In small animal practice, aural hematoma is a commonly diagnosed condition and is defined as hemorrhage occurring between the skin and cartilage of the concave portion of a pinna.1–3 The pressure from the accumulation of blood causes pain and irritation, triggering self-trauma and exacerbation of the injury. The exact pathogenesis of aural hematoma remains unclear,4 and theories include trauma, hypersensitivity diseases, ectoparasitism, increased capillary fragility (eg, associated with hyperadrenocorticism), and autoimmune diseases.5,6 In dogs with aural hematomas, there is often concurrent otitis externa, which is a pruritic, inflammatory condition affecting the external ear canal with multiple overlapping predisposing and perpetuating factors along with primary and secondary causes.7–9 For any affected animal, identification of the cause of the aural hematoma is important when working toward treatment and resolution and for the prevention of additional hematoma formation.

Aural hematomas in swine, sheep, and guinea pigs have also been reported.10–12 Anecdotally, aural hematomas are rare in horses, and there are no reports detailing the possible underlying causes, to the authors’ knowledge. The difference in incidence of aural hematoma between horses and small animal species may be related to the infrequency of primary otitis externa in horses.13 Pathological changes in the ear canal of horses occur secondary to otitis media or by extension of auditory tube diverticulum (guttural pouch) infection.14 Importantly, in horses, a unique sequela of otitis media is temporohyoid osteoarthropathy, which can result in fracture of the petrous temporal bone.15 Horses and small animal species with irritating ear conditions tend to self-traumatize differently; horses are unable to scratch the pinnae as readily as dogs or cats because horses lack claws. However, horses are able to rub the ears with their hind feet as well as against solid objects and can violently shake the head, all of which have the potential to damage small auricular vessels. Pinnal dermatitis has been described in horses and most commonly develops secondary to atopic dermatitis, fly bite trauma, insect bite hypersensitivity, solar dermatitis, or dermatophytosis.16 Less common causes of pinnal der-
matitis may include adverse food reaction, parasitic mange, vasculitis, and ectoparasitism.\textsuperscript{17} The primary cause of the pinna dermatitis and otitis directly influences the seasonality and frequency of disease onset, with some diseases occurring more commonly in warmer months (eg, atopic dermatitis, insect bite hypersensitivity, solar dermatitis, and fly bite trauma) and other diseases having a year-round distribution (eg, adverse food reaction). The inflammation and discomfort caused by these primary causes lead to pruritus-driven behaviors that cause trauma to the pinna vasculature and may potentially result in aural hematoma formation.

Treatments for aural hematomas in small animal species include surgical incision and suture;\textsuperscript{18,19} surgical incision without suture;\textsuperscript{20} incision with a CO\textsubscript{2} laser;\textsuperscript{21} indwelling drainage with\textsuperscript{22} or without\textsuperscript{23} intralesional corticosteroid administration, and needle drainage with corticosteroid administration.\textsuperscript{24,25} Often needle drainage with corticosteroid administration is sufficient to achieve resolution of the aural hematoma, and surgical options are reserved for cases of recurrence.\textsuperscript{3} Regardless of surgical technique, the prognosis for dogs and cats with aural hematomas is excellent if the primary cause of otic inflammation or discomfort is well managed.\textsuperscript{3} Anatomically, the equine pinna is similar to that of small animal species; the upright auricular cartilage is semicircular at the ear base and flattens out distally, covered on both sides by thin skin.\textsuperscript{26} The surgical techniques for aural hematoma management in small animal species all involve incision of the skin on the concave surface of the pinna to facilitate blood removal; commonly, this is followed by placement of full-thickness sutures through the pinna. Theoretically, any of the aforementioned techniques could be used in horses with aural hematomas. The purpose of the retrospective case series reported here was to characterize the clinical features, treatment, and outcome of aural hematomas in horses.

Materials and Methods

Case selection

The authors’ large animal teaching hospital’s medical records were searched for horses with a diagnosis of aural hematoma in 2008 through 2019. The search terms for the medical record system search included “ear,” “aural,” “hematoma,” “mass,” “blood,” “auditory,” and combinations thereof. Cases were included if a diagnosis of aural hematoma was confirmed by aspiration of blood from the identified aural lesion. Cases were excluded if no diagnostic testing was performed (eg, if a presumptive diagnosis was made on the basis of clinical signs).

