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THESIS
ON THE
FRACTURE OF BONES
IN
LOWER ANIMALS

BY J. G. VELDHUIS, '95

THESIS

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-: FRACTURE of BONES :-

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Fractures of bones have not received as much attention in the lower animals as they have in man. Indeed, it is only very rarely that the Veterinarian is called upon to treat a case of fracture.

One of the main reasons for this seeming neglect of this form of injury, especially in the case of smaller animals is that it does not pay the woner to call in a veterinarion, as two or three calls from the practitioner would cost as much if not more than the whole animal i s worth. The owner can better afford to kill the sheep or hog that is so unfortunate as to sustain an injury of thi s kind, and, by thus supplying his own table with meat, the loss will be small.

Another reason, and this is especially true of the dog is that the p tient will in the case of a simple fracture, usually do very well if left to itself.

In the case the bones are seldom fractured and if they are the owner will probably think it less trouble and expense to end the poor creature's life and to consume the meat.

In the case of the horse, especially if the animal is valuable and the fracture a simple one, the practitioner will probably be called upon to treat this injury. If however, the fracture is a severe one the owner will probably consider the difficulty and cost effecting a cure too great and he will kill the animal. As it will probably never be able to do good work again even if the case should be

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treated. In man it is a question of life and death, but in the lower animals it is simply a question of gain or loss.

Many stock owners are skilfull enough to assist nature by putting on some rude splints of bass wood and the like and the practitioner will again be left out of the case.

With so few opportunities for the practitioner to treat fractures it is not at all surprising that the treatment of the fractures of bones is not on a level with that of other diseases to which the animal is heir.

C-a-u-s-e.

A fracture may occur in one of three ways; By external violence directly upon the fractured part, by external violence producing concussion which will break the bone at some other place, or by severe muscular contraction.

Some bones are more easily fractured or are more liable to fracture than others. Bones are often rendered more liable to fracture by a diseased condition of the bone. The bones of the leg are more easily broken than those of other parts of the body, on account of the weight resting upon them, and because they are more exposed. Bones of old animals are more liable to be fractured than those of younger animals because they are more brittle.

Some of the external causes of fracture are: Violent contacts, collisions, falls, blows, extreme muscular

contraction, violent efforts in moving heavy loads, a quick move to avoid a fall or a blow, stopping too suddenly, struggling to liberate a foot and concussion or exertion as a result of throwing the animal to perform some operation.

C-l-a-s-s-i-f-i-c-a-t-i-o-n.

Fracture or solution of the continuity of bone may be, transverse, oblique or longitudinal, according to the direction with reference to the bone affected.

If the bone is broken only in one part without injury to the soft parts it is called a simple fracture; when there is an open wound in connection with it, it is called a compound fracture; when the bone is broken into several fragments it is comminuted; when besides the broken bone there is serious injury to the adjoining tissue, muscles, blood-vessels etc., it is called a complicated one; when one fragment has been formed into another it is impracted, and when the bone is only partly broken it is called a partial fracture. Bending may take place, but this is rare in any but young animals.

S-y-m-p-t-o-m-s.

In a fracture there is usually some deformity in the part, particularly a swelling caused by the accumulation of blood and the like. The animal will be more or less lame, according to the bone affected. In the case of a broken

rib the animal may not show much lameness, and even in the case of a fracture of the cannon bone the animal may not be able to rest its own weight upon the injured member, but in the case of a fracture of one of the long bones, especially in a compound fracture the lameness will be very evident.

In the case of a fracture of the lower jaw the process of mastication will be seriously interfered with.

The most reliable sign of fracture is the crepitation produced by the friction of one fragment upon the other. It is not necessary as a rule to exhort to severe manipulation, a gentle, careful manipulation of the affected part will be sufficient to diagnose the case. The history of the case and perhaps the external appearance of the injury will be of great service in the diagnosis.

M-o-d-e-s of U-n-i-o-n.

The first step towards the repair of the injury is the exudation of lymph. This is at first fluid, but it soon thickens, becoming elastic and moderately firm. At this stage it is called callus. This callus may either inclose the broken ends forming a sheath around it, when it is termed provisional callus, or it may be simply between those parts which are directly opposite each other and uniting them as though glueing the two parts together, this is the intermediate callus. In the ordinary fracture the sheath is com-

mon.

