Unilateral choristoma of the nictitating membrane in a horse

Kara R. Gornik, DVM; Christopher G. Pirie, DVM; Gillian L. Beamer, VMD, PhD

**Case Description**—A 2-year-old Morgan mare was evaluated because of a corneal ulceration.

**Clinical Findings**—An irregular, deep stromal corneal ulcer in an area of malacia was noted in the left eye. Hypopyon was present in the ventral portion of the anterior chamber with moderate aqueous flare. The nictitating membrane of the left eye had hairs originating from its leading edge that contacted the corneal surface.

**Treatment and Outcome**—General anesthesia was induced, and a bulbar pedicle conjunctival graft was performed. The conjunctiva at the leading edge of the nictitating membrane, including the aberrant hair follicles, was excised. Microscopically, a nonkeratinized stratified squamous epithelium, sebaceous glands, and hair shafts were present, confirming a choristoma of pilosebaceous origin at the leading edge of the nictitating membrane. Six weeks after surgery, the horse had no signs of discomfort, with no regrowth of the hairs; no loss of vision was evident.

**Clinical Relevance**—Ocular choristomas develop secondary to defective fetal cellular differentiation and are rarely reported in the equine literature. The choristoma in this horse contained ectopic hair follicles with hair growth as well as sebaceous glands. This finding emphasizes the importance of a thorough adnexal examination in horses with corneal disease. (J Am Vet Med Assoc 2015;246:231–235)
Aerobic bacterial culture results consisted of 1+ growth (scale, 1+ to 4+) of *Streptococcus zooepidemicus*, which was susceptible to all antimicrobials tested. Fungal culture yielded 1+ growth of *Candida* spp. Cytologic findings were consistent with severe neutrophilic inflammation. Degenerate and nondegenerate neutrophils were present, along with epithelial cells. No fungal organisms or intracellular bacteria were detected cytologically. The CBC results were within respective reference ranges. Serum biochemical abnormalities included low concentrations of magnesium (1.4 mEq/L; reference range, 1.8 to 3.0 mEq/L), total protein (3.7 g/dL; reference range, 5.6 to 7.0 g/dL), albumin (2.2 g/dL; reference range, 2.4 to 4.0 g/dL), and globulin (1.5 g/dL; reference range, 2.5 to 4.9 g/dL). Prothrombin time (10.4 seconds; reference range, 10.9 to 14.5 seconds) and activated partial thromboplastin time (50.2 seconds; reference range, 54.7 to 69.9 seconds) were both low, indicating more rapid clot formation times. A fast localized abdominal sonography evaluation was performed because of low serum protein concentrations and a history of reduced manure production. The horse had moderate thickening of the right dorsal colon, consistent with mild right dorsal colitis.

The horse was hospitalized for stabilization overnight. Treatments included topical application of autogenous serum (0.2 mL, q 2 h) and ophthalmic preparations of ofloxacin<sup>h</sup> (0.2 mL, q 4 h), 3.3% cefazolin<sup>b</sup> (0.2 mL, q 4 h), 1% voriconazole<sup>e</sup> (0.2 mL, q 6 h), and atropine<sup>f</sup> (0.2 mL, q 12 h) via the subpalpebral lavage catheter. Systemic treatment with flunixin meglumine<sup>i</sup> (1 mg/kg, IV, q 12 h), sulfamethoxazole-trimethoprim<sup>i</sup> (30 mg/kg [13.6 mg/lb], PO, q 12 h), fluconazole<sup>e</sup> (14 mg/kg [6.4 mg/lb], PO, once), omeprazole<sup>j</sup> (4.6 mg/kg [2.1 mg/lb], PO, q 24 h), misoprostol<sup>m</sup> (1 µg/kg, PO, q 12 h), ranitidine<sup>n</sup> (6.6 mg/kg [3 mg/lb], PO, q 8 h), and sucralfate<sup>o</sup> (22 g/kg [10 g/lb], PO, q 6 h) was initiated. Water was also administered frequently via a nasogastric tube.

