step might precede the casting) the entire sensitive frog from a point about one inch from the heel to its apex, is removed. This excision is effected by first making three incisions, one

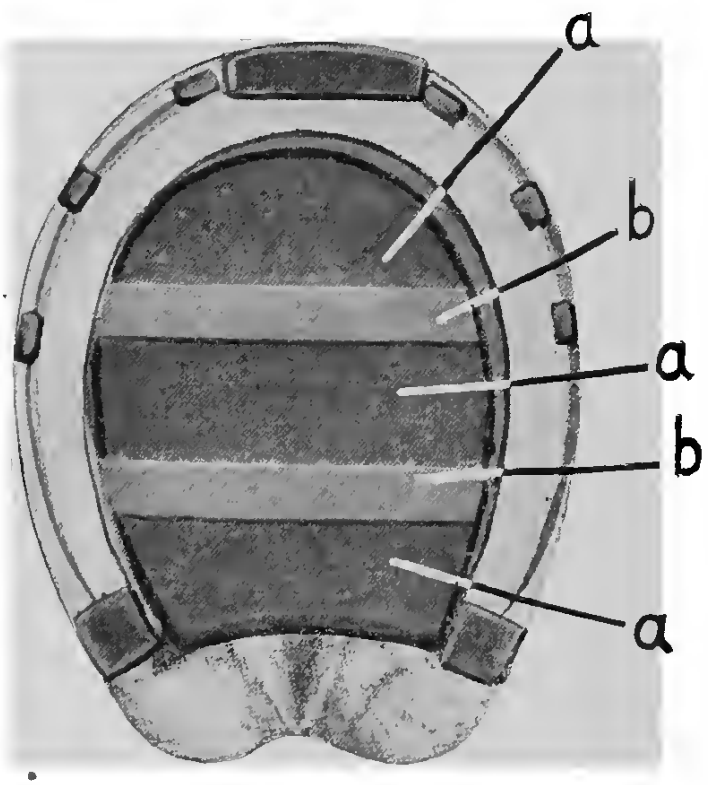


FIG. 241—Method of Dressing Nail-Prick Wound..

a, *a*, *a*, Sole Leather.
b, *b*, Retaining Plates of Hoop Iron.

across the frog one inch from the heel carried down to the very depths (about two inches) and one on each side of the frog from the transverse incision to the apex; and then grasping and drawing upon the triangular island thus isolated with a strong tumor forceps, while it is dissected from the plantar aponeurosis from before backward. Portions of the frog which still remain attached to the plantar aponeurosis are then carefully shaved off until the tendinous fibers become visible and the outlines of the navicular bone can be traced with the fingers. It might be well to remind the reader that the sensitive frog (plantar cushion) is firmly fused with the

plantar aponeurosis and cannot be separated from it except by sharp dissection.

A through-and-through transverse incision of the plantar aponeurosis is now made over the level of the navicular bone, whose axis it should follow as near as possible in order to avoid cutting into the inferior navicular ligament if made too far anteriorly, or the superior ligament if made too far posteriorly, which accident would at once invite the spread of the infectious matter directly into the articulation. Necrotic portions of the tendon around the tract of the nail are excised, the fibro-cartilage on the inferior surface of the bone is curetted off and the whole area of the sheath is swabbed with pure tincture of iodine and then packed with iodoform gauze.

The foot is dressed by packing the surgical cavity with antiseptic cotton and wrapping with abundance of muslin bandages.

At the end of twenty-four hours the dressing is removed, the sheath irrigated with hydrogen peroxide and then swabbed with tincture of iodine, the surface of the wound dusted with iodoform and the cotton and bandages reapplied.

On the second day the foot is shod loosely with a flat shoe which is utilized subsequently to retain the daily antiseptic and protecting dressings, consisting of iodoform dusted over the wound, cotton wadding, a piece of stiff leather that fits evenly but loosely into the inner circle of the shoe, and two pieces of hoop-iron to hold the latter in place. (Fig. 241.)

This daily dressing is continued until granulations have filled the cavity and all discharge has ceased.

Operation Against Urachal Urination.

Pervious urachus of the young is a very common affliction of all domestic mammals. The navel extremity of the urachus fails to close and as a consequence the urine, instead of being voided through the urethra, continues to flow through the pre-natal channel. The abnormality, which is usually noticed a few days after birth by the wetness of the skin surrounding the navel, either corrects itself without interference in a week or so or else persists until complications from infection end disastrously. Only small quantities of urine may flow through this unnatural channel. or the entire capacity of the bladder may be discharged at each act of micturition. Generally, however, the discharge occurs through both channels, a small part through the urachal and the major part through the urethral route.

The disease is very frequently complicated with **pyæmic arthritis** and other afflictions of navel origin whose causative microbes are offorded a free portal of entrance, while the pervious condition persists.

Various methods of treatment have been recommended, and among those in vogue are: (1) Antiseptic washings of the umbilical region to prevent microbian invasion as the urachus undergoes spontaneous closure. (2) Daily irrigations of the urachus with antiseptics and astringents. (3) Local antisepsis and frequent catheterization. (4) Irrigation of the urachus followed by the introduction of caustics into the orifice. (5) Actual cautery of the orifice following antiseptic irrigation. (6) Closure by ligation after having thoroughly irrigated the urachus with strong antiseptics.

The latter, besides being the author's choice, seems to be the most popular procedure among the experienced practitioners in the great breeding districts of the Mississippi Valley.

Pervious urachus would be a rare affection if the umbilical cord of animals were given proper attention at birth. A clean bed, ligation of the cord with an aseptic ligature and thorough antisepsis of the navel until it has healed would not only prevent many of the cases of pervious urachus but would also almost entirely eliminate the infections of navel origin.

TECHNIQUE.—The patient is placed in the dorsal recumbent position and the umbilical region clipped, shaved and thoroughly washed with mercuric chloride 1-500. Although the cleaning up of the umbilical region is somewhat difficult on account of the loose, delicate and wrinkled condition of the skin, and the opposition of the patient, the obstacle must not be made an excuse for perfunctory disinfection. The operation must start with a clean field, and with a well secured patient.

The urachal channel is first patiently irrigated with pure hydrogen peroxide by means of a long-piped syringe (ample time being allowed for each syringeful of the injected liquid to foam from the orifice) and then with mercuric chloride solution 1-1000 until good disinfection is assured. The hydrogen peroxide may be injected into the bladder with impunity while the latter, on account of its toxicity, should be used more prudently.

The protruding urachus is then drawn up with tumor forceps or with a piece of suture passed through its end, and a ligature fixed to its base as follows: A needle armed with two strands of strong braided silk is passed through the loose skin behind the urachus at the level of the abdominal sur-

face, back at the same level in front of it and then tied as tight as possible.

The parts are protected against putrefaction by cleanliness of the litter and by antiseptics. In hot seasons special care in this connection is essential. Quinine administered to the young, and potassium iodide to the mother with the object of medicating the milk, are helpful.

When urachal urination is accompanied with systemic complications, especially if the articulations are already announcing the existence of pyæmic arthritis, by tenderness and swelling, closure of the urachus by ligations should not be practiced. In such cases antiseptic and astringent irrigations must be depended upon exclusively as local treatment and the systemic complications must be managed by internal medication of the young and the mother.

Resection of the Prepuce in Horses—(Circumcision).

Circumcision is practiced in horses for **hypertrophy** of the **prepuce,** when this condition causes impotence or chronic paraphimosis. Inflammations of the penis, obstinate œdemas of the penis and sheath, or even local injuries to the prepuce itself are always very prone to end in a thickening of the preputial fold into a hardened mass that obstructs the free movement of the penis, and in stallions prevents normal copulation. When the condition causes chronic paraphimosis in geldings or when, in stallions, it incapacitates the individual for breeding purposes, the only resource is resection of the hypertrophied mass and approximation of the skin gap resulting therefrom.

TECHNIQUE.—The horse is secured in the dorsal recumbent position. A general anæsthetic may be administered, but local cocainization of the penis subcutaneously just behind the enlargement to be excised will answer. For this latter purpose a two per cent solution is injected hypodermically in a circle around the entire organ. The penis is held out by means of two pieces of tape, one hitched tightly some distance behind the enlargement (which also serves as a hæmostatic tourniquet) and one just behind the glands. The dangling ends of these two tapes are placed into the hands of an assistant who thus holds the organ firmly stretched into an operable position. The penis and internal surface of the sheath are given a good washing with brush, soap and water, and then with a strong mercuric chloride solution.

Two incisions encircling the enlargement are made so as to meet at each side of the raphe inferiorly, and so that the distance between them superiorly will dispose of the redundant skin. Superiorly, they should be separated one inch, two inches, or even more, according to the size of the enlargement, gradually converging as they approach the raphe inferiorly. A subcutaneous resection of the hypertrophied tissue is then made by sharp dissection with scalpel and thumb forceps. The skin flap, to facilitate matters, may be drawn out of the way with tenacula in the hands of an assistant who is also engaged in bailing blood. When the dissection has reached the level of the penis the enlargement may be detached by blunt dissection, as it has no firm connection with the body of the penis.

The uppermost tourniquet is then removed to allow the vessels, requiring attention, to bleed. These are carefully managed with forceps or ligatures according to their size.

The gap is closed with two sets of sutures,—mattress sutures about inch apart, placed an inch or so from each edge of the wound and interrupted sutures, a quarter of an inch apart along the edges.

The part is dusted with iodoform and the penis replaced into the sheath, where it is retained by taking a stitch or two across the sheath orifice. On the third or fourth day the sheath stitches are untied and the penis withdrawn, to be submitted to the necessary antiseptic treatment, after which it is replaced and retained by again tying the same stitches. At the end of eight days the wound stitches are removed and if primary union has occurred the penis is allowed its freedom.

Extirpation of the Membrana Nictitans.

INDICATIONS.—Removal is sometimes necessitated when this cartilaginous organ obstructs the cornea or irritates the eyeball. In certain rare cases, difficult to explain, the membrana nictitans permanently lies in an outward position so as to partially cover the internal zone of the cornea, and thus causes defective vision and maintains a constant watery condition of the affected eye from the irritation provoked. Extirpation of the redundant portion is the only remedy.

The most common disease, however, requiring extirpation, is tumors of the mucous membrane. The conjunctiva covering the membrana nictitans is very frequently the origin of growths which, if not promptly extirpated, soon encroach

upon the adjacent structures and thus develop into conditions requiring interventions of greater magnitude,—ablation of the eyeball, etc.

Then finally there is deformity of the cartilage following traumatisms. A serious inflammation of the membrana nictitans occasioned by violence may cause the cartilage to crimp along the free border and thus press upon the globe with harmful effect.

TECHNIQUE.—The operation is best performed in the recumbent position with aid of local anæsthesia, induced with cocaine ten per cent dropped into the field. Attempts to extirpate even portions of the organ in the standing position often are unsatisfactory on account of the impossibility of immobilizing the head.

The eye is first disinfected with boric acid solution and then anæsthetized with the cocaine solution. The latter is given ample time to penetrate the mucous membrane.

The lids are held apart with two stitches hitched into the borders of each and the membrana nictitans is drawn out with a third stitch hitched through its free edge. An assistant holds the eye open with the two lid stitches and the operator draws upon the organ with the third one as it is dissected loose with the scalpel or scissors.

The best dissection to effect a rapid ablation of the membrana nictitans is made as follows: The organ is drawn outward with the stitch, and the mucous membrane which connects it to the eyeball beneath is incised through and through from above downward. Then after drawing it forward as far as possible the incision is carried through the mucous membrane covering its external surface. A snip at each border (superior and inferior) now liberates the cartilage so that it can be torn out by traction, with the assistance of blunt dissection effected with the handle of the scalpel. If the cartilage resist avulsion the refractory attachments are snipped here and there with the blade of the scalpel as the traction continues.