During the first stage the fragments of bone become surrounded with blood and raise up the periosteum near the fracture. This blood either becomes organized or is replaced by liquor sanguinis. This stage occupies from eight to ten days.

During the second stage which occupies from ten to twelve days, this substance between the periosteum and the bone is changed to fibro cartilage, and the same change also takes place with that in the m edullary canals, that between the gragments, however, still remains a liquid.

During the third stage which occupies from ten to thirty days, according to the age and condition of the animal, this fibro -cartilage is converted to bone forming a ring around the outside and a plug in the medull ary canal. These two are for the purpose of keeping the bone in place and at rest while the formation of new bone between the fragments is going on. The substance between the fragments has now an opportunity for solidifying, and as a result it is changed to fibro-cartilage.

During the fourth stage occupying from three to four months this fibro-cartilage between the fragments is converted into true bone.

During the fifth stage occupying from five to six months, the provisional callus or sheath around the bone, and the plug

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medullary canal is absorbed.

These are the views of Duyupten, and Prof. Williams adds that the only exceptions he has seen have been in the lower jaw, when the fractures have been longitudinal and admitted of no motion between the fragments. In such cases the healing is by intermediate and permanent callus, no sheath of provisional callus being formed on the outside.

In order to secure a perfect union the ends must be kept at rest, it is however rarely possible to prevent motion between the two ends, and in order to overcome this, nature has provided this method.

After the new bone has been firmly established between the fragments, the process is to absorb all that material that is not needed by the bone. Sharp projecting points are removed and the injury assumes the general outline of the bone. The medullary tissue is closed up, the periosteum again covers the bone, and the compact external and the cancelated interior is formed and made continuous with the original. The new bone gradually acquires the same microscopic character as that of the rest of the bone.

T-r-e-a-t-m-e-n-t.

The question of whether a fracture shall be treated or not is one that should be decided first of all.

There are several fractures that are incurable, besides

this many animals are not worth the cost of treatment.

The nature of the fracture is of very great importance. If the fracture is simple and the ends can be readily brought into place and kept there, the prospects of recovery are, very good indeed. Simple fractures are always easier to treat than compound fractures. The compound fracture is liable to set up an inflammation which may soon develop into an angry looking sore, and prevent the healing of the bone. A comminuted or impacted fracture is liable to set up such an extensive irritation that pus will be formed, and besides this the different fragments of bones may become deceased and result in necrosis of the bone. Besides this it is hard to keep the different fragments of bone so immovable that the process of repair can go on.

Fractures which may be considered curable are those which suffer no great displacement and have no great laceration of the soft tissues or shattering of the bones. They are usually curable if the patient aids materially in the treatment. A very nervous and irritable animal is difficult to cure. A compound, complicated or comminuted fracture wherever the injury may be is considered incurable.

Fractures are less serious in small than in larger animals. They are easier to handle and there will be less weight upon the affected part.

Another important question is whether it will pay to

treat the animal. The animal will be idle for a few months, will lose in flesh and in the horse will probably never be able to do the full amount of work again.

The age and condition of the animal is also very important. In a young and vigorous animal the injury will probably heal in a very short time, while in an old and weak animal it will be very slow and tedious.

In the treatment of fractures the firststep is to reduce it, that is, to bring thebroken ends in place again. If the patient is away from home, it will be necessary to put on a dressing for the time being and the animal then removed as carefully as possible. If there is no displacement there will be no reduction and the necessary splints can be applied at once.

The manipulation of the fracture to bring it into place varies with the kind of fracture and with different bones. If the fracture is transverse the bones are brought in place in the easiest manner possible and simply pressure brought to bear on the sides. If the fracture is oblique, extension will be necessary to bring them to their original place. As a rule the manipulation will be readily suggested by the diagnosis of the case. The manipulation should always be gentle but firm, giving the animal as little pain and exciting the muscular contractions as little as possible.

The injured parts should be brought together as soon as possible, before there is any amount of swelling, thus making it easier to get them in place and also overcoming the injurious effects of irritation caused by the fractured ends lacerating the soft tissue. If swelling has already taken place this will probably gradually disappear if the fracture is only reduced at once.

