On-Farm Techniques for Repair of Bovine Fractures

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Over the years little has been written regarding repair of fractures in large animals. Although cattle are often mentioned in articles (1,2,3,4,6,9) dealing with equine fractures, a search of the literature reveals only one article (7) dealing specifically or primarily with bovine fractures. Many factors have influenced the lack of fracture repair in the bovine. Fractures always involve soft tissue damage as well as boney damage. This soft tissue damage is often difficult to evaluate yet it plays an important role in the later healing of the fracture. In addition to hard and soft tissue damage, the mere size of the bones and animals involved often enters into the prognosis of fracture repair in the bovine animal.

Overall prognosis then must be equated with economic value, disposition of the animal and skill of the veterinarian in deciding upon a method of repair. Unfortunately, over the years economic value has often been the overriding consideration in the bovine. As many fractures have been salvaged rather than repaired, the skill of the veterinarian in dealing with fracture repair has been held at a low level.

The economic value of many cattle in recent years dictates that fracture repair should be attempted and if at all possible, accomplished. As bovine practitioners undertake fracture repair they should draw on the knowledge the equine practitioners have developed over the years, as the problems of size and weight in the equine most closely resemble those problems in the bovine animal.

In choosing the fracture patient, one must consider temperament. An animal that is too fractious for adequate aftercare (fracture can be repaired under general anesthesia) has a poorer prognosis than the animal which can be handled. Conversely, an occasional bovine animal is so docile or pain-sensitive that once they suffer a fracture there will be no attempt to rise, no matter what method of repair is employed. This too must be considered in rendering a prognosis. Cattle do tend to be more sensible in handling a broken leg than the equine and as cattle spend more time lying down than the equine, the secondary problems, such as breaking down in other limbs, are less important.

The compound fracture, although theoretically possible to repair, is often a failure and consequently such fractures should have a poor prognosis. In addition to a poor prognosis, compound fractures tend to get extremely expensive at an early stage when massive doses of the newer broad-spectrum antibiotics are used. Owners should be made well aware of the prognosis and potential cost before an attempt is made to correct a compound fracture.

In fracture repair personal preference enters into the method used. In addition to personal preference, skill of the veterinarian must be considered. However, over the years certain techniques have been quite successful while others have been uniform failures.

Fractures below the carpus or tarsus are more practical to repair than fractures above these regions. Not only are these fractures easier to diagnose, but they are easier to repair. Bovine practitioners should be strongly advised to consider repair of fractures below the carpus or tarsus unless they are compound.

In young animals a metasplint or "gutter pipe" type of a splint has proven very successful in the treatment of metatarsal, metacarpal and phalangeal fractures. In using this type of a splint, adequate padding must be used to prevent decubital ulver formation. The newer thermoplastic materials (Orthoplast, Johnson and Johnson, New Brunswick, N.J., and Hexcelite, Hexcel Medical Products, Dublin, California) can be molded to fit the leg and provide very satisfactory "gutter pipe" type splints. The primary advantages of such splints are ease of application and ease of changing.

Many authors (4,5,6,10) have also discussed the use of compression plating of fractures of the metatarsus and metacarpus. The exposure of these bones is relatively simple and the bones in question tend to be straight and are thus well suited for internal fixation. However, soft tissue in the area is minimal and closure of fascia and skin over a plate or plates is often difficult or impossible. Anytime open reduction is attempted, the fracture is potentially a compound fracture and strict asepsis must be maintained. This problem seems more important in fractures of the metacarpus and metatarsus, possibly due to the likelihood of insufficient closure mentioned above.

Fractures of the metacarpus and metatarsus are probably the most amenable to the application of a suitable cast. These bones are surrounded by very little soft tissue, therefore good visual alignment can be attained and good immobilization achieved. A primary rule of cast application (applied to any bone)

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is adequate immobilization of the joint above and the joint below the fracture. In fractures of the distal one third of the metacarpus or metatarsus, this rule need not be strictly adhered to, as adequate immobilization of the fracture is achieved by the cast which closely conforms to the bone (metacarpus or metatarsus) above the fracture. If adequate immobilization can be achieved without immobilization of the carpus or tarsus, this is desired as immobilization of the tarsus or carpus greatly hinders the animal's ability to get around.

The newer lightweight cast materials (Hexcelite, Hexcel Medical Products, Dublin, California, and Light Cast, Merck, Sharp and Dohme, West Point, Pennsylvania) work very well in the bovine animal (9), however, cost is a large factor. The weight advantage provided by the newer materials does not appear to be a major factor. Therefore, the use of the heavier but less expensive plaster cast is probably preferred in most instances.

In cast application, bulky cast padding should be avoided for the sake of good immobilization. Cast padding makes high points higher and also compresses with time, creating the potential for excess movement. After cleaning the leg, boric acid powder or a sulfa powder should be liberally applied to the leg. This should be followed by a stockingette (single or double thickness). As one starts to roll cast, it is very important to not have wrinkles or creases in the first layer or two of cast material as these wrinkles tend to cause pressure points and possible future decubital ulcers. The cast material should be applied with enough pressure to prevent wrinkles but without any actual tension. The cast material should be applied with a running manner from top to bottom or bottom to top, so any single roll of material applies a thin layer to the entire cast rather than bulk in any one area. Each layer should be smoothed in with the hands so it gets a good bond to the preceding layer. If metal bars are to be added for reinforcement they should not be applied until approximately 0.5 cm of cast has been applied. This protects the leg from pressure or the possibility of being injured by the metal.