Medical records review

Admission data collected included signalment, history, clinical signs, and physical examination findings (including presence or absence of other signs of dermatologic problems). Diagnostic procedures (when performed) were noted, and the relevant reports were collected (eg, reports of diagnostic imaging, cytologic evaluations, and otoscopic examinations). Treatment data, including surgical and medical information, were retrieved. Case outcome was determined from reports of subsequent visits noted in the medical record or via telephone communication with the owner or referring veterinarian.

Results

Horses

For the period of 2008 through 2019, the medical record search yielded information for 7 horses with aural hematomas. All cases were confirmed on the basis of diagnostic test results; thus, all cases were included in the study. Of the 7 horses, 4 were geldings and 3 were mares. The age of the affected horses ranged from 1 year to 28 years. The horses’ weights ranged from 98 to 494 kg (215.6 to 1,086.8 lb). There were 2 Haflingers, 2 Quarter Horses, 2 Tennessee Walking Horses, and 1 Miniature Horse included in the study.

History and clinical signs

For the 7 horses, the duration of clinical signs ranged from 2 days to 2 months. Three horses were presented to the hospital for treatment of aural hematoma after diagnosis by the referring veterinarian. Three horses were presented for treatment after the hematoma recurred following surgical treatment by the referring veterinarian. In 1 of those 3 cases, the referring veterinarian treated a right-sided aural hematoma by surgical incision and placement of a drain and referred the horse after it developed an additional left-sided aural hematoma. In the other 2 cases, the surgical treatment attempted was surgical incision. The remaining horse was evaluated at the hospital without referral by a primary veterinarian.

A history of dermatologic disease was reported for 5 of the 7 horses and included insect bite hypersensitivity (n = 3), seasonal atopic dermatitis (2), and previous aural cutaneous mass located on the concave surface of the pinna (1). In the latter case, the mass was removed 6 months prior to the development of the aural hematoma, and histologic analysis identified the mass as proliferative fibrotic granulation tissue with dermal necrosis. The cause of the inflammation and granulation tissue was not identified.

There were 5 horses with a right-sided aural hematoma, 1 horse with a left-sided aural hematoma, and 1 horse with aural hematomas present in both ears. All horses were sensitive to palpation of the affected ear and required sedation for aural examination. All affected ears were described as swollen, with additional signs of otitis externa (including presence of aural discharge, lichenification, erythema, scaling, crusting, and canal stenosis) in 4 of the 7 horses. Four of the horses had generalized pruritus and crusting along the mane and tail head; 1 of those horses also had excoriations across the flanks, distal aspects of the extremities, and nuchal crest.
Diagnostic test results
Ultrasonographic examination of the affected pinna was performed for 3 horses and revealed hypoechoic fluid surrounded by a thick capsule. No concurrent masses or foreign bodies were identified.

Three horses underwent otoscopic examination of 1 or both ear canals with a 5.9-mm flexible video
endoscope. All horses had a moderate amount of ceruminous debris within the external ear canal. Two horses had moderate or severe stenosis of the external ear canal.

For 3 horses, swab samples from both ear canals were submitted for cytologic analysis. Neutrophilic exudate from the affected ear with evidence of rod- and cocci-shaped bacteria and Malassezia yeast were noted for 2 horses. For 1 horse, the cytologic evaluation findings were unremarkable.

The concave surface of the affected pinna of 1 horse was biopsied with a 5-mm-diameter biopsy punch, and specimens were submitted for histologic examination. Marked, chronic-active, focal, necrosuppurative dermatitis with granulation tissue and fibrosis was identified. There was fistulous tract formation, epidermal ulceration, acanthosis, and hyperkeratosis, and rare cocci were seen throughout the superficial epidermis.

In all 7 cases, drainage (considered a part of treatment) of the suspected aural hematoma yielded sanguineous fluid, which confirmed the diagnosis. One horse with atopic dermatitis underwent intradermal allergy testing against 70 allergens specific to the southeastern United States and reacted positively to numerous environmental allergens.