Several materials are used for splints. Some of those used generally are, leather, plaster of paris, poroplaster, gutta percha, card board, basswood, laths, birchbark, tin and silver.

Prof. Liautard recommends, oakum, bandages, splints and a compound forming a cement and consisting of black pitch, rosin and Venice turpentine. This dressing may be applied directly to the skin or a thin linen covering placed between. He mentions some other compounds which are of an adhesive nature and will become firm on drying out.

His method of applying is to pad the injury with a cushion of oakum, to equalize the surface and to prevent the skin from chaffing. Over this the splints are placed, and these are again covered with cloth bandages, soaked in the adhesive solution. These bandages are to be carefully applied and to embrace the whole length of the leg.

Prof. Williams favors the "bend leather." The pieces are made large enough to extend some distance above and below

the fracture, and wide enough to encircle the limb. If there is some projecting point in the way, holes may be made in the leather so it will fit close to the limb.

(No. II.)

Before the leather is applied it is soaked in warm water to make it soft and pliable.

The leather is held in place by bandages. If the limb is swollen the bandages must be changed as soon as the swelling disappears, and in its place bandages soaked in starch or flour paste, put on. The starch soon stiffens and makes the whole immovable so that the animal will soon be able to bear its own weight on the injured limb.

Dr Gragge prefers the poroplaster. This material is used much the same way as the leather. It is soaked in warm water at the temperature of about 140 degrees F. when it becomes very soft and pliable. It can now be moulded to any shape of the limb and upon cooling it regains it stiff condition and becomes a rigid splint. Around this the bandages are placed the same as in the case of the "bend leather." This material possesses the advantage of being porous thus allowing the escape of inflammation, and of being soft and pleasant to the skin, thus adding very materially to the comfort of the animal as well as to the healing of the injury.

The plaster of paris is perhaps most extensively used. This materialis, however, likely to crack and thus looses its immobility if it does not set up an irritation of the skin. The plaster is spread on a strip of cheese cloth to the depth of about an eighth of an inch and then rolled up. This rool is dropped into water and as soon as it ceases to bubble is taken out and wound around the injured part. The flannel side should be next to the skin. The winding is made about a quarter of an inch thich and if any of the plaster is dry, wet plaster should be put on in its place.

Splints may be also made of basswood. The strips of wood should be soft and somewhat pliable. They should be stiff enough to hold the limb in place after they have all been put on and the bandages have been applied both underneath and over the strips but each individual splint should be pliable enough to conform to some extent to the outline of the limb. Bandages are to be applied after the splints have been put in place, and these may be soaked in an adhesive solution to make the whole more rigid. These bandages should extend both above and below the splints.

The card board, birchbark and lath wouldbe put on in a similar manner to the basswood.

If the fracture is near a joint where it is hard to make

the splint immovable or where the joint itself is involved, block tin or copper cut in strips is perhaps the best. It might be well to have a thin layer of poroplaster beneath the strips, because it is less liable to produce inflammation of the skin, at any rate, something should be put in between the skin and the strips.

The strips of metal are held in place by bandages the same as those already described.

When the best materials are not at hand a splint can easily be made from thin splints of wood which will answer the purpose very well, and if it is necessary or thought desirable, these can afterwards be replaced by better material.

Horses unless young and restless are usually placed in slings fromtwo to three months. This would of course, depend on what bone is fractured. If the bone in the head was fractured the sling would be of no use, but if a bone one of the extremities is fractured, or if the spine is fractured, the sling is very serviceable.

Young horses or those that are very restless will not tolerate the sling, and these should be in as comfortable, loose box, with plenty of good dry bedding. In this way they will usually do very well.

Cattle as well as hogs and sheep are treated the same way as a horse, except that it is usually impracticable to put them into slings.

The limbs of dogs usually need only the starch bandage, and the animal will soon be completely recovered.

The animal will probably be lame for some time, but if no joint is involved, and if the fracture has properly united, it will gradually recover from the injury. Care should be taken that the animal does not use the limb too soon. The inability of the bone to support the weight may not be noticed at first but it will gradually bend over and become a serious case. The starch bandage should be kept on for some time and the animal kept easy in a box stall for a few weeks after it has been removed from the slings.