The following day, the serum total protein concentration was considered to be stable at a value of 4.0 g/dL. General anesthesia was induced. An auriculopalpebral nerve block, supraorbital nerve block, and retrobulbar block were performed with 2% lidocaine hydrochloride.<sup>g</sup> The cornea was debrided, and the malacic tissue was removed and submitted for histologic evaluation. A bulbar pedicle conjunctival graft was harvested from the dorsomedial conjunctiva and sutured over the ulcerated region of the cornea with 8-0 polyglactin 910<sup>p</sup> in a simple interrupted pattern.

The conjunctiva on the leading edge of the nictitating membrane, including associated hair follicles, was excised (Figure 2). Care was taken to avoid damage to the underlying cartilage of the nictitating membrane. Hemorrhage was controlled with cellulose sponges<sup>s</sup> and 2.5% phenylephrine solution.<sup>t</sup> The resultant wound was left to heal by second intention. The excised conjunctival tissue containing the hairs was submitted for histologic examination.

Anesthetic recovery was uneventful, and the horse remained hospitalized for 7 days following surgery. The PCV and circulating total solids concentration were evaluated daily. Continued treatment included topical administration of autogenous serum (0.2 mL, q 6 h), ofloxacin (0.2 mL, q 6 h), cefazolin (0.2 mL, q 6 h), 1% voriconazole (0.2 mL, q 6 h), and atropine (0.2 mL, q 12 h) via
the subpalpebral lavage catheter. Systemic administration of flunixin meglumine, sulfamethoxazole-trimethoprim, omeprazole, misoprostol, ranitidine, and sucralfate was continued at the previously described dosages, and the fluconazole dosage was reduced (5 mg/kg [2.3 mg/lb], PO, q 24 h). Flunixin meglumine administration was discontinued 5 days after admission, and administration of firocoxib (0.2 mg/kg [0.09 mg/lb], PO, q 24 h for 2 days, then 0.1 mg/kg [0.04 mg/lb], PO, q 24 h) was initiated because of sustained low serum total protein concentration (4.8 g/dL) as well as increased serum creatinine concentration (from 1.8 mg/dL [reference range, 0.9 to 1.9 mg/dL] on admission to 2.2 mg/dL 5 days after admission).

Results of the histologic examination of the corneal biopsy sample were consistent with the cytologic findings and consisted of stromal infiltration by neutrophils, lymphocytes, plasma cells, and macrophages. No bacterial or fungal organisms were observed with H&E stain or with Gomori methenamine silver stain. Histologically, the leading edge of the nictitating membrane contained a noncornified stratified squamous epithelium, sebaceous glandular tissue, follicular epithelium, and hair shafts (Figure 3).

Ophthalmic examination 7 days after surgery indicated that the graft was well vascularized with focal areas of bruising (Figure 4). The surrounding cornea remained mildly edematous. The pupil was fully dilated, and the intraocular inflammation largely resolved. The total protein concentration remained moderately low at 5.0 g/dL. The serum creatinine concentration returned to a normal value of 1.4 mg/dL. The horse was discharged from the hospital, and the owner was given instructions to administer autogenous serum, ofloxacin, cefazolin, 1% voriconazole, and atropine topically via the subpalpebral lavage catheter at the same dosages used after surgery. Systemic administration of firocoxib (0.1 mg/kg, PO, q 24 h) omeprazole (dose reduced to 1.15 mg/kg [0.5 mg/lb], PO, q 24 h), fluconazole, misoprostol, and sucralfate (at previously described dosages) was continued. Systemically administered antimicrobials were changed from sulfamethoxazole-trimethoprim to minocycline (4.0 mg/kg [1.8 mg/lb], PO, q 12 h) owing to its anticollagenolytic and anti-inflammatory properties.