By employing this method bleeding will be nominal and can easily be controlled by packing the cavity with gauze and holding it in place by tying the lid stitches together. To facilitate removal of the gauze its end is left protruding from the canthus.

After two or three hours the lid stitches are untied and removed and at the end of twenty-four hours the gauze is withdrawn.

Cicatrization follows without much reaction if asepsis is

respected throughout the operation Irrigations of the wound are not resorted to unless pronounced sepsis ensues, as they tend to provoke opposition from the patient.

Ablation of the Mammæ.

INDICATIONS.—Ablation of the mammæ may be found necessary in all of the domestic mammals, when these organs are affected with incurable disease that threatens the general health or else tends to advance beyond the limits of the affected gland. **Tumors,** both benign and malignant, very frequently develop in the mammary glands of mares, cows, bitches and sows. In fact these organs are relatively more susceptible to tumors than any other part

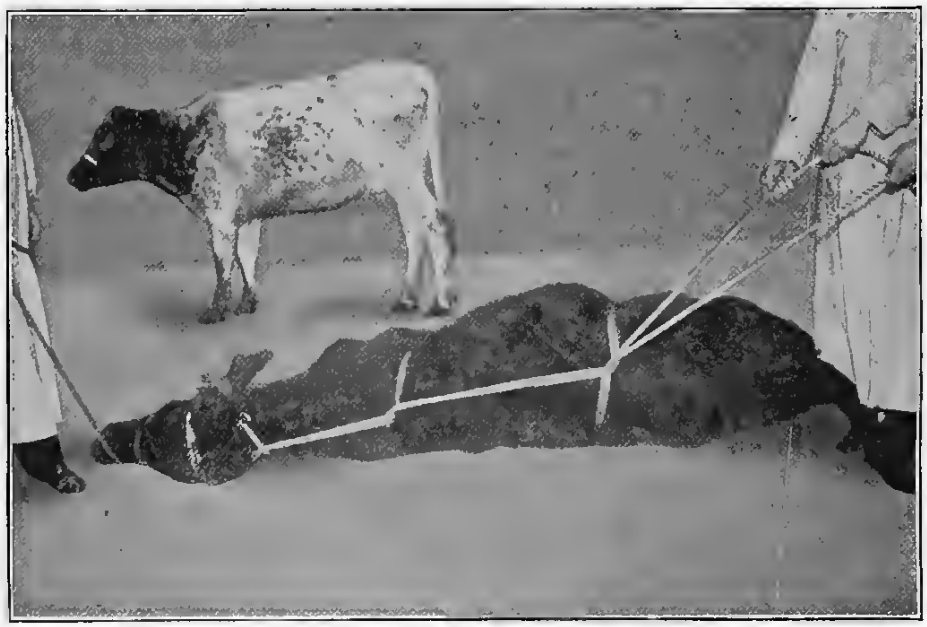


Fig. 242—Method of Casting Cows for Operations.

of the body, and as such morbidities will yield to no medical application, ablation is the only choice. Extirpation of tumors that transgress into the glandular tissue, without sacrificing the whole gland, is always an imprudent intervention, because of the certainty of recurrence in the case of malignant neoplasms, and because in the case of benign growths the partially removed gland will behave badly at each new period of lactation.

In meat producing animals parts of a mamma invaded by a new growth may be removed, preparatory to fattening for market, but in animals to be kept for breeding or working purposes total ablation of the affected gland and all of the integument implicated, should be at once per-

formed, in order that the general health be protected against troublesome recurrences and complications.

TECHNIQUE.—The patient must be secured in the dorsal recumbent position. In the mare and in the cow a general inhalation anæsthetic is administered, while in the bitch partial general anæsthesia with subcutaneous injections of morphia will answer.

Two curved incisions are made along the whole axis of the gland in such a way as to form an elliptical island which contains the teat. The width of the island must vary according to the amount of redundant skin to be disposed of. The growth at the island is grasped with the tumor forcep and drawn outward while the skin is carefully dissected from it as high as the level of the abdomen to which the gland is



FIG. 243—Lines of Incision for Ablation of the Mammæ of Cows.

attached by loose areolar tissue. Before proceeding with the ablation the dissection of the skin must be so complete throughout the whole circumference that the boundary of the gland where it attaches to the abdomen can be plainly seen. The first step in effecting the ablation is to ligate the nutrient artery and the vein. In the mare the artery will be found entering the gland antro-superiorly where its pulsation can be felt after careful search. The vein will be found leaving the gland postero-superiorly. Sometimes there are two, three or even four exit veins, all of which must be ligated to prevent a reflux bleeding from anasto-

mosing veins. The mammary veins are valveless and hence will not offer much resistance against reflux bleeding. These veins parallel each other and can therefore be ligated together as a single body.

The vessels having been thus handled and cut off, the growth is then torn out by traction or ablated by blunt dissection.

Bleeding vessels not previously controlled are now twisted or ligated and the cavity packed with gauze, which is retained with sutures.

AFTER-CARE.—The packing is removed twenty-four hours later and the cavity managed as an open wound with potent antiseptic washes and powders. Healing is usually rapid.

In the cow there are large cutaneous veins which must receive attention during the skinning process, and the nutrient vessels of the gland are much more difficult to find than those of the mare. The arterial mechanism consists of a short branch of the main artery for each mamma, which enters each gland in the center of the udder superiorly. These must be searched out individually and ligated for each gland to be extirpated, unless the whole udder is to be ablated. Then the main trunk is ligated, but the ligation of the main trunk must be sacredly avoided when only one or two of the mammæ are to be removed, because the remaining glands would be deprived of their nutrient supply, and would suffer accordingly. The veins must be handled in the same careful manner because ligation of the main trunk would cause a troublesome passive hyperæmia and œdema pending the establishment of an adequate collateral circulation. The numerous cases of gangrene, septicæmia and pyogenesis following ablations of one or two mammæ in cows are usually due to promiscuous ligation of vessels that are essential to the healthy life of the remaining glands.

IN BITCHES no special attention need be given to the blood vessels until the gland has been removed, at which time the spurting ones can be managed with the forceps before any serious loss of blood has occurred.

White's Hair-Lip and Cleft Palate Operation.

The common deformity called hair-lip which is so often combined with cleft palate, is met frequently in dogs of fancy breeds. Blenheims, Boston terriers, French Bulls, King Charles spaniels and Japanese poodles, are the ones in which the deformity occurs most frequently. In uncomplicated

hair-lip the operation is performed only for cosmetic purposes, but when combined with cleft palate the operation is a necessity because the impaired power of prehension interferes with proper nourishment and at once leads to malnutrition and non-development.

There are several varieties of the deformity:—(1) Simple, uncomplicated hair-lip, unilateral, medium or bilateral; (2) Hair-lip, unilateral or bilateral, complicated with single or double cleft palate. Of these the cleft may be complete or incomplete, anterior and posterior, wide or narrow. The deformity to which these varieties belong sometimes extends upward to the eye and backward through the velum. It is only the simplest forms of hair-lip and cleft palate that are amendable by surgical treatment in animals. The veterinarian is not expected to interfere with the complicated forms because the complexity of the procedure is out of proportion to the value of the individual affected. Notwithstanding the fact, however, that these operations have never been extensively attempted in the history of veterinary surgery, the author coincides with White's opinion that the possibilities are as wide and the general results as good in pups as similar operations amongst babies.

TECHNIQUE.—The deformity involves the skin, mucous membrane, periosteum and bone, constituting the lip, alveolar processes, palatine process of the superior maxilla, and the hard palate. The operation involves denudation, relaxation, coaptation and retention, of these structures and each of these processes must vary according to the character of the deformation.

First Step—Denudation.—In making raw edges to unite with sutures, strict economy of tissue must be practiced because there is never any tissue to spare, and when the fissure is a wide one it may tax the ingenuity to construct a covering for it. In babies it is sometimes found necessary to perform two, or even three, consecutive "crowding" operations to effect a complete closure, hence the advisability of saving all the tissues in denuding the border for coaptation. Marginal incisions are made along the borders of the cleft through the skin in the lip and through the mucous membrane and periosteum in the palate. These incisions are lifted up into flaps that can be sutured.

Second Step—Relaxation.—In the lip two lateral incisions are made through the skin some little distance from the denuded margin; or, if the fissure is wide, the cheek may be detached from the bone to allow the lip structure to be

brought inward. In the mouth a U-shaped incision is made through the hard palate and periosteum following the line of the gums. This loosening process must allow the denuded margins to come together without tension, otherwise the operation will fail.

Third Step—Coaptation and Retention.—The margins are now sutured from behind forward with a continuous catgut suture.

No after-care is required.

CHAPTER XIII.

ACCIDENTS.

STREET NAIL PRICKS.

The "picking up" of **street nails** occurs chiefly to urban work horses, of which it is the most common of all accidents. In rural horses and in cattle it occurs more rarely.

Nails penetrate any part of the solar aspect of the foot, but the most delectable place is the region of the frog, especially in the lateral lacunæ one inch from the point. In depth the penetration is likewise varied. Most nails only perforate the horn and velvety tissue, their course being deflected or arrested by the more firm overlying tissues,—the bone and plantar aponeurosis. When the latter is perforated formidable complications in the form of thecal or articular abscesses usually follow. The character of the infection also varies, from feebly virulent pyogenic microbes which provoke only a local and trivial suppuration to highly virulent death-dealing bacteria, whose presence in the velvety tissue is soon announced by a threatening, advancing inflammation that may prove fatal in a few days. Tetanus and malignant œdema are amongst the infections that are sometimes inoculated into the foot by nail pricks.

The seriousness of nail pricks depends, therefore, upon (1) the depth and the course of the puncture, (2) the nature and virulence of the infection, (3) resisting powers of the patient, (4) the soundness and conformation of the foot, and finally upon the promptness with which proper treatment is employed.

PREVENTIVE TREATMENT.—Nail pricks may be prevented by the application of a protecting plate that covers the solar surface. Thin sheet iron, sole leather or several layers of heavy canvas are the materials usually employed for the purpose. Although these are not entirely impenetrable, even the latter (the softest of the three) is almost universally preventive, because the mechanism which facilitates the "picking up" of nails is thereby destroyed. The nail lying flat upon the street is tipped against the frog by the toe of the shoe striking its head, and as the foot is simulta-

neously sliding forward the point is at once forced into the frog. At first it only enters the horn or is only wedged into the lacuna, but with each successive step it is driven inward more and more until it meets with resistance that causes the protruding part to bend against the foot. If the nail is pointed and favorably directed it may be driven inward step after step until the head reaches the level of the shoe. Sometimes in this manner a long nail or spike may completely transfix the foot from the side of the frog to the pit between the heels, following the perforans tendon on its upward course. By the simple application of a smooth cover to the solar surface nails are intercepted from attaching themselves to the frog as the point is tipped upward by treading upon the nail head, and thus penetration is successfully prevented. It is only the nail fixed point upward upon the street that penetrates protective pads and since such nails are rare as compared with those lying flat, street-nail punctures are almost entirely eliminated by them.

The economy from protecting pads can hardly be overestimated in large establishments, in view of the annual loss from this single disabling and often fatal accident.