The time of healing varies very much. The fretful horse will often cause the non-union of the bone, in even the simple transverse fracture, from its continually moving the limbs so that no union can take place.

This is the method for a simple fracture. If the fracture

is compound, however, the injury is not as easily reduced, in this case the open wound is liable to cause inflammation and fever and end in suppuration. In treating this kind of fracture the injury should be reduced to a simple fracture as soon as possible, by obtaining immediate union of the wound. In the lower animals the treatment is often unsatisfactory and the animal had better be killed at once unless it is very valuable, or unless the wound is small. If the compound fracture is to be treated reduce at once. This may be very difficult and the wound may have to be opened and the sharp projecting points of the bone taken out with the forceps, but as soon as the fracture has been brought into place the lips of the wound should be brought together and made to heal as quickly as possible. For this purpose,or rather to aid this the washing with dilute carbolic acid or with hyposulphite of soda is very good. These will prevent suppuration and aid in reducing the inflammation.

The splints should be applied the same as in simple fractures with the exception of an opening for the escape of matter and to allow the washing out with the antiseptic without removing the bandages. The poroplaster would be an excellent thing in compound fractures as it would admit more readily of the escape of the material than the other materials would.

The constitutional treatment should be the same for the different kinds of fractures. The bowels should be kept mildly laxative, nutritious but not bulky food should be given, a diarrhetic administered to keep the kidneys active, and if the pain is acute an anodyne should be given:

If suppuration has already taken place or if it takes place in spite of the dressing, the wound must be kept wet with tepid water, no pus must remain in the wound, and the carbolic acid solution must be frequently applied. If the wound will not heal the process of amputation may be resorted to.

F-a-l-s-e- J-o-i-n-t-s & N-o-n-u-n-i-o-n.

It sometimes that the fracture does not unite or that the ends are simply connected by a fiberous material.

One of the most common causes is that often the two ends can not be brought well in place. In this case there may be a union of one side but the union will be unnatural. It may also be the result of fever, hemorrage, rheumatism, paralysis, necrosis of the bone and other constitutional and local causes.

In order to secure the reunion there must be immobility of the pieces, no foreign material or fragments ofdiseased bone must be left between and a proper supply of healthy blood is necessary.

In the treatment of such cases we must expect a large percentage of deaths and there is a great liability that the fracture may never heal properly.

Various methods have been tried for thetreatment of obstinate cases to cause the union. Among others we find the seton, ivory pegs, blisters, caustics, a long needle thrust through the ends of the bone and the drill.

The seton, blisters, caustics and the long needle are used to excite the formation of the callus, while the ivory pegs and the drill are used to fasten the two fragments together and thus give it an oppurtunity to unite.

The seton is passed through the limb and in between the fragments, it causes an ittitation which will excitethe formation of callus. The blistering on the surface would seem to have little effect on the bone, unless the fracture was at a place where the bone was next to the skin. The caustics are often applied to the ends of the bone this may be done by a canula. The ends may have to be exposed in some cases. Care should be taken that the caustic does not cauterize the flesh any more than can be helped. The long needle is thrust through the skin at different points near the end of the bone and is used to excite the formation of callus. The ivory pegs are inserted after a hole has been drilled through one fragment and well into the other. These ivory pegs sometimes cause necrosis of the bone. The drill

is sometimes used. The drill is passed through one and into the other fragment and allowed to stay there a while. This is perhaps the best of the two

A-m-p-u-t-a-t-i-o-n.

Sometimes when the fracture is incurable and the animal valuable for breeding or for other purposes, the limb may be amputated with very good results.

To amputate the limb place a compress of somekind above the injury. Make an incision through the skin around the limb in such a manner that when the laps have been dissected back and the limb cut off, the flaps of skin will entirely cover the wound. Dissect back this skin and cut off the bone as far back as possible. Tie up the arteries and bring the two flaps together. Suture the wound carefully and firmly. Tow or something of that kind of material is put on the end of the stump and the whole is bandaged up. After the wound has healed a woodne leg may be made buckled on similar to that in the humans.

P-a-r-t-i-c-u-l-a-r- F-r-a-c-t-u-r-e-s.