**Treatment and outcome**

For all 7 horses, treatment was facilitated by sedation and local anesthesia either by performance of great auricular nerve and internal auricular nerve blocks or by a ring block around the base of the affected pinna. There were 8 treated aural hematomas. Treatment involved surgical incision of the hematoma with placement of compressive sutures across the ear surface (6/8 ears) or needle aspiration of the hematoma alone (2/8 ears). Immediately after hematoma needle aspiration in 1 ear, an intralesional injection of 125 mg of amikacin and 40 mg of methylprednisolone was administered; for this horse, hematoma aspiration and intralesional injection were performed twice (7 days apart) during the same hospital stay. For the 6 ears treated with surgical incision with placement of compressive sutures, a surgical technique involving nonabsorbable suture material (2-0 nylon) applied in a simple interrupted pattern with stenting (sterilized buttons) was used (Figure 1). In those instances, buttons were placed on both sides of the ear and distributed as evenly as possible in an attempt to maximize the compressive effect. In 5 of the 6 cases, 1 or 2 incisions were made with a No. 10 scalpel blade and were described as an S-shaped incision (n = 1), 2 parallel linear incisions (1), or a stab incision at the most dependent portion of the hematoma (3). In the remaining horse, a 20-mm-long incision was made with a CO₂ laser¹ at the most dependent portion of the hematoma, followed by several full-thickness holes made with the laser throughout the portion of the auricular cartilage spanned by the hematoma.

Of the 7 horses, 5 received trimethoprim-sulfamethoxazole (30 mg/kg [13.6 mg/lb], PO, q 12 h) for 10 to 14 days. Six of the 7 horses were treated with anti-inflammatory drugs, including phenylbutazone (1 g, PO, q 12 to 24 h) in 4 horses, flunixin meglumine (1.1 mg/kg [0.5 mg/lb], PO, q 24 h) in 2 horses, and a tapering course of dexamethasone (5 to 20 mg, PO, q 24 h) in 1 horse. The horse that received dexamethasone also received phenylbutazone. Three of the horses were treated with flushing of the aural lesion with 0.15% ketoconazole, an aqueous flush (Tris-EDTA), an otic flush (2 horses), or dilute povidone-iodine solution (1 horse). One horse was administered a course of allergen-specific immunotherapy injections. There was 1 horse that received hydroxyzine (1 mg/kg [0.45 mg/lb], PO, q 12 h).

Follow-up information was available for 6 of the 7 horses. Three horses were reevaluated at the large animal teaching hospital; follow-up information was provided during a telephone call with the owner for 2 horses and with the referring veterinarian for 1 horse. Time of follow-up (either at the hospital or by telephone) ranged from 3 weeks to 7 years. In all 6 cases, lichenification of the affected pinna was evident, and in 4 horses, the treated pinna was drooped rostrally over the concave aspect (Figure 1). Two horses reportedly had recurrence of the aural hematoma, 1 of which also developed a hematoma of the contralateral pinna. The owner of this horse reported that the horse’s pasture mate also developed an aural hematoma approximately 6 months after the original horse was treated. One horse required a repeated surgical incision and compression procedure 2 weeks after the first aural hematoma treatment. The horse treated with CO₂ laser incision had hematoma recurrence at 1 month after the procedure and was treated medically with an orally administered corticosteroid.

**Discussion**

To the authors’ knowledge, this was the first report detailing the treatment and long-term outcome of aural hematomas in horses. For 3 horses in this retrospective case series, the treated pinna was lichenified and drooped rostrally at both the short-term (3 weeks) and long-term (7 years) follow-up time points. This case series highlighted the importance of advising owners that a permanent change in appearance of the affected ear, despite appropriate treatment, is likely.