TREATMENT.—The horse-shoer's method, which consists of paring the hoof thin and excavating the horn around the perforation and then submitting the wound to a thorough cauterization with hydrochloric acid, is commendable because of the certainty with which the inoculated microbes are destroyed. It is only where the caustic does not reach the depth of the tract, or where the inflammation has already advanced into the inaccessible surroundings that such treatment fails or becomes more harmful than beneficial. This "first aid" can in no light be discredited if immediately employed, and especially if the penetration is superficial. On the other hand, when the tract is a deep one or the puncture is of several days' duration, the cauterization may do harm by producing an impervious eschar that will subsequently obstruct the drainage.

The veterinarian usually arrives upon the scene when the inflammation is already well advanced, the claudication is accentuating, and the patient is beginning to show systemic invasion of the microbic products. At this stage the following routine is recommended:

RESTRAINT.—The operation may be performed in the stable or at the horse-shoer's in the standing position. In the restive horse cocainization of the plantars is helpful.

Thoroughness however in many cases demands recumbent restraint. The operating table is par excellence the best.

First Step.—The unshod hoof is submitted to a thorough paring not only around the puncture but over the entire sole and frog which are patiently trimmed and "smoothed up" until the whole surface is compressible.

Second Step.—The horn around the puncture as far as it has become detached from the velvety tissue is then carefully removed without drawing blood by invading the healthy surrounding zone or wounding the bulging soft tissues.

Third Step.—The nail tract is then cleansed with a solution consisting of hydrogen peroxide, 20%, and mercuric chloride, 1-1000, 80%. The cleansing process is executed by a gentle syringing that will not force the fluid beyond the tract and pus cavity, and the injected solution must be afforded a free, unobstructed reflux around the canula Then, after the wound has been dried by bailing it with cotton or sponge and the bleeding has ceased, the tract is injected with a saturated solution of iodine crystals in ether.

Fourth Step.—The shoe is then nailed on loosely with two or three nails on each side, and the solar surface covered with cotton saturated with mercuric chloride solution, 1-500, which is held in place with a piece of heavy leather that fits evenly into the sole, and two transverse pieces of hoop-iron which are sprung beneath the shoe to hold the leather securely in position. (Fig. 241). This dressing assures perfect cleanliness against stable filth, is easily removed and replaced, maintains good antisepsis about the wound and freely absorbs the discharges.

AFTER-CARE.—Three or four times daily a few ounces of mercuric chloride solution 1-500 is poured into the cotton at the heel, and each day the dressing is removed and pus-soaked cotton replaced by a clean supply which is kept constantly saturated. At the time of dressing each day, or at least every second day, the horn around the wound is pared away as far as it is found to be detached from the velvety tissue.

This intensive antiseptic and protective treatment is continued until the discharge ceases and the velvety tissues have become reclothed with new horn.

If the lameness is refractory and the pain intense the foot is wrapped in a woolen swab soaked repeatedly with hot antiseptic water.

Continuation of the pain, accentuation of the lameness,

and especially general symptoms,—fever, anorexia, accelerated respirations, etc.,—indicate invasion of the navicular bursa. The suspicion is at once confirmed when the wound begins to discharge a thin, watery liquid-synovia that coagulates upon the dressing. This complication may require more radical intervention. See page 461.

It is also always advisable to administer an immunizing dose of antitetanic serum.

NAIL-TREADS.

Nail-treads is the name we apply to pricks from one or more nails caused by treading upon a shoe partially wrenched from the foot. The nails of a loose, clacking, badly worn shoe, drawn from their tracts with the shoe about to be cast off, are sometimes trampled into the foot along the solar margin, but the most common cause of the accident is the forcible wrenching of a shoe whose toe-calk or heel-calk becomes fixed into a crevice in the street pavement, railroad switches, defective street-car tracks, drawbridge, etc. While these menaces may thus cause the shoe, and sometimes the whole hoof, to be torn off completely, more often the shoe is only wrenched from one side of the foot and the protruding nails whose heads are still tightly wedged in their sockets, penetrate the sole at the next step. This form of penetrant nail presents entirely different phases from the typical "picked up" street nail. The latter usually invades the region of the frog, and complicates matters by implicating the navicular synovial bursa, while the former invades the border of the sole, and when serious involves the affected zone in an acute osteitis and laminitis that end in a more or less extensive necrosis of the os pedis and laminæ, and not infrequently in quittor.

PREVENTIVE TREATMENT.—The fact that it is usually the toe-calk that becomes caught in the defective street suggests the advisability of so shaping this part of the shoe as to reduce these accidents to the minimum. This may be done by making the toe-calk curve to the contour of the shoe instead of extending straight across the toe. The curved calk, three to four inches long according to the size of the shoe, seldom ever catches in street crevices. At the heels adequate protection is found in rubber pads.

TREATMENT.—The "first aid" treatment does not differ from that of the street nail. Paring the hoof thin

around the puncture and cauterizing with hydrochloric acid is sufficient treatment when the stabs are superficial, but when severe pain indicates a deeper injury prompt surgical intervention is always prudent. The procedure is as follows:

RESTRAINT.—Cocainize the plantar nerve on the affected side and operate in the standing position; or, better still, secure the patient upon the table.

First Step.—After submitting the sole and frog on the injured side to a good paring and trimming off all of the detached horn around the puncture, the foot is well disinfected with a strong solution of mercuric chloride.

Second Step.—After applying a tourniquet to the metacarpus a V-shaped section of wall is then stripped or pared off from the weight-bearing border of the wall upward. (Fig. 244). The laminæ externally and the velvety tissue beneath, that have been thus exposed, are then resected down to the bone and over as much surface as they are found to be involved in the inflammatory process. If the os pedis, indicated by roughness, is found denuded of periosteum over any part exposed, it is curetted.

Third Step.—The wound is then submitted to an intensive antiseptic treatment, first with hydrogen peroxide, which may even be injected freely into the soft tissues bordering the wound with a hypodermic syringe, and then with mercuric chloride 1-500.

Fourth Step.—The cavity is packed firmly with a pledget of antiseptic cotton and bound tight to prevent postoperative bleeding.

AFTER-CARE.—At the end of twenty-four hours the dressing is removed and the wound treated to a coating of iodine crystals in ether. The shoe is applied and the wound protected with antiseptic cotton held in position with the shoe and bandage. (Fig. 245). Daily dressing with the iodine solution is continued until all the lameness has disappeared and the discharge has ceased. The wound is examined carefully each day for exfoliations from the os pedis, which are extirpated as soon as they are detached. Superfluous granulations are controlled with astringents, or, if exuberant, with the actual cautery.

FORGE PRICKS.

Forge pricks is the name we apply to punctures of the keratogenous tissue by misdriven horseshoe nails. These are the most insidious of all hoof punctures. The initial

injury is often so trivial, the infection so feebly virulent, and the seat of invasion into the laminæ so deep and sheltered, and the lameness so slight at first that the cause of the claudication may escape discovery for some days after the accident has occurred.

The accident is sometimes due to careless driving, but more often the forge pricks encountered in practice are attributable to attempts to nail shoes securely to feet having thin, badly broken walls. In such feet the shoer always recognizes the necessity of driving the nails to a high level in order to assure retention of the shoe and to prevent further mutilation of the lower part of the wall. In these attempts



FIG. 244—Schematic View of Operation against Forge Pricks and Nail Treads.

nails may parallel the laminæ closely enough to cause inflammation by pressure without penetrating, or the wound they inflict to the laminæ may be slight, or it may extend along the whole or part of the course of the nail. Carelessly driven nails may enter the velvety tissue, nick the border of the os pedis, and then wound the laminæ from the border of the bone to the point of exit.

Forge pricks, if treated promptly, are relatively less serious than street-nail pricks and nail-treads, because everything connected with the accident is more clean. The nail is bright and clean, the hoof has been pared of all dirt-containing recesses, and the shoe has just come from the fire,

all of which combined constitute a favorable condition for the infliction of a wound, as compared with the filthy conditions under which the other hoof punctures are sustained. In fact, few misdriven nails that are promptly withdrawn ever cause either lameness or inflammation, and indeed many of them that sojourn for several days, promptly end favorably by no other treatment than that of readjusting the shoe. It is the delay in discovering the cause of the lameness and the inadequate "first aid" that renders these accidents serious, in certain cases.

TREATMENT.—The "first aid" usually administered



FIG. 245—Dressing for Operation on the Wall, against Forge Pricks and Nail-Treads.

by the horse shoer is seldom properly directed at the hot-bed of the infection. Usually the paring to evacuate pus is done at the sole while the hot-bed of the infection is higher up beneath the wall, at a point seldom ever invaded by the horse shoer's knife.

The general recommendations for the treatment of nail-treads will answer for forge pricks with the one exception that the V-shaped excavation in the wall should extend higher in order to overlap the diseased area. In fact it is usually necessary to extend the apex of the excavation to the lower border of the coronary cushion. The dressing, shoeing, and after care do not differ from that of nail-treads.

Wrenching of the Hoof.

When a firmly nailed shoe caught in a defect in the street does not yield to the traction exerted by the horse's momentum or struggles, the hoof receives the force of the accident, and sustains injuries of variable severity and character. **Generally this accident results in the detachment of the wall, one, two or three inches along the coronet, and one to two inches downward over the laminal surface,** but in other cases the injury may be much more complicated. The whole hoof may be wrenched off; the wall may be fractured longitudinally and one-half or one-third of the hoof detached; the wing of the os pedis may be fractured, and one or more of the phalangeal articulations may be severely strained.

TREATMENT.—These cases, under favorable conditions, are usually curable, although in the complicated cases some time may be required to restore the horse to full usefulness. The exceptions are found in cases neglected for several days, at which time infection will have eliminated all chances of curing the severe cases and will have allowed the milder ones to develop complications which will delay matters considerably. Septicæmia, exhaustion, and synovial and articular complications will prove the undoing of serious cases that are neglected, and quittor often follows the milder cases that are permitted to undergo an infective inflammation.

A horse so injured should be immediately transported to the hospital after having the injured foot temporarily protected against contamination with dirt, and then submitted to an intelligent surgical treatment.

RESTRAINT.—Recumbent restraint is essential to the best results; in fact, thoroughness would be impossible in the standing position. To control the pain, the plantar nerve on the affected side is anæsthetized with cocaine.

First Step.—After applying a tourniquet to the leg to control bleeding, the foot is given a liberal washing with abundance of water. The hose from the hydrant or the large fountain syringe should be turned upon the foot for ten or fifteen minutes as the hand washes it clean with cotton or sponge. At the same time the hair around the coronet is clipped and shaved and rinsed off with the stream.

Second Step.—The detached part of the hoof, no matter how extensive, is now removed by paring or by cutting a groove through the wall and effecting the extirpation with

the pincers. Especial pains are taken to invade every part detached.

Third Step.—The denuded surface is now examined for earth, cinders, sand, dirt, or hairs that may have been ground into the tissue at the time of the accident. These are managed by dissecting away the tissues containing them, as they can not be otherwise dislodged or rendered innocuous. This mechanical disinfection must be thorough, even though the whole surface must be shaved off with the scalpel. This dissection may be made more effectual by employing a stream of water from the fountain syringe to wash off the shreds and dirt as fast as they are dissected away.

Fourth Step.—The surface is submitted to a prolonged irrigation with mercuric chloride as a final disinfection, and then bound up in cotton and bandage soaked in the same solution.

AFTER-CARE.—The dressing is removed in twenty-four hours and the wound treated to a liberal dusting of iodoform daily until amply protected against infection by the new horn, which develops rapidly where the genetic tissues have not been destroyed. Where these have been destroyed the granulations will require the application of astringents to prevent excessive growth.

Barbed Wire Cuts.