Follow-up conversations with the referring veterinarian 6 weeks after discharge confirmed that the horse had no detectable visual defects and had no signs of discomfort in the left eye. The graft was not trimmed because of its medial location and presence outside of the visual field. No regrowth of hairs was noted on the leading edge of the nictitating membrane.

**Discussion**

The nictitating membrane or third eyelid is a structure that normally lies in the ventromedial conjunctival sac, between the lacrimal caruncle and the globe. The nictitating membrane is covered by conjunctiva on its bulbar and palpebral surfaces and is supported by a T-shaped fragment of hyaline cartilage. The nictitating membrane contains a lacrimal gland, which contributes
substantially to the aqueous portion of the tear film. The primary function of the nictitating membrane is to provide added protection to the globe, sweeping across the cornea in a dorsolateral direction when the eye is passively retracted into the orbit. Histologically, a normal nictitating membrane is covered by a nonkeratinized stratified squamous epithelium with interspersed goblet cells on the bulbar and palpebral surfaces. The bulbar aspect also contains lymphoid tissue and deep glandular tissue, which adjoins the T-shaped cartilage.

A choristoma is an accumulation of microscopically normal tissue located at an aberrant site resulting from abnormal cellular differentiation during fetal development. The most commonly recognized type of choristoma involving ocular tissue is a dermoid, which results from the abnormal proliferation of elements of skin and dermis and is composed of a cornified epithelium variably including hair, blood vessels, fibrous tissue, nerves, glands, smooth muscle, and cartilage components. Dermoids are most frequently located at the temporal limbus but may involve the conjunctiva, nictitating membrane, eyelid margin (termed hamartoma), limbus, or cornea, alone or in various combinations. Dermoids develop secondary to defective induction or differentiation of the surface ectoderm and are rare in horses. In a recent report, Greenberg et al reported a lesion in a mature gelding that was similar in clinical appearance to that in the Morgan horse of this report and was located at the leading edge of the nictitating membrane. That lesion contributed to the formation of recurrent superficial corneal ulcerations. A previous clinical report has also described bilateral ocular choristomas affecting the dorsal limbus and sclera in a colt.

Histologically, dermoids typically contain a keratinized, variably pigmented, stratified squamous epithelium. They also include the regular presence of hair follicles, blood vessels, glandular tissue (sebaceous and sweat glands), adipose tissue, fibrous tissue, and nerves. On rare occasions, cartilage and bone can be identified among the contents of a dermoid. Generally, the edges of ocular dermoids are indistinct and merge with the neighboring corneal and conjunctival epithelium and stroma. Clinically, the choristoma reported in the horse of this report appeared to lack the typical skinlike appearance routinely associated with a dermoid. A lack of keratinized stratified squamous epithelium was confirmed histologically. Rather, in this mare, the nictitating membrane was observed to contain several ectopic hairs that emerged from the leading edge of the nictitating membrane along with associated sebaceous glandular tissue, making the clinical and histologic diagnoses less consistent with a true dermoid.

Other examples of choristomas affecting the ocular surface involve abnormal or misdirected hair growth that can lead to subsequent corneal and conjunctival irritation. These include distichiasis and ectopic cilia, both of which are rare in equine species. To the authors’ knowledge, distichiasis has only been reported once, and there have been 2 reports of ectopic cilia in horses. The first describes 1 horse with recurrent corneal ulcerations secondary to an aberrant eyelash located in the upper eyelids palpebral conjunctiva. The other report was a case series of 7 horses with blepharospasm, ocular discharge, and keratitis secondary to the presence of ectopic cilia in the palpebral conjunctiva of the upper eyelid. The presence of the hair follicles arising from the leading edge of the nictitating membrane rather than the meibomian glands or the palpebral conjunctiva underneath the eyelid rules out the diagnoses of distichiasis or ectopic cilia in the horse of the present report.

