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Modified Ear Canal Ablation and Lateral Bulla Osteotomy for Management of Otitis Media in an Alpaca

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Abstract

Objective—To report surgical treatment of severe otitis media in an alpaca by a modification of a subtotal ear canal ablation and lateral bulla osteotomy technique used in dogs.

Study Design—Case report.

Animals—An 11-week-old female alpaca cria.

Methods—The cria had a 2-week history of right otitis media, nonresponsive to medical treatment, as well as right facial nerve paralysis, and a melting corneal ulcer of the right eye. Otitis media was confirmed by computed tomography. Right subtotal ear canal ablation and lateral bulla osteotomy were performed using a modification of a technique reported in dogs.

Results—There were no surgical complications and the alpaca was discharged from the hospital 5 days later. At 10 months, moderate motor function had been restored to the pinna with the ear standing partially erect. The otitis had resolved, and the alpaca was reportedly well integrated into the herd.

Conclusion—Subtotal ear canal ablation and lateral bulla osteotomy, a technique modified from that performed in dogs, were successful in providing complete clinical resolution of otitis media in an alpaca.

Otitis media is an uncommon condition in South American camelids and is thought to occur more commonly as a consequence of upper respiratory disease rather than an extension of otitis externa as reported in dogs.^{1–3} Medical treatment of chronic otitis media in alpacas can be challenging because of the sigmoid shape of the external acoustic meatus, which prohibits evaluation of the tympanic membrane, and the multicompartamental tympanic bulla that does not allow for easy surgical drainage.^{2, 4, 5}

Total ear canal ablation (TECA) with lateral bulla osteotomy (LBO) is a widely accepted surgical treatment for end-stage otitis externa, otitis media, and masses confined to the external or middle ear in dogs and cats.^{6–13} Although surgical treatment for otitis is well described in dogs and cats, there are only sparse reports describing surgical treatment of otitis media in South American camelids.^{2, 3} These reports document complications

including hemorrhage, lack of improvement, and euthanasia² or involve removal of the pinna,³ which may result in behavioral and social consequences in camelids.³

A modified technique (subtotal ear canal ablation) has been described for dogs and cats with otitis or neoplasia with minimal distal ear canal involvement.¹⁴ This technique would be ideal in camelids with otitis media, where the distal ear canal is typically not involved. We report a surgical technique for subtotal ear canal ablation and LBO in an alpaca, modified from that described in dogs. Computed tomography (CT) was used to confirm otitis media and provide relevant anatomy of the external and middle ear canal to guide surgical exploration.

CLINICAL REPORT

An 11-week-old female alpaca was admitted for evaluation of suspected right middle ear disease. The cria had a 2-week history of ceruminous discharge from the right ear, right ear droop, head shaking and a right-sided head tilt, weight loss, and right corneal ulcer. Treatment had consisted of lavaging the external acoustic meatus with dilute chlorhexidine, which temporarily improved the discharge and discomfort. The corneal ulcer had been treated topically with oxytetracycline/polymixin B ointment twice daily and frequent application of artificial tears.

On admission, the cria was bright, alert, and responsive. There was a right head tilt and right facial nerve paralysis (lack of right nostril movement, right ear droop, and absent right palpebral reflex) and a melting corneal ulcer in the right eye. No abnormalities were identified on complete blood count and serum biochemical profile. A diagnosis of right otitis media was made. Initial treatment consisted of topical treatment for the corneal ulcer (atropine, miconazole, autologous serum, ciprofloxacin, and cefazolin) and a partial temporary tarsorrhaphy. Systemic treatment for the otitis consisted of flunixin meglumine (1.1 mg/kg intravenously [IV] once daily), potassium penicillin (22,000 U/kg every 6 hours), and enrofloxacin (5 mg/kg IV twice daily); however, the cria's neurologic status continued to decline so surgical treatment was recommended.

Diagnostic Imaging

On digital radiographs (Fig 1), the right tympanic bulla and petrous temporal bone had increased opacity when compared with the contralateral side, and the right external ear canal was poorly defined. These findings were consistent with a right-sided petrous temporal osteomyelitis, tympanic bulla osteitis, and right otitis media and externa.