The phrase "barbed-wire cuts" is quite generally used by American veterinarians and stockmen when referring to lacerated wounds sustained on barbed-wire fences. These wounds possess certain uniform characteristics as to cause, location and physiognomy that deserve a nosological consideration, and while the name applied to them is admittedly ordinary it has been consecrated by usage and its appropriateness cannot be disputed.

Whilst lacerations from barbed-wire fences may be sustained at various parts of the body, there is a surprising analogy in the four points of predilection at which they are usually found. Named in the order of frequency these locations are: (1) **In the region of the fore heels;** (2) **In the flexion surface of the hock;** (3) **In the pectoral region;** and (4) **In the anterior surface of the forearm.**

1. **In the Region of the Heels.**—These wounds are sustained by the horse rearing or striking into the fence, generally while rollicking with animals in the adjacent pasture. The foot usually is caught in the second or third wire from

the ground, but sometimes on the topmost one. In the attempt to withdraw the foot thus caught the wire falls into the space behind the lateral cartilage that extends from its anterior extremity to the median lacuna of the frog, where it soon saws a ragged laceration, the depth and extent of which depends upon the maneuvers executed in the frantic efforts to release the leg. Sometimes one, or even both quarters, are almost severed from the body, but the real seriousness of the wound depends more upon whether or not the navicular or sesamoidean synovials have escaped direct injury. Strangely enough, these structures are not as frequently invaded by the wire as might be supposed from the relations they bear to the traumatic cavity.

When these wounds are allowed to become infected, and especially if the synovials are involved, a serious, distressing lameness ensues that may incapacitate the patient for months, leave a deforming indelible horn-like blemish, and even terminate fatally.

TREATMENT.—As a proper nosocomial operation and after-care must usually be substituted by ordinary stable treatment, much the best procedure is to promptly submit the wound to an **"intensive antisepsis"** amounting to cauterization. Shreds should be trimmed off, bleeding arrested and dirt particles washed out; then, without further ceremony, every part of the wound is touched up with the following solution: Mercuric chloride, four drams, hydrochloric acid one ounce and alcohol twelve ounces, after which it is filled full of boric acid and bound up loosely with cotton and bandage. Each day the boric acid is wiped out with pledgets of cotton without washing, and the walls of the wound painted with the solution, after which it is again filled up with the former. The strong cauterant solution will promptly destroy any microbes invading the living tissues, and the boric acid may be depended upon to prevent putrefaction of the dead cauterized elements. Thus, after eight days of treatment the eschar separates, falls out, and leaves behind a wound well carpeted with rosy granulations that will soon fill up the wound and be transformed into a scar. After separation of the eschar the boric acid may be continued to prevent infection of the granulations, or it may be substituted by iodoform or any potent antiseptic powder. Exuberant granulations will require astringents, trimming or even actual cautery, but these are rarely ever in evidence in the absence of infection with pyogenic microbes.

When the wound is of some days' duration, and of course

badly infected, its walls should first be submitted to a thorough mechanical disinfection, curettage, dissection of the infected walls, etc., and then treated as above directed for a recent case.

Implication of the synovials requires no change from the above procedure, except that the copious discharge will necessitate renewal of the dressing two or three times daily.

Other drugs may be substituted for the cauterant mixture above recommended, amongst which are phenol, equal parts of phenol, tincture of iron and glycerine, and butter of antimony.

2. **In the Flexion Surface of the Hock.**—This wound is sustained by kicking through the fence, and sometimes, but rarely, by an unsuccessful jump. In this case the wire saws a ragged laceration into the region, in the attempt to release the leg. The wound varies from a simple cutaneous breach to a serious articular injury in which the tibio-astragular articulation is laid bare and the tendons of the flexor metatarsi and extensor pedis are severed. Frequently, indeed, the capsule of the articulation is torn open. This wound is always a serious affair, even when the tendons and synovials are not injured, because the flexion movements of the joint interfere with healing during the acute stage of the inflammation, and always end in promoting the formation of a blemishing scar that leaves the patient practically unsalable thereafter.

TREATMENT.—The most annoying phase of the treatment of this injury is the patient's formidable opposition to bandages. As soon as the bandages are nicely applied the horse at once opposes them by executing a series of contortions with the leg which are continued until the whole affair is disarranged and much damage has been done to the wound. Braces, paddings, or any of the various immobilizing contrivances are likewise resented to the extent of rendering their application both useless and harmful. Furthermore, the patient is often an unbroken youngster that will not take kindly to any form of interference.

All things considered, a special form of open-wound treatment seems best, except when the tractability of the patient indicates that the protective dressing would not be thus disturbed. In the latter event the "intensive antisepsis" mentioned in the foregoing variety, and the packings with abundance of boric acid, which is renewed according as it becomes soaked with secretions, is advisable, but when the bandaging is opposed by movements of the leg the following

procedure is recommended: Trim off all unviable shreds, including dangling pieces of skin; remove all dirt by washing or by dissecting away the tissues containing it; spray the wound, after the bleeding has ceased, with a solution of iodine crystals in ether,—two drams to eight ounces,—and then insufflate the surface liberally with iodoform. During the first three to four days this medication is repeated three to five times daily. Washing the wound is harmful; but the parts below it should be kept free from accumulations of dried secretions by inunctions of vaseline and daily cleansing with soap and water. The iodine spray and the iodoform are continued until a bed of granulations has formed; then repeated applications of **white lotion** to control exuber-



FIG. 246—Large Scar Supervening Barb-Wire Cut on Flexion of Hock.

ant vegetations become necessary, and these should be continued until the scar formation is complete.

When there is a synovial discharge of articular origin the same treatment will answer, but in addition the whole hock surface excepting the wound itself should be promptly blistered at the beginning with a strong cantharides ointment, one to four. Copious discharges of synovia from the tendon sheaths must not, however, be mistaken for "articular" synovia.

3. **In the Pectoral Region.**—These are sustained by running headlong against the uppermost wire of a too low fense. An attack upon a horse in the neighboring pasture, accidental contact at night, and defective vision are among the circumstances attending the infliction of this variety of "barb wire cuts." This wound usually consists of a more or less extensive tearing of the skin. Sometimes only a small

patch is torn loose, while at other times the whole pectoral region is rent of its cutaneous covering which hangs down like an apron.

TREATMENT.—In this variety painstaking repair of the breach is the only sensible course to pursue. Although some part of the great skin-flap will surely prove to be unviable, it is nevertheless prudent to preserve it intact until the unviable zones are distinguishable by the formation of lines of demarcation some days later.

The operation begins with a patient shaving of the circumference of the wound and the circumference of the flap so as to make a hairless tract for the sutures no less than three inches wide. In addition the flap should be shaved in spots here and there, to serve as entrance points for the "quilting sutures" to be applied subsequently.

The general plan of procedure, after the field has been mechanically and medicinally disinfected with unmistakable thoroughness, is to (1) "quilt" the patch to the body from the attached part toward the free end, by means of a series of simple stitches systematically arranged over its surface; (2) to hold the edges together with button sutures one inch apart and approximate them neatly with interrupted sutures; and (3) to provide numerous drainage orifices to prevent the accumulation of subdermal serosity.

The quilting sutures should be as short as possible in order to incarcerate as little skin as possible, and they should always be inserted before the edges are sutured together because a short stitch cannot be applied, even with a small, full curved needle, after the patch is once attached to the body.

The sutures are covered with a thick layer of collodion and the drainage orifices are kept open by wadding them for a few days with gauze plugs which are renewed frequently.

If fluctuant areas appear which cannot be drained through the orifices previously provided, they are lanced.

At the end of eight days the sutures that are no longer of service, either on account of primary union or stitch necrosis, are taken out, the buttons are removed and the dead areas resected. The latter, however, should not be molested if still serviceable in holding viable parts in place. The quilting sutures are the last to be removed.

Compared with the practice of hurriedly sacrificing the skin flap in these cases where successful repair seems impossible the above procedure is always attended with much better final results, as some of the skin, and sometimes all

of it, is always thereby preserved to the patient and the blemish is always less conspicuous.

4. **In the Anterior Surface of the Fore Arm.**—This wound is sustained by headlong contact with a low fence, usually one having its uppermost wire broken. The wound, as to character, varies from a cutaneous laceration of variable extent to a serious mutilation that severs the continuity of the anterior antibrachial group of muscles. The seriousness depends largely upon the extent of the muscular injury. Often extension is permanently impaired and the impediment is manifested by frequent stumbling.

TREATMENT.—When only the skin is involved, or when the muscular injury is slight, reparative treatment is in order. The wound is disinfected, its surrounding shaved and the flap sutured with button and interrupted sutures, and drainage is provided. On the other hand, the wound invading the muscles extensively had better be left to the open wound treatment recommended for the first variety described, on account of the tendency of secretion gravitating downwards amongst the muscles and tendons of the region. The patient should be kept exceptionally quiet, and if the wound permits the immobilizing brace (Fig. 258) may be helpful.

Penetrant Abdominal Wounds.

(EVENTRATION.)

This accident is caused by violent contact with pointed objects, such as shafts of vehicles, protruding, broken fence boards, horns of cattle, etc. These objects usually strike the body at an angle, penetrate the surface at one place and then pass obliquely through the abdominal muscles for some distance before perforating the peritoneal cavity. The wound thus inflicted is an elongated, mutilated laceration of the muscles and internal inguments, with but a small cutaneous breach. The opening into the peritoneal cavity, on the contrary, is of considerable size, and usually allows the viscera to fall into the traumatic cavity, where they may be retained by the narrowness of the entrance orifice. At other times, when the tract is short and quite direct through the wall, they may prolapse externally, gravitating more and more until parts of them trail the ground.

The seriousness of this accident depends upon the extent of the visceral injury sustained, either directly by the

wounding object or by external exposure to filth and bruises, and also upon the promptness of the treatment.

TREATMENT.—As a patient soon develops a fatal state of shock delay in reaching the scene and in promptly administering relief adds materially in the poor success usually met in the treatment of such injuries. To end successfully the treatment must be prompt. The "first aid" is important. If the prolapsing intestines were promptly sup-



FIG. 247—A Penetrant Abdominal Wound Safely Healed.

ported with a clean wrap pending the arrival of the surgeon and the conditions met upon arrival were favorable to the performance of an abdominal operation, many of these apparently hopeless cases could be successfully treated. On the farm, and in the city stable, it is seldom possible for the surgeon to hurriedly surround himself with conditions upon which successful intervention would depend. Much the best management consists of flushing the wound, its sur-

roundings, and the intestines if protruding externally, with abundance of water, warm if obtainable, manually returning the viscera into the abdominal cavity, and then wrapping the body tightly to retain them until adequate preparations can be made for the operation. If possible the patient should be conveyed as quietly as possible to the hospital, where a more thorough operation can be performed. If the prolapsed bowels can be returned and safely retained, the emergency has been met and some time may then be allotted to complete the preparations for the following procedure:

Restraint.—The patient is cast or secured upon the operating table and anæsthetized with chloroform.

First Step.—The region is washed, shaved and disinfected with more than ordinary thoroughness, and to provide against soiling the intestines that may subsequently be forced out through the surgical wound about to be made, sterilized cloths are laid below the field. The surface of the body around the wound is moistened with wet sponges to allay loosened hair which may fly into the wound.

Second Step.—It is now necessary to lay bare the entire tract from the wound in the skin to the opening into the peritoneal cavity. No matter how long or how short the tract may be, it must be opened completely. Sometimes its course is just beneath the skin; at others it enters at once through one or two layers of underlying integuments. In either case the structures constituting the outer boundary of the tract are incised from one end to the other. The bleeding may be considerable, but this is arrested with the forceps or by ligation. If only the skin is incised the bleeding will be trivial. The edges of the incision are now parted with tenacula or tumor forceps and the tract submitted to a thorough trimming that will destroy its anfractuosity, and remove the soiled and mutilated shreds and all of the dirt particles or foreign bodies it may contain. Attempt is made to construct a favorable channel for drainage.

