Field Stabilization and Management of Ruminant Fractures

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Key Points:

- Ruminants are excellent candidates for external coaptation for the healing of fractures.
- External coaptation is indicated for definitive fracture management of closed, transverse or short oblique diaphyseal fractures below the carpus or tarsus.
- Appropriate on-farm wound care and coaptation act to prevent further compromise of the fractured limb until referral can be pursued.

Appendicular fractures are commonly encountered in large animal practice and, fortunately, many ruminant patients are excellent candidates for treatment, even when less costly methods of fracture management are pursued. Factors for this include the following: external coaptation is generally well tolerated, ruminants spend a large amount of time lying down, decreased likelihood of contralateral limb breakdown and/or laminitis in ruminants, and an excellent capacity for bone healing.

The first step of the management of fractures is to provide patient first-aid. The cardiopulmonary status should be rapidly evaluated prior to administration of analgesic and/or sedative medications, which may be administered once the patient has been confirmed to be stable. While many patients require light to no sedation at all for the initial first-aid steps, some fractious or anxious patients require heavy sedation or general anesthesia. It is necessary to globally evaluate the patient for other fractures or injuries, and it is suggested to do this prior to focusing on the fracture for which they are presenting. All wounds should be covered with a light bandage to prevent further contamination until wound cleaning and debridement can be performed. The fracture of primary concern should be evaluated for being open, degree of comminution, and whether the fracture is suspected to be articular. Radiographs, while not strictly required for the management of all fractures, is recommended for those suspected to be articular and is required for all fractures to undergo internal fixation methods. The affected limb must also be evaluated for neurovascular compromise; palpating for an arterial pulse or an appropriate degree of warmth from the limb and response to a noxious stimulus, such as pinching with a hemostat, are simple methods of doing so, and additional diagnostics include doppler ultrasonography and angiogram radiographic study. Fracture stabilization should be performed, except in rare instances where it is contraindicated. Details on this follow a brief discussion on open fracture care. Lastly, in neonates, successful transfer of passive immunity must be confirmed and addressed appropriately if partial or complete failure is suspected.

It is important to identify open fractures for both treatment planning and prognostication purposes; as the degree of soft tissue loss, exposed bone, and contamination increases, the prognosis for healing generally decreases. Sterile water-based lubricant is applied to the wound and surrounding hair is clipped with a #40 blade. The wound is cleansed and aseptically prepared with dilute chlorhexidine or betadine solution and sterile saline, not scrub or alcohol since these items are cytotoxic. A local block or a regional limb perfusion containing a local anesthetic helps to facilitate these wound care steps, as well as sharp debridement and partially closing the wound, if indicated, and fracture reduction. When a regional limb perfusion is used, it is recommended to add an antimicrobial as well, bearing in mind this constitutes extra-label drug use and antimicrobials are selected accordingly. Regardless, systemic broad spectrum antimicrobial therapy is started at the initial presentation. The wound must be copiously lavaged with sterile saline at the conclusion of debridement. A sterile bandage is applied to the wound, consisting of a non-adhesive layer, roll gauze, and a light adherent elastic tape.

Fracture stabilization recommendations are based upon which bones are affected, with a general rule requiring immobilization of both the joint proximal and distal to the fractured bone. A Modified Robert Jones or traditional Robert Jones bandage may provide adequate immobilization in light animals; however, most require splinting or casting. Splints made of longitudinally split PVC pipe are ideal as they are light, strong, and re-useable; a less expensive option includes wooden boards or dowels. For most fractures, two splints should be used, and they should be applied orthogonal to each other, for example one lateral and one palmar/plantar. Casts, whether applied as a traditional cast or a bandage cast, and splints should always include the foot and extend to the proximal aspect of the bone to end near a joint, as opposed to mid-diaphyseal, which creates a stress-riser and increases likelihood of fracture at that site. These three options, bandage, splint, or cast, can be quickly and easily applied for any lower limb fractures (below carpus or tarsus). For fractures of the radius or tibia, the joint proximal is difficult to immobilize due to the musculature present and proximity to the body, and a Thomas-Schroeder splint and cast combination is recommended. No coaptation is applied for fractures of the humerus or femur due to inability to immobilize the shoulder or hip joints, respectively.

These simple types of coaptation may suffice as definitive treatment for fracture healing, but is dependent on fracture configuration, location, and other factors discussed as follows. At a minimum, these principles should be followed for fracture stabilization prior to transportation to a referral facility, as the initial fracture first aid provided may significantly affect the ultimate outcome. The goals of field stabilization for the purpose of referral include reducing patient pain and anxiety and preventing further compromise through the immobilization of adjacent joints. These goals are accomplished by adhering to the above-described practices. Lastly, patients should be encouraged to lie down during transportation.

Fracture configurations that are amenable to cast or splint coaptation are those that have axial stability when reduced, which include simple diaphyseal fractures in either transverse or short oblique configuration. Physeal fractures with a Salter-Harris (SH) classification of type 1 and most type 2 are amenable to external coaptation as well, however, SH type 2 fractures with a large metaphyseal spike may require additional stabilization. Fracture configurations that are not amenable to external coaptation include spiral, long oblique, and all comminuted fractures. Articular fractures require near-perfect reduction and rigid internal fixation to prevent articular callous formation and subsequent arthritis. Body weight is an additional factor to consider, with heavier or adult animals being more likely to require additional stabilization, regardless of fracture configuration or location.

If external coaptation alone is to be used for treatment, the animal should be individually housed in a small pen for 8 weeks, the duration of fracture healing. Comfort level is assessed daily and a recheck examination by a veterinarian is performed urgently if the patient shows signs of discomfort. Casts may be left in place for the duration of fracture healing in adult patients, however, a cast change at the mid-point of 4 weeks is preferred. In young animals the cast must be changed at 3–4-week intervals to accommodate skeletal growth. Complications to be aware of include cast sores, cast breakage, wound complications, malunion or delayed/non-union of fractures, and contralateral limb breakdown. Cast breakage must be addressed immediately as it poses a potential catastrophic complication that results in additional soft tissue damage and destabilization of the fracture. Cast sores can be prevented by providing adequate padding of boney prominences with felt underneath the cast, including the accessory carpal bone, the point of the calcaneus, the medial and lateral malleoli of the tibia, between the toes, and underneath the dewclaws. Following development, cast sores are treated as any other wound by performing debridement and lavage, then providing an ideal wound healing environment with the use of a bandage and minimizing motion. Contralateral limb breakdown results from compensatory overloading of the non-affected limb and is generally due to soft tissue laxity rather than a bone deformation. The most common is fetlock hyperextension, which may partially or fully resolve once fracture healing is complete and the animal is able to fully load the formerly casted limb.

References:

1. Anderson DE, St. Jean G. Management of fractures in field settings. *Vet Clin Food Anim*. 2008; 24: 567-582.
2. Fessler JF, Adams SB. Decision making in ruminant orthopedics. *Vet Clin Food Anim*. 1996; 12(1) 1-18.
3. Mulon PY, Desrochers A. Indications and limitations of splints and casts. *Vet Clin Food Anim*. 2014; 30: 55-76.
4. Tulleners EP. Metacarpal and metatarsal fractures in cattle. *Vet Clin Food Anim*. 1996; 12(1) 199-209.