Before surgery, CT examination of the skull was performed to evaluate the external and middle ear anatomy as well as to rule out extension of disease into the brain (Fig 2). Using a single-detector row, third generation helical scanner (GE HighSpeed LXi, GE Medical Systems, Milwaukee, WI), images of the head and cranial aspect of the neck were obtained in axial acquisition mode with the cria positioned in sternal recumbency. Survey images were acquired using bone and detail reconstruction algorithms, followed by an IV bolus of ionic iodinated contrast medium (800 mg I/kg, MD-76, Mallinckrodt Inc., St. Louis, MO). Postcontrast images using only the detail reconstruction algorithm were obtained. All images were acquired at a slice thickness of 2 mm (120 kVp, 140 mAs). Pertinent findings included a thickened and sclerotic right bony tympanic bulla with soft tissue attenuating material within the bulla and soft tissue attenuating material present in the right ear canal. Thinning of the right petrous temporal bone was visible with a small bony defect of the adjacent calvarial floor that measured 0.2 cm (Fig 2); however, contrast enhancement of the adjacent brain parenchyma was not present.

The final diagnosis was severe right otitis media and bulla osteitis, mild right otitis externa, and right petrous bone pressure necrosis. Benign differentials for the petrous bone defect include artifacts, such as volume averaging versus asymmetry from mild obliquity in patient positioning, but given the clinical signs, these differentials were considered unlikely.

Surgical Technique

The cria was positioned in left lateral recumbency. The right ear and right periocular area were surgically clipped and aseptically prepared. Surgical drapes were used to isolate the operative field leaving the right pinna exposed. A single 5-cm vertical skin incision was made overlying the vertical ear canal, beginning just ventral to the tragus and continuing in a cranioventral direction using bipolar electrocautery for hemostasis. With the aid of retractors, the vertical ear canal was dissected free from its soft tissue attachments and transected 1.5 cm ventral to the tragus (Fig 3A). The proximal portion of the vertical canal and the horizontal canal were dissected free from surrounding tissue and removed to expose the external acoustic meatus (Fig 3B). Epithelium was removed from the external acoustic meatus and dorsal bulla and submitted for culture and susceptibility testing.

The facial nerve was identified and gently retracted. An air-driven burr was used to enlarge the external acoustic meatus and to perform a LBO through the honeycomb-like bone of the ventral bulla (Fig 3C). Care was taken to avoid the defect in the petrous temporal bone, clearly visible upon enlarging the external acoustic meatus (Fig 3D). Samples were obtained from the bulla and submitted for fungal and bacterial culture and susceptibility testing. The bulla was lavaged and suctioned several times. The remaining portion of the distal vertical ear canal was closed with 3–0 polyglyconate in a simple interrupted pattern. A 0.25-inch Penrose drain was placed in the tympanic bulla, exiting the skin through a 1-cm incision ventral to the primary incision. The drain was secured to the skin with 2 simple interrupted sutures using 2–0 nylon. The subcutaneous tissue was closed with 3–0 synthetic monofilament suture using simple interrupted and cruciate patterns and the skin closed with 4–0 synthetic monofilament suture in an intradermal pattern (Fig 3E). After subtotal ear canal ablation and LBO, the right eye was enucleated. The cria recovered uneventfully from anesthesia.

Postoperative Care

After surgery, analgesia was maintained with a constant rate infusion (CRI; 60 mL/kg/day) of MLK (morphine, 10 mg/L; lidocaine, 300 mg/L; ketamine, 60 mg/L). Medetomidine CRI (1 µg/kg/h) was administered for additional pain relief and mild sedation. A 50 µg/h fentanyl patch was applied. Six hours after surgery, the cria was able to nurse, and the MLK and medetomidine were discontinued to allow the cria to remain with the dam. Flunixin meglumine (0.5 mg/kg IV twice daily) was administered for 5 treatments. Potassium penicillin (22,000 U/kg IV every 6 hours) and enrofloxacin (5 mg/kg IV twice daily) were administered for 5 days. Given the level of stress and prolonged nonsteroidal antiinflammatory drug administration, pantoprazole was administered empirically (1 mg/kg IV once daily) for possible gastric ulceration during hospitalization. The surgical site was monitored for discharge and cleaned every 6 hours after surgery. The Penrose drain was removed 2 days after surgery. The fentanyl patch was removed 72 hours after application.

Outcome

Five days after surgery, the cria was discharged with instructions to administer sucralfate (30 mg/kg orally every 8 hours) for 7 days. The head tilt had gradually improved and the incisions were healing without complication. There was no bacterial or fungal growth from the specimens obtained from the bulla during surgery. At ~10 months after surgery, the cria was reported to be doing exceptionally well, without a head tilt and had regained partial

movement of the right ear. The pinna is not carried fully erect; however, the cria has rejoined the herd and is thriving.