Third Step.—Abdominal lavage is not attempted. If the viscera have been soiled and were not cleansed in the preparatory washing, they are left to the resisting powers of the body, as any attempt to carry out an effectual washing of the enormous volume of bowels and abdominal cavity is more apt to do harm than good. The wound itself, however, is cleansed with peroxide of hydrogen and then with mercuric chloride, after which it is sprinkled liberally with iodoform.

Fourth Step.—A perforated rubber drainage tube is now

placed along the tract so as to invade the abdominal cavity about one inch and protrude from the external orifice about two inches. Over this the muscular layers are sutured with strong catgut interrupted sutures placed no less than one-half inch apart. The cutaneous wound is sutured first with button sutures (Fig. 56) and then with interrupted sutures of strong braided silk. At the orifice a stitch or two is taken into the rubber tubing to prevent it from working outward by the respiratory movements.

Fifth Step.—Strong wraps of muslin are then encircled

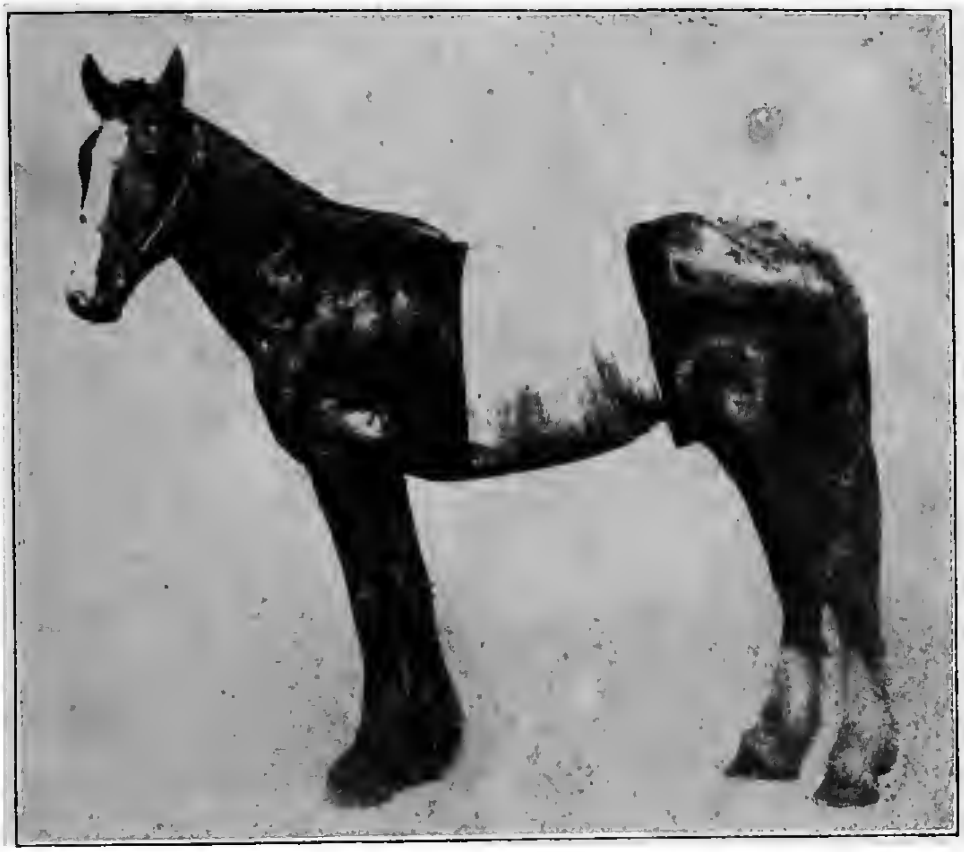


FIG. 248—Dressing in Operation for Penetrant Wounds.

around the body and fastened securely to prevent slipping. At the orifice a perforation is made in the bandage for the drainage tube.

AFTER-CARE.—The patient is sustained on a light, succulent diet. Constipation is combated with linseed oil and rectal injections, and the strength is maintained with ammoniacal stimulants.

At the end of four days the bandage is removed temporarily to treat the wound to a sprinkling of iodoform. The drainage tube is kept open by probing to dislodge desiccated products that accumulate around the opening. In ten days

the tube is extracted and the tract allowed to close, and the cutaneous sutures removed. Fever and general malaise that is certain to ensue is treated medicinally according to the indications presented.

Punctured Wounds of the Thorax.

These wounds should at once be divided into (1) **penetrant wounds** and (2) **non-penetrant wounds.** The former enter the thoracic cavity with or without injuring the viscera, while the latter only invade the structures constituting the chest wall.

They are usually located on the anterior face of the pectoral region and are sustained in a large percentage of instances in collisions with vehicles, the shafts of which perforate the body by the force of the clash. The puncture may be shallow when the force is slight, or when the object is arrested by the sternum. If located high it may at once perforate the thorax along the course of the trachea, sometimes wounding large vessels, or even the heart, and cause death in a few moments. The usual course, however, is between the shoulder and the costal surface after glancing off of the keel-like sternum. In this space the puncture may reach the depth of six inches, one foot, two feet or even more. The posterior end of the tract is often located just within the olecranon. A case was reported at the 1907 meeting of the Illinois Veterinary Medical Association in which the object, —a fence board,—perforated the pectoral muscles, passed between the shoulder and ribs and then followed backward subcutaneously as far as the stifle.

These wounds may be complicated by fracture of the sternum, fracture of one or more ribs, tearing loose of the costal cartilages, and sometimes by the foreign bodies—a part of the object having broken off within the tract.

Inter-costal penetrations are rather rare in animals because the overlapping arrangement of the ribs causes objects to glance off instead of perforating the thorax. A glancing clash against a pointed object may, however, tear a rent through the cartilages of the false ribs and enter the abdominal cavity, causing breach of the thorax, diaphragm and abdomen. The author has observed several such wounds in horses, and White refers to their frequency in dogs. Direct inter-costal perforations of the thorax are, however, sometimes sustained by horn-thrusts, malicious blows with tools and by kicks from sharp-shod hoofs.

1. Penetrant Wounds.

TREATMENT.—In solipeds the free admission of air into the thorax at once provokes a distressing dyspnœa that reflects over the whole organism and materially mitigates against recovery from the wound itself. Inflammation of the pleura and lungs is also difficult to prevent or control. In bovines and canines a unilateral chest wound is much less serious because the supervening phenomena are more prone to remain unilateral. As there is no communication between the two pleural sacs in these species, the inflammation is less inclined to invade the opposite side, but the favoring element is the possibility of maintaining drainage without producing the distressing bilateral pneumothorax that always accompanies the application of drainage tubes in the thorax of horses, whose pleural sacs communicate with each other.

In the animals having non-communicating pleural sacs the procedure consists of first submitting the environs of the wound to a thorough shaving and cleansing, and the wound itself to a mechanical and medicinal disinfection. The ragged parts are trimmed and the whole channel treated to a good soaking with tincture of iodine. Irrigations that might wash infectious matter into the thoracic cavity are avoided. The disinfection having been properly completed, a perforated rubber drainage tube is placed into the tract so that its inner extremity invades the thorax. The outer end is then fixed to the skin with a stitch or two and the wound closed tightly around it with interrupted sutures. A coating of collodion to the sutures to protect against infection, and a tight body wrap of muslin to immobilize the costal movements as much as possible, complete the procedure.

The **after-care** consists of probing into the tube to prevent blocking up with dried secretions. At the end of eight days the tube is removed and the wound packed loosely with gauze daily until closed.

In solipeds penetrant wounds, after being submitted to a thorough disinfection, must be closed tightly with sutures or else drained with an apparatus that will prevent the admission of air into the thorax with each inspiration. This apparatus is constructed as follows: A flexible rubber hose is attached to the end of the drainage tube and then dropped into a quart bottle of water hung from a surcingle. The wound secretions overflow the bottle, whose neck is unobstructed by the small tube.

2. Non-Penetrant Wounds.

The deep puncture that enters the anterior face of the pectoral region and invades the space between the scapula and the ribs concerns us most. The first step in its treatment is to assure against the possible existence of foreign bodies by examining the object that made the puncture. If such exist their removal at all hazards is imperative. When there is reason to suppose that the wound extends almost to the space behind the olecranon, a long sound is passed into the wound and attempt is made to find its end through an incision through the loose skin that passes from the olecranon to the costal surface. In addition to the skin it may be found necessary to carry the incision through the latissimus dorsi, provided the end of the sound can be felt beneath it.

Whether this posterior opening is made or not, the subsequent proceedings are the same. The horse is placed backward into a narrow stall and allowed as little freedom as possible by tying the head tightly between the pillars. A fountain syringe as large as possible, equipped with a long hose, is then filled with warm mercuric chloride solution, about 1-1500. The hose is carefully passed to the very bottom of the tract and fastened to the skin with a stitch so adjusted as to not obstruct the orifice. The antiseptic stream is then turned on and allowed to flow continuously for no less than four hours, after which a long dry strip of antiseptic gauze is inserted into the tract. The orifice may be wadded moderately, or else sprinkled with iodoform. This treatment is repeated for three or four days, after which the gauze packing alone will be sufficient. The wound, thus being prevented from becoming a veritable microbian incubator, as is usually the case in such wounds, cicatrizes rapidly and the horse returns to work, often ,within three weeks.

When an opening has been made posteriorly, the only change necessary is to place the end of the hose at a point in the tract whence the liquid will flow from both openings, and thus come into contact with every part.

Lacerated Wound of the Buttocks.

This wound is usually caused by the kick of a shod foot. It is generally a stable accident, but sometimes occurs to horses in harness from other cause than kicks· amongst which is backing against sharp objects protruding from a load.

The wound is located on the hip behind the articulation, on the level of the os innominatum or slightly below it. The biceps rotator tibialis and the triceps abductor femoris are the muscles usually invaded. In addition to a triangular rent in the skin whose dimensions vary from three to six inches on each side, the muscles are more or less torn. Owing to the bluntness of the object inflicting the wound there is seldom much bleeding.

TREATMENT.—There are two courses to choose in the treatment of this wound; one is open wound treatment, and the other is suturing and draining. The former is much the preferable one when the patient cannot be conveyed to the hospital; on the other hand if nosocomial accommodations are within reach, the latter should be selected.

Open wound treatment should begin by a thorough mechanical disinfection in which the shreds and the dirt are disposed of by trimming the surface. Then, after the bleeding has ceased, the whole surface is painted with the following solution: mercuric chloride four drams, hydrochloric acid, two ounces, and alcohol twelve ounces, and then filled up with as much boric acid as will pack into the recesses and adhere to the prominent parts. The boric acid is reapplied frequently during each day, and the cauterant solution once daily until a bed of rosy granulations has formed beneath the eschar. Thereafter, mild astringents—white lotion—will answer.

The proper procedure against this wound, however, is the surgical method. The patient is confined on the table, or, if very tractable, with the single sideline. The skin around the wound is shaved about two inches from the edge. Before shaving the cavity is packed with cotton to prevent the shaved hairs from falling into it, and before the cotton is removed the shaved surface is disinfected with mercuric chloride 1-500 and then given a good friction with alcohol. The cotton is now removed and the cavity submitted to a thorough trimming of all unviable elements—dirt and conspicuous protrusions that would obstruct the flow of secretions toward the drainage orifice to be provided subsequently. When the bleeding has ceased the surface is sprinkled with iodoform.