At presentation, most of the horses had signs of generalized pruritus and a history of skin disease. The most common diagnosis was insect bite hypersensitivity. Insect bite hypersensitivity is a seasonal dermatitis caused by an immunoglobulin E–mediated allergic reaction (type 1 hypersensitivity) to the bites of midges (Culicoides sp), black flies (Simulium sp), or other insects.²⁸ Affected horses are often intensely pruritic and self-traumatize the mane, caudal aspect of the base of the neck (ie, withers), dorsum, base of the tail, and ventral midline as well as the face and the ears, resulting in hair loss, local effusion, hemorrhage, and secondary infection.²⁹
trauma secondary to pruritic skin disease is proposed as a primary inciting factor for the development of aural hematomas. Persistent scratching of the pinnae and head shaking are thought to cause separation of the skin of the concave surface of the pinna from the auricular cartilage, thereby triggering vessel rupture and hemorrhage into the cavity. Although horses cannot scratch at their pinnae in the same way as dogs can, self-induced excoriations and trauma are common in horses, suggesting that aural hematomas in this species could develop by means of a similar traumatic mechanism.

In the present study, 3 horses with aural hematomas did not have signs of generalized pruritus or a history of allergic skin disease. In a study of 10 dogs with aural hematomas, immunohistopathologic evidence of a hypersensitivity reaction in auricular tissue samples was identified, even in some dogs that did not have skin disease or pruritus. Erosion of the auricular cartilage was identified in 14 of 15 affected ears, and immunohistochemical analysis revealed epidermal immunoglobulin deposition in 8 of 15 affected ears in that study. The authors postulated that those findings indicated the possibility of an early cartilage-targeted immunologic cause of aural hematomas that did not evolve to allergic skin disease or induce self-trauma. Because no immunohistochmical analyses were performed in the present study, it is unknown whether this theory could explain why 3 nonpruritic horses in the present case series developed aural hematomas.

All 7 horses of the present study were evaluated because of auricular swelling. Four horses had additional signs of otitis externa, such as the presence of otic exudate and erythema and lichenification of the auricular tissues. Otitis externa is rare in horses, and it has been postulated that the upright conformation of the equine ear in combination with the lack of ceruminous glands in the osseous part of the ear canal results in a relatively sterile environment. Dogs with aural hematomas often have concurrent otitis externa. It may be that the horses in the present case series had preexisting otitis externa and then self-traumatized the ear and caused the hematoma. Additionally, 4 horses had a prior diagnosis of allergic skin disease, which is one of the most common primary causes of otitis externa in dogs. It is also possible that the hematomas developed through a different mechanism (such as part of a hypersensitivity-like syndrome) and that the otitis externa was secondary to obstruction of the ear canal lumen or attributable to extensive inflammation of the external ear canal. For example, 1 horse had right-sided copious otic exudate that may have been the result of secondary infection of the hematoma, given that this horse did not have generalized signs of skin disease. A limitation of this retrospective study was the inability to definitely identify the primary cause of hematoma formation in each horse.

In the study of the present report, 3 horses were evaluated because of recurrence of the hematoma following needle drainage performed by the referring veterinarian. According to a 2016 survey of the treatment methods used for dogs with aural hematomas, most veterinarians elect to first perform needle drainage, with or without intracartilaginous corticosteroid administration. In that report, surgery (defined as an incision along the central aspect of the affected pinna) was elected most commonly in cases of recurrence. In the present study, 1 horse was treated with needle drainage and intracartilaginous corticosteroid injections, and the hematoma resolved. Most of the horses in this case series were referred for treatment with an expectation from the referring veterinarian that surgery would be performed. Hence, there was probably a degree of bias within the sample studied. It may be that simple needle drainage, without surgical incision, is sufficient as the first treatment technique for equine hematomas. Additionally, needle drainage often provides an instant diagnosis. Additional diagnostic techniques, such as those described in the present report, should be used to identify possible underlying causes in cases of hematoma recurrence. For example, otoscopy of the ear canal and ultrasonographic examination of the pinna can facilitate foreign body identification, and cytologic and histologic examination of macroscopically abnormal tissue can help identify underlying infectious or neoplastic causes.