DISCUSSION

We report successful subtotal ear canal ablation and LBO in an alpaca cria for management of severe otitis media. The technique we used was adapted from one previously reported in dogs.

Otitis media in alpacas is rarely reported^{2, 3} and may develop from extension of otitis externa, but is more often thought to be a consequence of an ascending infection from the Eustachian tube.³ Given no previous history of otitis externa, the most likely cause was an ascending infection through the Eustachian tube; however, there was no history of prior or concomitant respiratory or oral disease.

Medical management of otitis in alpacas can be very challenging. Treatment involves removal of foreign material, treatment of local disease, and diagnosis and treatment of underlying systemic disease, with long-term antimicrobial treatment used as mainstay of medical management.¹⁵ The anatomy of the alpaca ear is markedly different than in dogs. The osseous canal of the external acoustic meatus tends to have a sigmoid shape^{2, 4, 5, 16} that makes otoscopic examination impossible without use of an endoscope in the adult.² In addition, the acute angle of the ear canal accompanied with a multicompartamental tympanic bulla prevents thorough lavage of the horizontal canal in the standing animal.^{3–5, 15} Therefore, in cases of advanced disease, medical therapy may not be successful and surgical therapy is warranted.

CT can be a useful diagnostic tool in camelids and can be accomplished by most scanners with techniques similar to small animals, with only slight adjustments to the scanning table to allow the area of interest to fit into the gantry.¹⁶ In this cria, the CT images were especially helpful for surgical planning, allowing us to compare and contrast the anatomy of the alpaca and dog bulla and outline the intended osteotomy. The CT images (Fig 2) revealed the osseous defect within the dorsal wall of the bulla communicating with the brain. This defect was immediately adjacent to the external acoustic meatus, but was not visible until the meatus had been substantially enlarged. Thus, the CT images made us aware of the defect, preventing inadvertent damage to the central nervous tissue. The postcontrast CT scan also ruled out any evidence of disease within the brain.

The technique commonly described for TECA LBO in dogs was modified because of anatomic differences between alpacas and dogs. The external ear canal of the alpaca is a distinct funnel shape compared with dogs where the external ear canal can be flattened easily in a dorsoventral direction. When performing TECA in a dog, the initial incision is circular, around the external ear canal just medial to the tragus.¹² The tragus in the alpaca is located deep within the pinna above the conchal eminence, so we decided to perform a subtotal ear canal ablation, removing only the proximal portion of the vertical ear canal, to maintain normal conformation of the pinna. This is only recommended if the distal ear canal is free of disease.

Like the dog, the auditory acoustic canal of the alpaca lies medial to the annular cartilage of the pinna; however, in the alpaca, the cartilaginous portion of the ear canal is relatively short.⁴ The osseous portion of the ear canal enters the petrous temporal bone immediately ventral to the zygomatic process.^{4, 5} It is directed rostrally and ventrally in the adult and is relatively straight in the neonate.⁴ In the adult, the canal extends for a distance of ~1.8 cm, then deviates ventrally by 120° for 1 cm before ending at the tympanic membrane.⁴ The

width of the canal in adults is thought to be a maximum of 6 mm in the external canal narrowing to 4 mm distally.⁴

The facial nerve in the alpaca traverses the ventrocaudal aspect of the external ear canal as occurs in dogs.^{5, 12, 13} Facial nerve paralysis occurs in 10–15% of dogs with this surgery and may be temporary or permanent.^{12, 13} The recommendation in dogs to avoid facial nerve injury is to establish a dissection plane as close as possible to the auricular cartilage.¹³ The facial nerve in this cria was identified coursing on the ventralcaudal aspect of the canal and retracted during surgery (although we did not purposely seek out this structure). This cria had facial nerve paresis before surgery that improved in the months after surgery. Thus, the facial nerve did not likely sustain additional damage during surgery.