SUTURING.—A row of button sutures or mattress sutures (Figs. 56-57) are first adjusted around the two sides about one inch from the edges; then these are drawn together and approximated neatly with interrupted sutures. A small orifice is provided inferiorly and superiorly for the

drainage tube, which is then passed through the cavity and fastened at the superior orifice to prevent it from slipping downward. The whole surface is then coated with collodion.

The after-care consists of probing the tube to prevent blocking up with dried secretions, feeble irrigations of peroxide of hydrogen administered through the tube, and removal of the sutures when the proper time has arrived.

A dose of antitetanic serum should always be administered to valuable charges, as such wounds are decidedly tetanogenic, whether treated as open or closed.

SUBPERIOSTEAL FRACTURES.

Fractures without immediate displacement occur with considerable frequency in horses, generally from kicks of other horses. The points of predilection of these injuries are (1) **the internal surface of the tibia,** especially the middle and inferior thirds; (2) **the inferior third of the anterior** surface of the radius, "just above the knee," and (3) **the superior third of the external border of the radius** "just below the elbow." At these three points the bones are exposed with no protecting envelope except the skin, and the periosteum is so thick and of such unusual toughness that a wicked kick may shatter the underlying bone without causing an immediate displacement. The fracture may be complete or partial, transverse or oblique, simple or comminuted, and yet produce no immediate lameness or indisposition to harmonize with the seriousness of the injury. A horse so injured will sometimes walk for several miles or even perform an ordinary day's work before any pronounced lameness develops, and then after several days of rest the lameness may disappear, leaving the patient apparently ready for service again. Dependent upon the character of the fracture, ten to twenty days may elapse before the segments separate, and for the first time reveal the nature of the injury by a sudden dangling of the leg, crepitation and inability to support weight. Moller mentions a case in which one hundred and twenty-seven days elapsed between the date of injury and the date of separation. Hughes reports several cases in which the final dissolution of the bone occurred from three to four weeks after the accident, and the author observed the following interesting circumstace: A trotting stud twelve years old was kicked in the lower third of the radius by a mare about to be served. There was but a slight abrasion of the skin, and although he limped conspicuously after the acci-

dent, the claudication entirely disappeared after twenty-four hours. In ten days he was entered in a matinee race, apparently entirely recovered. He trotted the first half mile in one minute and six seconds, and then fell suddenly so lame as to be unable to proceed further. After limping to the stable with great difficulty he was conveyed home some ten miles in a horse ambulance, where an examination by a competent veterinarian still failed to disclose the serious nature of the trouble. On the morning of the twenty-third day the bones parted, and an examination post mortem revealed an oblique fracture extending from the seat of injury at the lower third of the radius to the superior part of the upper third. Analogous cases occur with great regularity.

The displacement of the segments in subperiosteal fracture is not always due to accident; it is sometimes the inevitable termination of a serious injury. The periosteum holds the bone intact until it has undergone inflammatory changes; then the segments collapse from non-support. A slip, a sudden transfer of the weight upon the affected leg in rising, etc., may precipitate a dissolution prematurely, but in many cases separation cannot be avoided.

TREATMENT.—At the onset subperiosteal fracture can not be diagnosed; the pathognomonic symptoms of fracture are wanting. Its existence should, however, **always be suspected** when dealing with injuries at one of the three points of predilection above enumerated. The wise practitioner never fails to announce, and even emphasize the possible seriousness of contusions, or even apparently trivial abrasions, located on the internal surface of the tibia, the anterior surface of the radius and the external border of the radius.

When displacement has occurred the patient is shot as incurable. Before this event has occurred the patient is placed in slings and the wound submitted to a good antiseptic treatment for at least twenty days, after which time a moderate exercise may be allowed.

When located upon the radius and there is ample reason to suspect unmistakable fracture the leg brace (Fig. 258) should be applied.

FRACTURE OF THE PHALANGES OF HORSES.

Fracture of the os suffraginus or os corona is usually caused by various forms of violence, notably slipping upon a smooth street, traction upon a foot caught in a street crevice, fence or defective stall, violence sustained in runaways, etc.

These are only the curable fractures that occur to the long bones of horses. Fracture of the others is usually regarded as incurable, and rightly so, because recoveries are rare, the disability permanent and the expense an excess over the salvage.

Even in the case of the first and the second phalanx the results are none too inviting. While the life can usually be saved, if the patient is not aged, there is always the permanent claudication and deformity to be considered before advising the long, tedious and expensive treatment necessary to effect the partial cure.

As fracture of these phalanges is almost always articular, the osseous tissue deposited in the regenerative and reparative process must needs invade the articulation and thus interfere with the normal movements thereafter. While nature's processes often construct and ingeniously repair, a

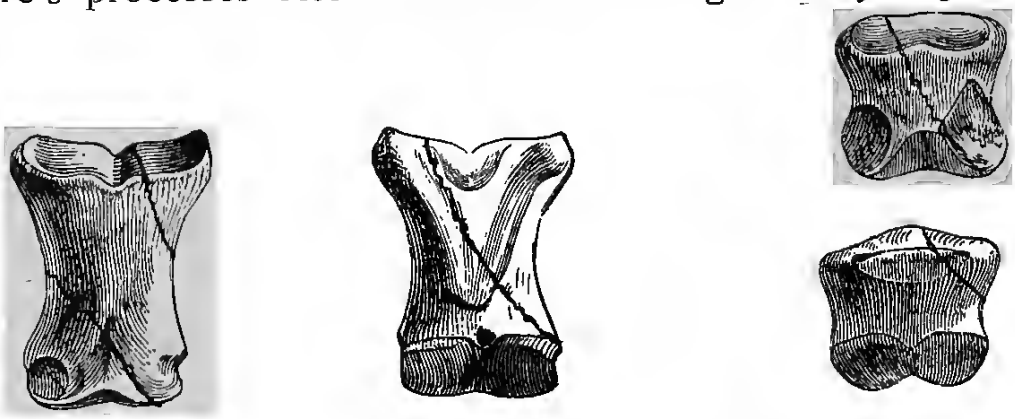


FIG. 249—Forms of Fracture of the Phalanges.

perfect restoration of the joint to its normal condition is seldom ever effected.

TREATMENT.—The patient is retained in slings for at least four weeks, after which it may be allowed the freedom of a loose box. As there is little displacement of the segment "setting" is not found necessary, but to immobilize the segments against friction produced in the attempts to support weight, a hard bandage extending from the upper third of the cannon to the level of the floor must be applied. Plaster of paris is strictly contra-indicated on account of the pressure-necrosis of the skin it is so prone to produce, and the opposition its weight always provokes.

The most successful procedure against these fractures is as follows: First **trim the long hairs of the fetlock and ergot** submit the leg to a **good cleansing** with soap, hot water and mercuric chloride, and then when dried and the hairs smoothed down, sprinkle the whole area to be bandaged

with **talcum powder.** The first bandage is of four-inch **cheese cloth** wrapped neatly and evenly from the upper third of the cannon to the level of the coronet. The talcum powder may be sprinkled into the hair as this bandage is being applied. A retention bandage consisting of **electrician's insulation tape** is then wrapped neatly, layer after layer, from the upper third of the cannon **to the floor** until it reaches a uniform thickness of about an inch. A piece of soft wood, whittled to fit **loosely** into the hollow of the fetlock is then adjusted and retained by enough additional wraps of the tape to fix it firmly.

After two weeks the bandage is removed and refitted to afford an opportunity to treat any wounds it may have produced by pressure. At the end of four weeks it is dispensed with and substituted by an ordinary fabric bandage which may be removed and reapplied daily.

During the first two weeks it is important to draw the slings tight enough to prevent the injured foot from supporting weight, providing too much discomfort is not produced thereby.

FRACTURE OF THE OS INNOMINATUM.

This is the most common of all fractures of horses. In almost every case it is caused by falling heavily, but in some cases occurs by slipping or by striking the side of the stable door.

The most common varieties of these fractures are: (1) Fracture of a part of the external angle of the ilium; (2) fractures of the whole angle at different points toward the center of the bone; (3) fracture of the shaft of the ilium; (4) fractures through the acetabulum; (5) fracture of the shaft of the ischium; (6) fracture of the ischial tuberosity; (7) fractures of the pubis—often bilateral; (8) separation of the ischio-pubic symphysis; and (9) fracture of both ischii.

I. **Fracture of a Part of the External Angle of the Ilium.**—The inferior portion is the part broken, and the seriousness depends upon the size of the segment, which may vary from a very small section of the very angle to a piece as large as a man's hand, extending from the uppermost angle backward toward the shaft.

This is the least serious of all the pelvic fractures. When only a small segment is broken the accident causes only a passing inconvenience to the patient, and often goes unnoticed. The deformity is slight and almost imperceptible,

especially in horses in good flesh. On the other hand when the fracture invades the greater part of the whole angle there is a marked lameness lasting two to three weeks, and the deformity is thereafter a conspicuous defect in the affected hip.

When the lesion becomes infected an abscess forms and then after bursting at the surface develops into a chronic fistula that can only be cured by extirpation of the segment.

When large and entirely free the segment is usually drawn downward toward the stifle by muscular contraction.

2. **Fractures of the Whole Angle of the Ilium** vary but slightly in the size of the segment and direction of the fracture. The line usually extends from the anterior border obliquely backward to the shaft. In the scale of seriousness this fracture stands second. It causes a pronounced lameness, a dragging of the leg, and a bias gait, that gradually disappears during three to four weeks succeeding the date of injury. The permanent deformation of the hip is always conspicuous, but the patient is restored to full usefulness. As in the foregoing, infection may end in the formation of a chronic fistula. In this case the tract may extend behind the segment, which, on account of its size and position, offers a serious obstacle to successful surgical intervention. The segment falls downward toward the stifle in juxtaposition to the peritoneal cavity, and instead of separating from the surrounding soft tissue it becomes more closely fused to them and at the same time enlarges into a larger body from the productive propensities of its still well-nourished periosteum. The extirpation of such a body is a hazardous undertaking on account of its close relation to the abdominal cavity with whose walls it is often firmly fused.

3. **Fracture of the Shaft of the Ilium** is a serious fracture, causing at once a serious claudication and later a pronounced deformity and defective gait that render the subject unsalable and in fact almost useless. In brood mares it is a serious hindrance to pregnancy and parturition.

The patient is totally incapacitated for three months, and although able to support weight on the affected side, suffers considerable pain that reflects over the whole organism. The lameness never entirely disappears, but sojourns permanently in the form of a hitch and short anterior stride. The deformation of the hip is pronounced. The whole hip anterior to the level of the articulation is depressed by the sinking of the bone and atrophy of the gluteals. In some cases the injury is complicated with visceral injury. The

sharp end of the fractured shaft may penetrate the abdominal or pelvic viscera, and sometimes wounds large vessels with serious if not fatal results.

4. **Fracture through the Acetabulum** is announced by an immediate inability to support weight and by great pain and suffering. Recovery is rare, and when the patient does survive the long painful ordeal, the lameness is permanent.