Additional plaster should then be applied over the metal reinforcement to incorporate it into the cast and to reach the total desired strength of the cast. Total size of cast as compared to the size of the animal is learned by experience. However, it is better to err on the side of too large a cast than to have one which is too light and breaks before the desired healing has taken place.

As one places the cast on the foot and leg, removal of the cast must be considered. If one does not have a cast saw available, one might want to incorporate obstetrical wire between the stockingette and cast to be used later in removal. Incasing the obstetrical wire in polyethylene tubing before placing it prevents rusting and helps insure a good wire to later use in cast removal.

Adequate healing can rarely be achieved in less than 6-8 weeks. In many cases, in the grown animal, a single cast can be used this entire time if it is kept dry. In the growing animal, however, the cast should be changed every 2-3 weeks.

Fractures above the carpus or tarsus become increasingly difficult to handle successfully, especially in the grown animal. Successful cast application to the upper leg is impossible as the large muscle masses preclude adequate immobilization of the fracture fragments and immobilization of the joint above the fracture (rule of thumb) is impossible. Compression plating and intramedullary pinning work well in calves up to about 500 lbs. of weight. Above this weight, the mechanical devices (pins, plates and screws) do not have the required strength unless used multiply (more than one device), and then the expense factor increases dramatically.

Hock fractures can be handled with compression plating, pins or casts. Some success has been reported with all of these methods. However, the success is probably equally great with stall rest.

Cast application will not work for tibial fractures and in fact is probably detrimental to healing. If a cast is applied as high as possible, the top of the cast is invariably very close to the site of the fracture and, as such, acts as a fulcrum at the fracture site.

Compression plating has been used very successfully in tibial fractures. Plates work best in animals under 500 lbs. If plating is considered, radiographs must be carefully evaluated, before surgery, for any small secondary fracture lines which might enlarge as screws are applied. In animals weighing over 500 lbs., double-plating or plating in combination with external fixation must be considered. When double-plating, the additional cost factor must be considered and discussed with the owner.

Thomas splints work well in tibial fractures in the bovine animal, although perfect alignment is often difficult to achieve. Adequate alignment, with the bone's wonderful ability to remodel for normal function can be achieved in most cases. In spite of the fact the leg is in extreme extension with the Thomas splint, most cattle will adapt to this situation very well within several days. As with the cast, the Thomas splint must be used for 6-8 weeks. During this time the animal should be kept in an area free of obstructions so that the splint does not become entangled. If the splint should slide or become "ill fitting" during this time, re-adjustment may be necessary.

In smaller animals a 1/4-1/2 inch metal rod is sufficient to make a Thomas splint. However, in larger animals 3/4-inch pipe must be bent and welded for adequate strength. The ring around the femur should be bent at approximately a 45-degree angle from the vertical legs of the splint to provide the proper support for the pelvis. Two or more vertical bars are needed to support the ring and leg. Adequate padding must be taped securely to the ring and the hoof must be wired to the distal end of the splint, as taping (as performed in small animals) is inadequate. Some

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method of medial-to-lateral stability is necessary to prevent excess motion when the animal walks. In young animals, tape applied to the leg and vertical supports are adequate, while in larger animals the incorporation of cast material into the splint is often necessary.

The Charnley apparatus as described by White and Wheat (11) should work well in fractures of the proximal tibial epiphysis, however, its use has never been reported in cattle.

Fractures in the distal 1/3 of the radius and ulna responded well to cast application in spite of the fact that the proximal joint cannot be immobilized. With fractures above the distal 1/3, the same hazards as noted with tibial fractures apply. Consequently, radial fractures can be handled well following the same principles used with tibial fractures.

Femoral fractures are difficult if not impossible to repair in adult cattle. Femoral fractures are too high for cast application and application of a Thomas splint actually hinders healing of femoral fractures by acting as a fulcrum at the fracture site. Intramedullary pins seem to offer the best chance for femoral fractures but probably do not provide sufficient strength in animals over about 400-500 lbs. In younger animals, many times the pin can migrate through the distal femur in several weeks, but adequate stability seems to have been provided by this time and healing takes place. Open reduction with retrograde placement of the pins is probably the most satisfactory in the majority of cases. Stall rest should be considered as a method of treatment in adult animals. This is usually quite successful in midshaft fractures and less satisfactory in proximal or distal fractures.

Femoral neck fractures and slipped proximal femoral epiphysis are fairly rare except in young calves. Although stall rest has been recommended (4) as a method of treatment in these fractures, medullary pinning seems to work very well if the cost factor can be justified.

Humeral fractures are rare and usually are long spiral midshaft fractures. As there is usually very little displacement in these fractures, stall rest will often result in satisfactory recovery. Again, these fractures are too high for cast application but Thomas splints do work quite well. Plate application to the humerus is very difficult due to poor exposure and the extremely crooked nature of the bone (making fitting of the plate nearly impossible). Pins have been used but, again, weight is a limiting factor.

As this paper was to deal primarily with on-farm treatment of fractures, little discussion of pins or plates and their application has been included. Strength of materials and cost are definite factors in internal fixation. However, as technology and the value of animals increase in the future, we will see more and more internal fixation used in cattle.

If we are to continue to offer our clients the high-quality professional care we are trained to provide, all fractures should be evaluated and if the costs can be justified, the fracture should be repaired by the most economical means available.

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