Common emergency and musculoskeletal repairs in the small ruminant

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Abstract

Small ruminants suffer musculoskeletal disease most commonly due to fracture, wildlife attack, fence injuries, infectious or degenerative diseases. Due to their size, behavior and physiologic healing capacity compared to other species, they are excellent orthopedic patients. External coaptation is well tolerated in these species and can be applied in many cases, and often results in a satisfactory clinical outcome. In unfortunate circumstances where limb amputation is elected, small ruminants appear to tolerate this procedure and can have fair to good long-term outcomes.

Key words: musculoskeletal, emergency, small ruminant, external coaptation

Musculoskeletal evaluation of the small ruminant

Musculoskeletal emergencies in the small ruminant can be a stressful endeavor, and mismanagement can be catastrophic to a satisfactory outcome. Before any emergency is encountered, it is vital for the clinician to know the equipment, personal skill level and resources they have available. A pre-formulated plan on what musculoskeletal disorders the clinician is comfortable treating and which ones warrant referral can aid in musculoskeletal emergency management. General recommendations include distal transverse fractures, distal luxations and septic arthritis that can be treated at-farm. Whereas proximal fractures (i.e., humeral, femoral, tibial and radial), proximal luxations, comminuted fractures and oblique fractures can be considered for referral.

The musculoskeletal evaluation of sheep and goats consists of a thorough history, evaluation of posture, a gait analysis and limb palpation with range of motion assessment. Depending on the purpose of the animal, the ability of the client to give a detailed history may be limited. Important information to gather from the client prior to evaluation of the animal includes age, breed, sex, purpose of the animal, intended use or goals of the client after treatment, duration of perceived lameness, inciting cause (if known), perceived limb affected, husbandry practices, treatments and management changes initiated since lameness, response to treatment, perceived worth of the animal, and financial investment capabilities.

Generally, evaluation of posture, gait analysis and limb assessment can be performed more easily compared to cattle. However, larger breed small ruminants, especially bucks and rams, may be difficult to fully evaluate depending on the facilities and personnel available. For larger small ruminants, squeeze chutes, chute transporters or trimming stands can be used to aid in manual restraint during limb assessment. In some circumstances chemical restraint may be warranted. Small ruminants are different than cattle in that they do not exhibit a significantly arched back with worsening lameness. Rather, as the lameness worsens, they simply become non-weightbearing and use the unaffected limb to hop. This is especially apparent in pygmy and Nigerian dwarf breeds. To the author's knowledge, there is no universal small ruminant lameness scoring system. Therefore, the Sprecher Cattle Lameness Scoring System can be adapted to the small ruminant.[1] In the aforementioned adaptation, 1 is normal and 5 is severe non-weightbearing lameness. If possible, limb palpation and range of motion assessment should be performed methodically with the animal in lateral recumbency. The author prefers to start distally at the tip of the claws and work proximally. The hoof walls, soles and interdigital space should be evaluated and trimmed if needed to detect any possible foot lesions. Moving distally to proximal, each joint should be palpated, flexed, extended, rotated and manipulated in medial and lateral directions to detect instability, crepitus, increased laxity or pain. Moving up the limb, the long bones should be palpated, squeezed and bending force placed upon them at the level of epiphysis, metaphysis and diaphysis. The entire limb should be flexed and extended. In healthy hindlimbs, flexion and extension of the hock results in the flexion and extension of the stifle, respectively.[2] A flexed stifle with an extended hock indicates a peroneus tertius tear, whereas an extended stifle with a flexed hock indicates a gastrocnemius tear. While difficult to perform in cattle, cranial drawer can be performed in smaller small ruminant breeds for the detection of cranial cruciate tears.

After initial assessment and the lameness is localized on the limb, diagnostics can be elected to further evaluate the cause of lameness. Diagnostics of the musculoskeletal system of the small ruminant include ultrasonography, arthrocentesis, thermography, radiographs, computed tomography, magnetic resonance imaging and nerve blocks. Currently, FARAD does not recommend bone scintigraphy for food-producing animals.[3]

After a diagnosis, therapeutic considerations must be evaluated. Advantages in the small ruminants include more rapid bone healing compared to other species, tolerance of external coaptation, less likely to overuse affected limb, higher tendency of recumbency immediately after therapeutic intervention, and less locomotion expectations (production vs. performance). Disadvantages include potential size of the animal, possible immediate use of the limb, contralateral limb breakdown, and prolonged recumbency resulting in sores, myopathies and neuropathies.