5. **Fracture of the Shaft of the Ischium** is usually accompanied with fracture of the pubis from the obturator foramen to the symphysis, and then backward along the symphysis to the ischial arch. It is caused by falling upon the haunches. The lameness is pronounced and the pain intense, although the full weight is supported on the affected side. The patient is incapacitated for work for six weeks

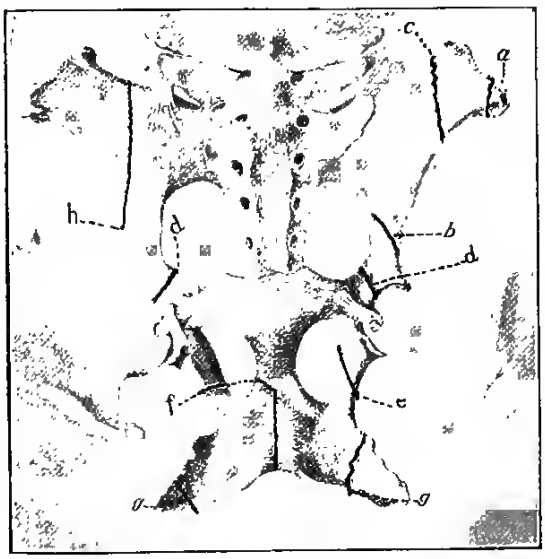


FIG. 250—Fractures of the Os Innominatum.

a, *c*—Fractures of the Angle of the Ilium. *b*—Fracture of the Shaft of the Ilium. *d*—Fracture of the Acetabulum. *e*—Fracture of the Shaft of the Ischium. *g*—Fracture of the Ischial Tuberosity.

to two months and is never entirely sound thereafter. The buttock is depressed and lameness continues indefinitely while trotting.

6. **Fracture of the Ischial Tuberosity** would appear to be a rather trivial injury as compared with the other pelvic fractures. On the contrary, it is always a serious affair in that chronic lameness supervenes despite a long period of rest, and the deformity is conspicuous enough.

7, 8 and 9. These fractures implicating the pubes and ischii are always serious. They are usually complicated with visceral inflammation or visceral injury, besides producing a disability lasting for months, often ending in the in-

ability of the patient to rise unassisted from decumbency after the use of the slings has been discontinued.

Treatment of Pelvic Fractures. In all the uncomplicated cases (fistulæ, visceral injury, etc.) the treatment is similar. The patient is placed in slings from two weeks in the less serious cases to six weeks to three months in the more serious ones. Decumbency, even for a few minutes, is always harmful, because of the injury inflicted to the soft tissues by the movements of the jagged segments, incident to rising. Often the suffering patient will refuse to rise unassisted after the first attempt and not infrequently, especially in pubic and ischial fractures, it refuses to remain standing, even after having been raised with the slings.

In addition to the slings, succulent feeds and laxatives are essential to the best results. Coprostasis of the floating colon and rectum which is prone to occur on account of the pain produced by defecation is prevented by occasional enemata, and dysuria is met by catheterization.

External applications are useless, although if properly continued for some hours daily, steaming hot blankets applied over the affected parts should be helpful in reducing the amount of pain. Liniments and blisters only add to the patient's discomfort.

When it is thought prudent to dispense with the slings the patient is given the freedom of a large loose box where there is ample room to "give a lift" if found necessary.

Rupture of the Tendinous Portion of the Flexor Metatarsi.

This injury has often been erroneously described under the name of "sprain of the flexor metatarsi," in spite of the fact that the tendinous portion of this complicated muscle is not only sprained but actually torn completely in twain. The injury may be sustained by any accident that will bring traction upon the anterior tibial group of muscles by an excessive sudden extension of the hock. Falling suddenly with one hind leg extending backward and falling in the shafts after having kicked over the cross-bar with one leg are the two chief accidents which result in this injury. The author has seen one horse so injured by the slipping backward of the leg supporting the weight while secured in the standing position with the single sideline for firing, and two cases from pulling frantically upon the uppermost hind leg while secured upon the operating table.

As soon as the accident occurs a most remarkable phe-

nomenon ensues. The leg, while able to support weight, dangles helpless in the posterior stride, as if affected with a serious fracture. (Fig. 251). The anterior stride is wanting, and hock flexion nil, but the pathognomonic symptom is the **curling up of the tendo-Achilles while walking** and the extreme relaxed condition found on palpation when the leg is not supporting weight.

TREATMENT.—The patient is kept in the standing position with slings for two weeks and then given the freedom of a loose box or paddock, or else turned out **alone** in the pasture. The surface of the anterior tibial region may be medicated with liniments, and later with a good cantharides blister.



FIG. 251—Rupture of Posterior Metatarsi.

PROGNOSIS.—Recovery occurs in eight weeks to three months in a horse in the prime of life. Aged horses recover such slower, and some of them never entirely recover the lost hock flexion.

TRAUMATIC DISLOCATIONS.

The truly ginglymoid character of the joints of quadrupeds, the interlocking arrangement of most all of the articular surfaces and the strength of the binding ligaments protect animals against luxations. Animals are more exposed to the very kind of injuries that should cause luxations than human beings, but on acount of these anatomical features their occurrence is rare.

The coxo-femoral articulation, in exceptionally rare cases, is dislocated in dogs and oxen; the scapulo-humeral in still more exceptional instances may be dislocated in horses; and partial dislocation of the cervical vertebræ have been reported. But these occurrences are too rare to warrant any special attention. The more common ones, and these are indeed rare enough, are:—(1) Dislocation of the fetlock of horses: (2) Dislocation of the patella from the femoral trochlea in horses; and (3) Dislocation of the temporo-maxillary articulation in dogs.

1. **Dislocation of the Fetlock of Horses.** This accident occurs to work horses, and is caused by catching the shoe calk or the foot in a defective pavement, street-car rail, bridge, etc., while walking fast enough to be thrown violently to the ground in a forward and lateral direction. The foot is fixed and as the body topples from its momentum the extremity is broken at a right angle at the fetlock. When released the phalanges dangle. There is no displacement requiring forcible reposition; the joint falls into place automatically, although it can be worked laterally like a hinge.

The injury is serious in that the lateral ligament and the capsule are lacerated and the surrounding soft tissues are more or less bruised from the tension to which they were subjected.

TREATMENT.—The patient is placed in the slings and the leg bandaged in the manner recommended for fractures of the phalanges (page 497) after the swelling has reached its climax. During the first three days a good, firm and thick muslin wrap is depended upon as a retaining bandage. The permanent bandage of electrician's tape is removed and readjusted after ten days to fit the decreasing size of the leg, incident to the disappearance of the swelling. In four weeks it can be safely dispensed with and substituted by an ordinary muslin support. At the end of six weeks firing and blistering is indicated to assist in curing the lameness that usually sojourns stubbornly. A protracted rest at pasture is helpful, but in almost every instance the joint is permanently enlarged, and not infrequently the lameness is chronic.

2. **Traumatic Dislocation of the Patella from the Trochlea** must not be confounded with simple "pseudo-luxation of the patella" (stifle-cramp). This is both a rare and a serious injury. It usually occurs in some mysterious manner by stall maneuvers at night, and is manifested at once by inability to reach the floor with the foot of the affected leg.

The foot is held one to one and a half feet from the floor, and it can not be drawn further down by manual traction. In one case observed by the author the toe was held at the level of the hock. The stifle is painful and the patella stands out in bold relief amid a mass of swelling.

In simple stifle cramp, which the "old school" practitioners thought was dislocation of the patella, the foot is fixed to the floor; here it is fixed above the floor.

TREATMENT.—A rope is attached to the pastern and the leg is drawn backward with all of the force of five or six men until the operator, standing at the stifle, is able to push the patella over the lip of the trochlea. In one case observed by the author it snapped in unassisted after the leg had been drawn upon with sufficient force to "straighten out" the femora-tibial angle. To properly execute this

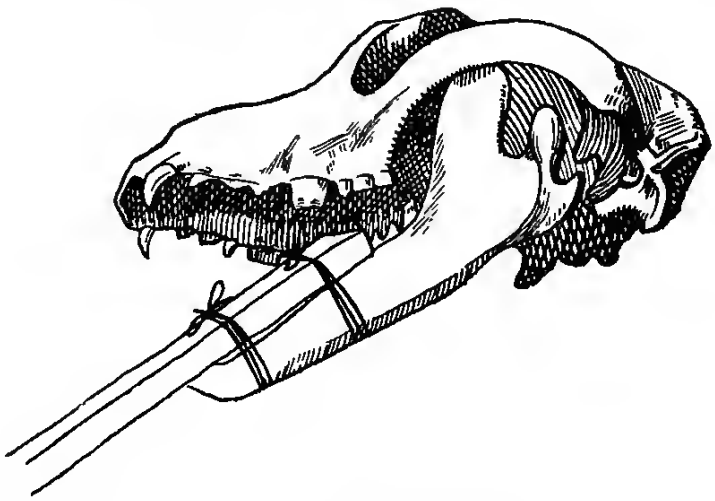


FIG. 252—Lever Fixed to Jaw to Effect Reduction of Dislocation of Temporo-Maxillary Articulation.

maneuver, the horse is placed in a narrow stall where there is ample room behind for the men to work. To prevent the patient from being drawn backward by the traction a rope is passed beneath the tail and tied forward on each side of the manger. Decumbency may be prevented with slings or a rope passed around the body and secured over a ceiling beam.

When the reposition has been successfully effected the foot falls to the floor and walking becomes possible. A pronounced lameness, however, always follows this injury, and this must be met by fometations, liniments, and later by blisters. A protracted rest will be found necessary on account of the continuation of a disabling claudication.

3. **Dislocation of the Temporo-maxillary Articulation of Dogs** occurs occasionally. It is said to occur from yawning,

but is probably always the result of attempts to gnaw upon bones of large size or to seize large objects. The accident is manifested by the absolute inability to close the mouth by the use of force. The mouth stands open and the watery saliva flows out of each side. The accident in human beings is both unilateral and bilateral, and the same is usually said of dogs. The author has never seen the unilateral form in dogs, although its existence is not doubted.

The displacement is backward; the condyle slips behind the glenoid cavity. French describes the accident as a forward dislocation, but an examination of canine skulls clearly shows that such an occurrence is a physical impossibility.

TREATMENT.—The reduction of this dislocation is effected by simply depressing the jaw posteriorly but as sufficient force is difficult to apply at this point a special appliance must be used. The human surgeon simply depresses the jaws with the thumbs after wrapping them with cloth to provide against a bite as the jaw snaps shut. The length of the jaw of dogs renders this procedure impossible.

The operator first provides himself with a hardwood stick two and a half feet long, wide enough to ride both posterior molars of the lower jaw and thick enough to assure against bending. After the dog is anæsthetized with ether the stick is passed into the mouth so that its end rests upon the posterior molars, where it is tied firmly to the jaw with wrap after wrap of good strong tape or cord. The assistant now supports the head with both hands and the operator takes hold of the outer end of the stick with the left hand and the part bound to the jaw with the right. By pressing downward with the right (the fulcrum) and upward with the left (the lever) the jaw (the weight) immediately falls into place with the greatest ease. Feeding with easily masticated food is the only after-care required.

Brachial Paralysis.

Brachial Paralysis is the name applied to a paralysis of the nerves proceeding from the brachial plexus due to a direct injury to the plexus itself. The injury may be a contusion from falling or lying heavily upon the shoulder, from decumbency during serious illness or surgical restraint, from traction upon a fixed leg in surgical restraint, or from slipping upon the street without falling. The nerves constituting the brachial plexus wind around the upper third of the first rib, and when arranged into a plexus lie between the

rib and the scapula. If the first rib is fractured the contractions of the scalenus muscle displace the segments anteriorly and draw upon the nerves which pass around its anterior border, and thus paralyze them. This accident constitutes the most serious form of the disease—**the incurable form**,—as the displaced rib permanently prevents the nerve from functionating. When the disease is due simply to a bruising of the plexus or a stretching of the nerves the nervous lesion may be capable of undergoing a successful regeneration, and recovery may follow sooner or later, according to the severity of the injury to the nerves—**the curable form.**



Fig. 253—Horse Affected with Brachial Paralysis in Its Curable Form.