Ocular choristomas containing hair follicles may produce hairs that emanate from the surface and subsequently contact local ocular tissues. Irritation caused by these hairs can culminate in conjunctival and corneal inflammation, with secondary epiphora and corneal changes, including keratitis and corneal ulceration. Surgical removal of the abnormal tissue is recommended when aberrant hairs, if present, result in corneal or conjunctival irritation and pathological changes or, in cases of dermoids, if the lesion is large enough to obstruct vision. In this report, the aberrant hairs were observed to directly contact the cornea following movement of the nictitating membrane. It is possible these hairs caused the initial corneal ulceration, and it was considered likely that they contributed to its persistence and severity. Surgical removal of the hairs and underlying follicles, in conjunction with a bulbar pedicle conjunctival graft, was sufficient to repair the corneal ulceration and resolve the source of continued irritation.

Because choristomas result from abnormal tissue differentiation early in fetal development, they can often occur in conjunction with other ocular abnormalities. Baumgartner et al described a case in a Thoroughbred affected with bilateral corneal dermoids accompanied by multiple concurrent ophthalmic abnormalities, including microphthalmia, severe anterior segment dysgenesis, aphakia, retinal dysplasia, and optic nerve hypoplasia. Additionally, Joyce et al described a Quarter Horse sire and 4 offspring noted to have aniridia or severe iridial hypoplasia, limbal dermoids, as well as anterior and posterior nuclear cataracts. Although minor and considered to be an incidental finding, fundoscopically, the mare of this report had a well-demarcated area of decreased pigmentation in the nontapetal fundus, consistent with a coloboma of the retinal pigmented epithelium and choroid in the right eye.

Posterior segment coloboma locations can be categorized into typical and atypical colobomas. Typical colobomas are infrequently found in the retinas of horses and develop secondary to incomplete closure of the optic fissure during embryogenesis. Typical colobomas are located along a plane running vertically from the optic disc into the ventral region of the nontapetal fundus. Atypical colobomas are seen more frequently but are still relatively uncommon; these develop outside the plane of the optic fissure and are generally found within the nontapetal fundus, lateral or medial to the optic disc. Colobomas in the equine fundus can affect the tapetum, tapetum with the underlying retinal pigmented epithelium, retinal pigmented epithelium and underlying choroid, blood vessels, or optic papilla. The coloboma in the horse of the present report can be classified as typical, given that it was located ventral to the optic disc along a plane in the vertical meridian. The appearance of the coloboma indicated involvement of the retinal pigmented epithelium along with the cho-
roid, exposing a small portion of the sclera. Histologic examination would be required to determine the full extent of retinal and choroidal involvement of the coloboma. In the mare of this report, a posterior segment coloboma occurred concurrently with the choristoma of the nictitating membrane. The finding of a choristoma that likely contributed to severe corneal ulceration highlights the importance of a thorough assessment of the adnexa in horses with corneal ulcerations.

a. Neomycin-Polymyxin-Dexamethasone Ophthalmic Ointment, Falcon Pharmaceuticals Ltd, Fort Worth, Tex.

b. Atropine Ophthalmic Ointment, Bausch & Lomb, Tampa, Fla.
c. Banamine Paste, Merck, Whitehouse Station, NJ.
d. Ofloxacin Ophthalmic Solution, Akorn Inc, Lake Forest, Ill.
e. Voriconazole, Amerinet Inc, New York, NY.
f. Atropine Ophthalmic Solution, Bausch & Lomb, Tampa, Fla.
g. Lidocaine Hydrochloride, Hospira Inc, Lake Forest, Ill.
h. Cefazolin, Hospira Inc, Lake Forest, Ill.
i. SMZ-TMP, Amneal Pharmaceuticals, Hauppage, NY.
j. Minocycline, Teva Pharmaceuticals, Sellersville, Pa.
k. Lipocaine, Hospira Inc, Lake Forest, Ill.
l. Neo-Surgical Ophthalmic Adjuvant, Bausch & Lomb, Tampa, Fla.
m. Neo-Surgical Ophthalmic Adjuvant, Bausch & Lomb, Tampa, Fla.

References