External coaptation of the small ruminant

External coaptation for fractures is often elected in small ruminants due to its practicality, ease of application, it is well-tolerated by the animal, and can be financially feasible. Important considerations before the application of external coaptation include: will adequate stabilization of the fracture occur, and is closed reduction possible? Generally, fractures distal to the elbow and stifle are preferred for external coaptation. Options for external coaptation include casts, slings, splints and

transfixation pin casts (hanging limb cast). In short, casts are best for transverse fractures distal to the carpus or hock. Casting tibial, radial or ulnar fractures is ill-advised due to the inability to immobilize the elbow or stifle joint with the cast. In these cases, a Thomas splint should be considered.[4]

Hanging limb casts carry many advantages in that minimal load is placed across the fracture plane, preservation of the physiologic hematoma occurs, and less expertise and specialty skills are required compared to internal fixation.[5] General anesthesia or heavy sedation with a lumbosacral epidural is recommended prior to the surgical procedure. The animal is placed in either lateral or dorsal recumbency and a 1-cm stab incision is made through the skin proximal to the fracture. Next, using an appropriately sized drill bit, a guide hole is made. It is recommended to use positive profile, mid-threaded, self-tapping pins that are 20% to 30% the width of the bone.[6] The pin is drilled into the bone through the 1-cm stab incision and guide hole until the threads contact both cortices. A second pin is placed parallel to the first and at a divergent angel of 30 degrees within the transverse plane. It is recommended the second pin be a distance of 6 times the pins diameter (2 cm to 4 cm) to the first. Once the pins are placed, the fracture is reduced by closed reduction and casted. The cast incorporates the pins placed proximal to the fracture and extends to the floor. By definition, a transfixation pin cast is a modified type II external skeletal fixator.

Transfixation pin cast management includes re-evaluation in 2 to 3 weeks in young growing animals or 6 to 8 weeks in adults. Upon recheck, the cast is removed, and the fracture is palpated to determine callus formation; radiographs can be performed to confirm clinical suspicions. If adequate callus formation is determined, the pins can be removed; this can be done under light sedation. The pin tracts are left open to drain and heal by second intention. The limb is re-casted and kept on for 2 to 4 weeks in young animals and 4 to 6 weeks for adults. In a retrospective study by Lozier et al., the medical records of 39 animals were reviewed that received a transfixation pin-cast at The Ohio State University College of Veterinary Medicine.[7] Thirty-one (79%) had a positive short-term outcome. Of the 8 non-survivors, the majority were associated with open fractures.

Septic arthritis management

Beside fractures, septic arthritis is a common emergency musculoskeletal disease of the small ruminant, and infection often occurs due to bacterial hematogenous spread in young neonates secondarily to failure of passive transfer.[8] Treatment and satisfactory clinical outcomes are often disappointing due to lack of timely intervention, virulence of the bacteria, irreversible articular damage and lack of effective therapeutics.

Following prompt diagnosis, therapy is focused on rapid intervention that includes joint lavage via through-and-through needle lavage, arthrotomy or arthroscopy, and systemic and local antimicrobials. Local antimicrobials are commonly used for septic arthritis treatment in large animals and achieve antimicrobial concentrations exceeding the minimum inhibitory concentrations (MICs) against bacteria for a prolonged duration and prevents adverse/toxic effects of systemic antimicrobials, and potentially, decreased antimicrobial residues in meat and milk. Currently, there are no antimicrobials labeled for septic arthritis treatment approved by the FDA for local (intravenous regional limb perfusion [IVRLP] or intra-articular [IA]) administration in the United States. In following with the tenets of AMDUCA, the use of ampicillin-sulbactum is allowed in cattle and small ruminants in the U. S. for treatment of septic arthritis.[9] Ampicillin-sulbactum administered via IVRLP achieved therapeutic concentrations in the respective synovial fluid samples in an experimental study involving healthy adult cattle without any adverse effects, and has also shown efficacy in clinical treatment of deep digital sepsis.[10,11] Several in vitro experimental studies have also demonstrated the antimicrobial properties of equine, ruminant and human platelet-rich plasma. One of the most recent investigations found that autologous bovine PRP had similar chondroprotective efficacy in *Staphylococcus aureus*-induced in vitro septic arthritis model to ampicillin-sulbactum.[12] If regenerative therapies prove to be an effective treatment modality, they would bypass the restrictions associated with local/systemic antimicrobial use in food-producing animals.

Limb amputation

Unlike cattle, limb amputation is a reasonable and feasible option in the small ruminant that appears to have a reasonable clinical outcome. Limb amputation can be considered in circumstances of financial constraint, lack of response to treatment, or severe musculoskeletal disease. Important considerations prior to limb amputation include intended use of the animal, age, weight, financial investment, amputation site, affected limb and client compliance. A retrospective study by Gamsjäeger and Chigerwe in 2018 reviewed the medical records of 22 small ruminants that underwent partial to complete limb amputation between 1985 to 2015 at UC Davis Veterinary Hospital.[13] All goats and sheep survived to hospital discharge. Short-term follow up showed 6 of 8 goats contacted were able to ambulate satisfactory. Of the 5 goats that had been doing well at short-term follow up, 3 goats were reported to have a good quality of life, 1 goat developed a wound infection and laxity in the contralateral limb, and 1 goat developed joint laxity in the contralateral limb 8 months after amputation and was euthanized. In this study no association was identified between postsurgical complications and body weight, age and amputated limb. In partial limb amputations, home-made or professionally made prosthetics can be considered, and in the author's experience small ruminants tolerate them well.

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