Differentiation is not always possible at the onset, although the former may be suspected when the patient suffers considerable pain, is perfectly helpless, cannot be induced to move even when punished, and the leg is entirely helpless. When, after four weeks, there is no amelioration of the paralysis, the muscles have atrophied, and the patient has become emaciated from pain and discomfort, the diagnosis of brachial paralysis with fracture of the first rib may then be announced. On the other hand, if the strength of the leg is gradually restored after the second week it is

evident that no such serious lesion as fracture of the rib exists and that a rapid recovery is forthcoming.

The symptoms of the disease are shown in Fig. 254. The elbow drops, the foot is held one foot to eighteen inches in advance of the opposite one, the caput muscles are flaccid and if attempt is made to support weight the leg collapses. The pathognomonic symptom is the ability to support the entire weight of the body when the knee is forcibly prevented from collapsing forward.



FIG. 254—Incurable Brachial Paralysis.

TREATMENT.—The patient is retained in the standing position, with slings if necessary, and the knee is prevented from collapsing forward by means of a brace (Fig. 258) extending from the foot to the elbow. A strong piece of iron shaped to follow the curves of the leg and equipped with straps and buckles at the foot, at the cannon, and two at the forearm, will answer the purpose. The leg must be well padded with bandages at the points encircled by the straps, especially at the upper third of the forearm, to prevent pressure necrosis of the skin.

The author's special method of accomplishing the same

effect is as follows: The saddle and breachment of a common buggy harness, including back-strap and crupper, is



FIGS. 255 AND 256—Two Views of Fractured Rib Found Post-Mortem in Horse Shown in Fig. 254.

placed on the patient and buckled snugly to the body. The holdback straps are buckled together in the middle of the

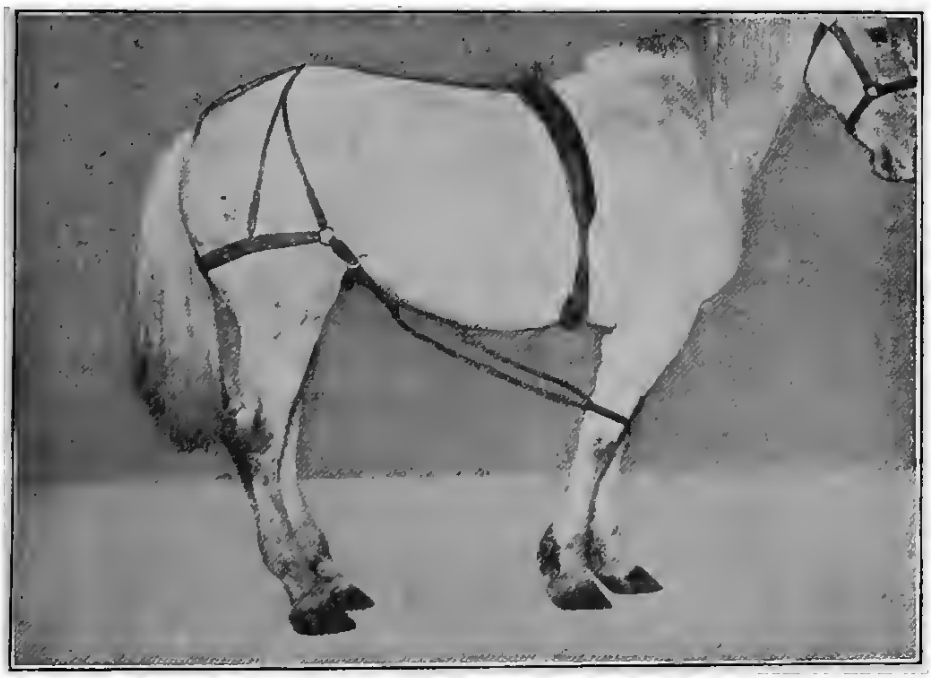


FIG. 257—Author's Method of Fixing Knee in Brachial Paralysis.

ventral surface in front of the hind legs. From these a strap is passed to the knee of the affected leg and buckled up until the leg is drawn into its proper vertical position. The

force required to hold the leg in position thus falls upon the buttock, and as this region is accustomed to breachment pressure no discomfort is provoked, and the horse wears it day after day without display of opposition.

The essential part of the treatment is to keep the leg continually in a vertical, weight-bearing position until the function of the paralyzed muscles is sufficiently restored to enable the patient to walk about. After this time a limited amount of exercise will assist in restoring the leg to its normal condition. As long as the leg collapses, however, when the patient stands, the apparatus must be readjusted after

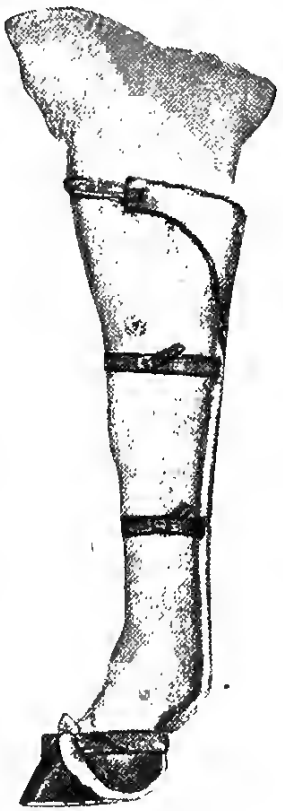


FIG. 258—Schematic View of Leg Brace for Brachial Paralysis.

each period of exercise. It is only dispensed with when the patient holds the leg in the normal position unassisted.

Local applications to the flaccid caputs, such as fomentations, liniments, blisters and setons, have very little effect in hastening the restorative process.

BROKEN KNEES.

The phrase "broken knee" is the name applied by veterinarians and horsemen to more or less serious abrasions of the anterior surface of the carpus. These injuries are sustained by the friction of the knees against the road-bed after stumbling and falling upon them. The seriousness of the

accident depends upon the character of the road-bed and the distance slid after the knees have struck it. Macadam and gravel roads produce the most formidable varieties. In regard to extent, the injury varies from a trivial abrasion to an extensive excavation of the whole anterior part of the knee, including the tendon sheaths and the tendons, even exposing the carpal bones. And in addition, road dirt, sand and gravel are ground into the mutilated tissues and defy removal except by dissection. The accident is usually a grave one. Some may even prove fatal; others heal with a rigid scar that limits flexion, and nearly all of them leave an indelible, conspicuous, denuded blemish, thereafter interpreted as an evidence that the horse is an habitual stumbler.

TREATMENT.—The wound must be disinfected with more than ordinary care. The leg is showered with water to rinse off all the sand and dirt, the hair is shaved from the immediate surroundings, the dirt-containing tissues carefully dissected away, and finally the wound is irrigated with mercuric chloride 1-1000 for no less than one-half to one hour. The wound having thus been disinfected and all of the bleeding arrested, a brace (Fig. 258) is placed upon the leg to prevent flexion and a dressing composed of boric acid 75% and iodoform 25% is bound to the wound with cotton and bandage. The antiseptic powder is used in abundance and renewed twice daily during the first eight to ten days. When the synovial discharge is copious it may be changed three times daily. After the granulations have filled the cavity and the discharge has ceased, astringents are applied until sclerogensis is complete. The brace is dispensed with as soon as the formative tissue is substantial enough to prevent fissuring from flexion. If kept on too long a stiff knee may result, in the more serious cases. A little exercise when the healing has progressed to a safe point is advisable, but the standing position must be maintained until the scar has become a quite substantial affair.

Cherry's operation, which consists of excising an island of skin shaped like a melon slice, with the abrasion within, and then bringing the edges together with sutures assisted by two lateral relaxing incisions, is a special method of handling broken knees. But in spite of the fact that it has been recommended as a classical procedure to no less than two generations of veterinarians, it has never gained popularity, because it is only applicable to the circumscribed abrasion that will heal with even less blemish than that produced by the lateral relaxing incisions.

HYGROMA OF THE KNEE.

Bruise of the knee from falling upon hard streets without solution of continuity of the skin causes an "acute hygroma," a serous sac or a sanguineous sac that appears in the form of a large fluctuant enlargement, slightly painful at first but finally sojourning for weeks, and even months, in the absence of all pain and inflammation. In rare cases they become purulent and then cause considerable pain until the pus is evacuated.

Hygroma of the knee is seen chiefly in draft horses, although the lighter breeds sometimes sustain it. It is caused by slipping, usually when starting a heavy load. The toe calk fails to hold, the foot slips backward and the knees strike the street violently. The accident occurs quickly, often entirely unnoticed by the teamster. It is rarely bilateral at first, although both knees may sustain the injury consecutively.

The trend of this lesion is toward permanent tumefaction of the knee, either by thickening of the skin or by the formation of a chronic hygroma. In either case the blemish is permanent.

TREATMENT.—The greatest obstacle in the treatment of knee bruises of this variety is the constant repetition of the accident. While it may sometimes be directly attributed to insufficient calking during the slippery season more often it is an habitual fault of the horse, which will continue to injure the half healed sac of a former accident, and thus prevent cicatrization.

To successfully cope with the affliction absolute rest of four weeks is required, for if the animal is kept at work the enlargement becomes chronic.

To effect a perfect cure the sac is evacuated by lancing inferiorly, after having shaved and disinfected the seat of operation with due thoroughness. The opening should be no longer than one-half inch. The bleeding, which usually consists of a spurting vessel or two in the skin on each side of the incision, is arrested by touching up the spots with the thermo-cautery. The opening is then wadded snugly with a small cotton pledget soaked in a strong antiseptic, and the leg placed in a brace (Fig. 258) for ten days to two weeks. At first twice per day and later once daily the wad is removed and the accumulated secretion gently pressed out. At the end of two weeks the horse is given gentle exercise

and is ready for work in twenty days, almost entirely cured.

The secret of success lies in the prevention of infection and in the immobilization of the leg with the brace.

CAPPED HOCK.

This hygroma is caused by lying upon the unbedded floor, and sometimes by kicking against the stall. It is a subcutaneous hygroma, but sometimes implicates the bursa of the flexor pedis perforatus. It is one of the formidable accidents of horses. In good horses it is a veritable calamity on account of the great liability to end in a chronic conspicuous enlargement.

TREATMENT.—The first step is to determine the cause and control it. Treatment is futile if the cause is extant. In proceeding, against them there is the choice of three methods: (1) Repeated aseptic aspirations, (2) medical applications, and (3) lancing. The first and second are sometimes successful if the patient is kept standing for two to three weeks and not permitted to irritate the seat of injury by moving about. Decumbency, kicking against the stall, and exercise are positively harmful by stimulating a new quota as fast as it is aspirated or absorbed. The third method (lancing) is probably the best, although it will leave an indelible blemish if the wound and the cavity are allowed to become infected, and may even result disastrously by extension of the infective inflammation to the underlying bursa. The success of the operation depends upon asepsis throughout the entire period of exposure and immobilization. The latter is not as easily effected as in the fore-limb, because braces applied to the pelvic limb are opposed by the patient, and can not very well be retained in position.

The modus operandi of evacuating the capped hock is as follows: The patient is restrained with the twitch and side line. The inferior part of the sac is shaved and disinfected with mercuric chloride 1-500 and then perforated with a small lance. When the fluid has been squeezed out the opening is wadded with antiseptic cotton. The horse is tied up in a narrow and short single stall which restricts movement and prevents kicking against the pillars. The after-care consists of daily injections of adrenalin chloride 1-1000 under the strictest aseptic precaution, and wadding of the wound to prevent infection. Injections of sterilized methyline blue 2% are also markedly effectual in arresting the secretion and promoting prompt cicatrization.



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