Performing a LBO is quite different in the alpaca than in the dog. There is a successful report of a TECA LBO performed in 2 adult bongos (*Tragelaphus eurycerus*).¹⁵ In that report, the authors highlighted the need to remove the lateral aspect of the osseous canal, bony wall, and osseous bulla using a bone burr to achieve adequate exposure and drainage.¹⁵ We found this true in the alpaca, as we were unable to access the dorsal compartment of the bulla to remove the epithelium until we had enlarged the external acoustic meatus and removed the lateral aspect of the osseous canal with the burr. This can be challenging if the area is fibrotic or chronically inflamed leading to additional ossification as occurs in dogs.^{13, 15}

In contrast to dogs, the ventral portion of the tympanic bulla in the alpaca is large and is filled with extensive bony subcompartments resembling a honeycomb rather than being hollow like in dogs (Fig 4).^{2, 4} The multiple compartments of the tympanic bulla are thought to aid in enhanced auditory aptitude with the ability to better distinguish between high and low frequencies.¹⁶ It is this feature of alpaca anatomy that makes LBO challenging in this species. The endpoint of a bulla osteotomy in the dog is removal of all epithelium and infected material. In the cria, all epithelium was contained within the osseous portion of the ear canal and the hollow, dorsal portion of the bulla. There was no epithelium within the ventral multicompartmental portion of the bulla, and therefore, we did not believe that the entire ventral bulla needed to be obliterated to achieve complete debridement of the infected tissue.

Previous reports documenting surgical treatment of otitis media in llamas and alpacas are sparse,^{2, 3} and the technique we describe differs from techniques described in these reports. In one report of a llama with chronic otitis externa refractory to medical management, the ear canal was initially removed using a technique similar to a vertical ear canal ablation previously described in dogs.^{2, 13} When this technique failed to resolve the condition, LBO was attempted using a Steinmann pin and hand chuck.² Curettage through the osteotomy failed to remove epithelium and resulted in severe hemorrhage and euthanasia of the llama.² We chose to use a modified TECA LBO procedure because as reported in dogs, vertical ear canal resection is only indicated for disease limited to the external ear canal and will not resolve disease within the middle ear.¹³

Marriott et al described a successful outcome after a TECA LBO in an adult alpaca for chronic otitis media.³ In contrast to our case, they described a technique that incorporated the removal of the pinna with electrocautery.³ The rationale for removing the pinna was that it was nonfunctional at the time of surgery. We chose to leave the pinna and the distal portion of the vertical ear canal in place, both for cosmetic reasons and because ear carriage is important for social interaction among camelids.^{3, 4} Although the cria had abnormally low ear carriage before surgery, we could not predict whether or not this would improve

postoperatively. The ear carriage did improve postoperatively in this cria, and thus we were satisfied that we had left the pinna intact.

Summarily, we report successful completion of a subtotal ear canal ablation and LBO in an alpaca cria and provide a detailed description of the anatomy and CT appearance relevant to this procedure, which is recommended in alpacas for severe otitis media that is refractory to medical management.

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Figure 1. Dorsoventral radiographic projection of the skull. The right bulla and petrous temporal bone (arrows) are more opaque when compared to the left.

Figure 2.

Transverse CT image, bone reconstruction algorithm, WW 2000/WL 300. The right bulla is thickened (thick arrowhead) and soft tissue attenuating material is present within the middle ear. Note the discontinuity of the right petrous temporal bone (thin arrow). WW: Window Width (Hounsfield units); WL: Window Level (Hounsfield units).

Figure 3.

Right ear (distal aspect of the vertical ear canal [*]). (A) a 5-cm skin incision was made overlying the vertical ear canal from just below the tragus. The vertical ear canal has been dissected free from its soft tissue attachments and transected 1.5 cm ventral to the tragus. The proximal vertical ear canal is being held with the Babcock forceps (arrow); (B) the vertical and horizontal ear canal have been dissected from the surrounding tissue and removed to expose the external acoustic meatus (arrow); (C) lateral bulla osteotomy. Note the honeycomb appearance of the bone in the alpaca bullae (arrow); (D) appearance of the completed lateral bulla osteotomy. The defect in the petrous temporal bone is visible (arrow); (E) postoperative appearance. The incision was closed with an intradermal suture pattern, and a Penrose drain was placed (arrow). The eye was enucleated because of a melting corneal ulcer. (Note the opaque appearance of the right cornea at the edge of the photograph).

Figure 4. Comparison of normal alpaca bullae (A) to normal canine bullae. (B) Transverse CT images, bone reconstruction algorithm, WW 2000/WL 300. Note the alpaca bulla is divided into a hollow dorsal compartment (black arrow) and a multicompartmental ventral compartment (white arrow).