Fractured Cranium is usually fatal. If the bones project inward the trephine may be used and then the part lifted up. All foreighn matter mustbe carefully removed. Abandage is put on, after this a plaster of paris or poroplaster dressing may be applied. If the bone does not project

inward the treatment will be simply to apply the dressing.

Bones of the Face, should be restored as well as possible and kept in place by splints and bandages covering the entire face. In case the naval bones being fractured hemorrhage is often the result. In this case styptic or other means of stopping the blood should be resorted to.

Lower Jaw, is frequently fractured. The symptoms are well marked, and often a bloody saliva will run out. For a simple fracture the plasterbandage or the poroplaster may be all that is necessary. If, however, the bone is displaced the bone must first be brought in place and then proper steps be taken to keep it there. Mr Walker in William's Principles and Practice of Veterinary Surgery has a very ingenious arrangement for holding the parts in place. The apparatus consists of a cradle made to fit the lower jaw. Two pieces of wood run along the side of the jaw, and are joined together at the back of the head. These pieces extend down as far as the lip. To these strips is fastened on each side of the jaw a piece of metal, which is made to fit on top of the bone, inside the mouth. The first molars will probably have to be filed down to make room for this piece, and in order that it may fit closely to the bone. Underneath the jawis anotherstrip which is wider and not as long. This

piece of wood is curved at the lower end so as to fit to the end of the bone. Straps pass under the jaw and hols these three strips together. A strap also passes over the brow and another down along the throat thus holding the apparatus firmly in place. In this way the bone is kept rigid and if the animal is fed soft food for a few days it will soon be able to use its teeth to masticate the food. The mouth should be cleaned frequently with water. A weak solution of hydro-chloric acid is also very good. The bowels should be kept open and laxative food given.

If the cradle is not at hand and the bandage is used, liquid food must be supplied. These may be such as hay tea, bran tea and the like. Liquid food should also be supplied per rectum.

FRACTURE of the SPINE. Is not very common. It is often very hard to diagnose. The history of the case should make the operator suspicious. There are however certain peculiar signs. The patient becomes suddenly quiet, perhaps a trembling l sting for a few minutes, the posterior part of the body will be more or less paralyzed, and there may be a slight depression in the back at the place of injury. Recovery is very rare.

The patient should be placed in slings and kept as quiet as possible. If the bone h s been displaced the injury will

probably prove fatal, if not it may recover.

FRACTURE OF THE RIBS. is not always noticed or able to be diagnosed. The true ribs beyond the elbow are most liable to fracture. The free ribs have more motion. The way detect fracture of the ribs is to run the hand along the side to feel for any irregularity, press slightly on this and listen for crepitation.

If the bones remain in place simply a plaster of Burgundy pitch spread on a cloth and poured over the injury is all that is necessary. If a bandage is also wound around the chest the breathing will be limited but it will be beneficial to the injury. If one part projects a compress may be good. If, however, the part projects inward the injruy is more serious but the treatment will still be the same.

FRACTURED PELVIS is rare but quite serious. To examine it insert the hand in the rectum and feel for crepitation. Quiet and right kind of food is all that can be done.

FRACTURE OF BONES OF THE TAIL. Simply apply the starched bandage.

FRACTURE OF THE SCAPULA, is rare. Put on bandage and plaster.

FRACTURE OF HUMERUS is quite common. Often oblique thus making it quite serious. Bandaging is all that can be done.

FRACTURE OF FEMUR is similar to that of humerus.

FRACTURED LEG. Quite common. The treatment has already been described.

FRACTURED PASTERN. If the fracture is longitudinal it w will probably extend into other bones, and the healing will produce anchylosis. If it is transverse it is easy to treat.

FRACTURED SESAMOID. Usually the fracture is the result of disease.

FRACTURE OF THE COFFIN BONE is difficult to diagnose. No displacement is possible and it usually heals itself.

FRACTURE OF NAVICULAR BONE. This often happens after neurotomy has been performed it is usually the result of disease.

The authorities that have been consulted are Prof. W. Williams, Dr. E. A. A. Grange, Prof. A. Liautard, William Percivall, E. Courtany, Dr. H. Agnew, and Dr. F. H. Hammilton.

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