The treatment techniques used in the present study were directly extrapolated from small animal medicine and included surgical incision and suture placement. Incision with a CO₂ laser and needle drainage with intracartilaginous corticosteroid deposition. Ears that were treated with surgical incision and suture placement had compression applied to the pinna through the use of sterilized buttons placed on both sides of the ear and secured with sutures in a simple interrupted pattern. Buttons were distributed across the pinna as evenly as possible to try to maximize the compressive effect, but this technique is limited by the size of the available buttons. Compression is needed to prevent hematoma recurrence and potentially improve cosmesis. Further prospective research to develop new techniques that adhere to this principle is warranted.

In the present study, follow-up information was available for 6 of the 7 horses, and findings were similar; the affected pinnae were lichenified and most had drooped. Recurrence was reported for 2 horses; 1 horse treated surgically required additional pinnal drainage and compression at 2 weeks after the procedure, and the horse treated with CO₂ laser incision had hematoma recurrence at 1 month after the procedure and was treated medically with an orally administered corticosteroid. In the aforementioned survey, the success of initial treatment of canine aural hematomas with surgery with regard to preventing recurrence was considered excellent or good in 90% of 74 cases, whereas the success of initial treatment of canine aural hematomas with needle drainage and corticosteroid deposition was considered excellent or good in 59% of 109 cases. In a canine case series of 109 cases.
10 pinnae (8 dogs) with hematomas that were treated with CO₂ laser incision, 2 ears required additional procedures for resolution. The rate of aural hematoma recurrence in the present study was similar to that reported for small animals.

In addition to the surgical techniques described in the present report, horses were treated with antimicrobials, anti-inflammatory drugs, and medications to manage allergies. Horses were provided antimicrobials and anti-inflammatory drugs for treatment of the associated otitis externa, protection of the open surgery site from infection, and alleviation of pain. Although surgical drainage is an important component of aural hematoma treatment, adequately addressing any underlying medical issues, such as allergic skin disease or chronic inflammation, is also imperative.

For 6 of the 7 horses in the present case series, there was a noticeable cosmetic change to the treated pinna, and 4 horses had permanent drooping of the pinna. In small animal medicine, prompt treatment of aural hematomas generally results in favorable cosmetic outcomes. Pinnal drooping occurs when the fibrotic tissue on the concave surface of the pinna contracts. In dogs, this can be avoided by rapid correction of the hematoma prior to fibrotic clot formation. Most of the horses in the present case series were presented for evaluation > 1 week after the onset of clinical signs, which may have contributed to the poor cosmetic outcomes. Additionally, the treatment of these horses may have been limited by the difficulties associated with compressive bandaging of equine pinnae. Compressive bandaging is a key principle of aural hematoma treatment in small animal species, but such bandaging is notoriously difficult to apply in horses. In a case report of a horse with pinnal curling secondary to a previous wound, surgical correction with fibrotic tissue resection, tension-relieving incisions, and skin grafting was undertaken. In that report, thermoplastic material was contoured to the concave surface of the pinna and sutured into position to support healing of the pinna in the corrected shape. The horse had an excellent cosmetic outcome with retention of the normal upright shape of the pinna. This splinting technique is similar to the small animal technique of suturing radiographic film to the concave aspect of the pinna to form a so-called aural hematoma pad, and either of these splinting techniques may be worth consideration in the treatment of equine aural hematoma, especially in cases where an excellent cosmetic outcome is required for the horse’s career.

Finally, all the horses in the present case series were treated in a standing procedure, whereas small animal species are frequently anesthetized and positioned in lateral recumbency to enable complete drainage of the hematoma and, when applying compressive sutures, accurate suture placement.

Aural hematomas in horses are a rare condition with an unknown pathogenesis. Treatment options can be successfully translated from small animal medicine; however, the ideal treatment for horses with aural hematomas is currently unknown and merits further investigation. Owners should be warned that a permanent change to the appearance of the treated pinna is likely but techniques that provide support to the healing pinna may improve cosmetic outcome.

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**Footnotes**

a. Aplio i700 TUS-A700 7MHz microconvex probe, Canon Medical Systems USA Inc, Calif.
b. Eluxeo 700 series 5.9-mm slimline gastroscope, Fuji Medical Systems USA Inc, Wayne, NJ.c. AE-3020-M vet scalpel, Aesculight LLC, Bothell, Wash.

**References**


