BONE SEQUESTRATION OF THE APPENDICULAR SKELETON IN CAMELIDS
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Key Points

• Sequestration of the long bones is not common, but most often occurs in younger (<2 years) camelids. Affected animals are lame.
• Surgical management has a favourable prognosis despite risk of destabilization; overall success depends on correct timing of the surgical procedure.

Osseous sequestration has been recognized with increased frequency in South American camelids. In horses and cattle, sequestration is most commonly associated with traumatic events that lead to localized cortical ischemia and bacterial invasion secondary to loss of adjacent periosteal and soft tissue integrity and viability. In humans, osteomyelitis without prior trauma is rarely seen in adults, but is reported in neonates. Etiology is suspected to be hematogenous spread of bacteria which seeds specific regions due to unique blood flow present in neonatal long bones. At OSU-VTH we have seen a population of young South American camelids that developed osseous sequestration without evidence of trauma.

Materials & Methods:
A retrospective study was performed to include confirmed cases of primary appendicular osseous sequestra in camelids between 1998 and 2008; nine animals were identified. Additional cases will also be discussed. Medical records of these animals were examined and data were collected for case review.

Results:
Preoperative Findings:
Nine animals were affected and there were a total of 13 sequestra in 10 limbs. Distribution was: phalange (1), metacarpus (2), talus (1), tibia (5), femur (3) and humerus (1). One cria had a sequestrum in each tibia and femur.

Seven of the nine animals were female and seven animals were less than 3 months of age. Median duration of lameness was 14 days (range 1-28 days). All animals were lame on presentation, with lameness ranging from mild to non-weightbearing. Seven of nine animals were moderate to severely lame. Five animals had history of extenuating circumstances at birth or in the first two weeks of the early neonatal period. Two crias were treated with antimicrobials after onset of lameness. The lameness improved initially in both animals, but returned in one animal when antibiotics were discontinued. The sequestrum resolved without surgery in the other cria.

All sequestra were identified radiographically when they presented to our hospital. But, in three cases, a sequestrum was not visualized when radiographs were taken by the referring veterinarian at the onset of lameness.

Surgical Findings:
In two cases, removal was delayed until radiographic signs had progressed to show a more obvious involucrum and supporting pericortical bone. Surgery was delayed in four cases because of concerns with limb stabilization after sequestrum removal. Surgery was performed
once pericortical new bone was expected to provide stability. One cria with tibial and femoral sequestra did not have sequestrectomy due to the fact that the sequestra involved a large portion of the bone and removal could have destabilized the limb. That animal was lost when it was allowed pasture freedom after one month of confinement and the limb destabilized. One alpaca with a sequestrum of the talus was euthanized prior to institution of therapy due to poor prognosis for return to soundness. At surgery, four of five sequestra were successfully removed. In the fifth case, a discrete fragment was not found despite curettage. Eight animals were cultured and isolates were obtained only in three. Isolates included Fusobacterium(2) and a Clostridium species.

Of the animals that underwent sequestrectomy (n=5), all survived to be discharged from the hospital. In all animals where a sequestrum was removed, there was a decrease in degree of lameness postoperatively. Complications after discharge were limited to postoperative infection in one animal and pathologic fracture in two animals.

Discussion:

In other species, sequestration is most commonly associated with traumatic events that lead to localized cortical ischemia. This relationship directly contrasts with the cases of sequestration we have seen in this population of camelids. In our cases, there is no evidence of trauma prior to sequestrum formation.

Cattle between the ages of 6 months and 2 years are considered at a higher risk for sequestrum formation; most likely because adolescent animals are more likely to be involved in traumatic accidents than are adults. Also, periosteal trauma may have a more severe outcome in young animals because the periosteum plays a greater role in cortical circulation in young animals than it does in adults. All of our cases were 2 years of age or younger, with 78% (7/9) being less that 3 months of age.

In one study of 86 cattle diagnosed with sequestration involving a long bone, 32 (29%) had a draining tract present. They submitted 45 samples for bacteriology and cultured 84 different organisms (61 aerobic, 23 anaerobic) from 40 positive cultures. In our cases, only three samples cultured positive; all were anaerobic organisms. These cultures were taken at a time when the disease process was advanced. Perhaps in cases where a negative culture result was obtained, the causative agent was not viable after a prolonged immune response. It is also possible the bacterial embolism may have resulted in an exaggerated inflammatory response that damaged the blood supply to that area, resulting in a sterile sequestrum.

There has only been one other study that addressed the type of sequestration we have seen in camelids. In this study, four of the five camelids with appendicular sequestra were four months old or younger. Three of the five sequestra were in the metacarpus or metatarsus; the other two were femoral sequestra.

In humans, it is known that differences in circulation of the metaphysis and epiphysis between neonates and adults is likely responsible for vascular seeding of bacteria during periods of sepsis. The infection begins in metaphyseal venous sinusoids and sluggish blood flow allows settling of bacterial which colonize the metaphyseal periosteum and bone. Exudate then exits the porous metaphyseal cortex and forms subperiosteal abscess, involucrum, and sequestrum.

There are no studies to date that assess whether differences in cortical or periosteal circulation exist between juvenile and adult camelids. This may be an area of further research to define a cause for the disease process.
Frequency of long bone sequestration in juvenile camelids prompts understanding of the pathogenesis and management of the disease. Medical management using antimicrobials and strict confinement, sometimes on a long term basis, is indicated prior to surgery. One case resolved with medical management and confinement only. Surgical excision of sequestra is indicated if the lesion is radiographically apparent and the animal has developed adequate innate stability through the formation of pericortical bridging bone, or the surgeon is prepared to provide necessary stabilization. The primary author feels these lesions are secondary to bacterial infection, but bacterial isolation is rare at the time of surgery.

The formation of a sequestrum should be considered in any juvenile alpaca with a sudden onset of lameness and swelling of a limb, despite a lack of history of trauma to that limb. We feel surgical removal of primary osseous sequestration in juvenile camelids results in an excellent prognosis for survival. Timing of surgery is critical. Sequestrectomy may need to be delayed until the sequestrum is mature radiographically, or, in the case of large sequestra, until a stabilizing callus is formed.

References


