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CASE REPORT

Diode laser photoablation to correct distal nasolacrimal duct atresia in an adult horse

Riccardo Stoppini,* Stefano Tassan† and Laura Barachetti‡

**Equine Ophthalmology Practitioner, Brescia, Italy; †Equine Practitioner, Milan, Italy; and ‡Department of Veterinary Science and Public Health, University of Milan, Milan, Italy*

Address communications to:
R. Stoppini
Tel.: 0039-335-6815081
Fax: 0039-030-601475
e-mail: stopric@tin.it

Abstract

Case description An 8-year-old Hanoverian mare was presented for chronic mucopurulent discharge in the left eye, which was responsive to topical antibiotic therapy.
Clinical findings The nasolacrimal orifice was absent in the left nasal meatum, and anterograde irrigation of left nasolacrimal duct was not possible. Dacryocystorhinography was performed and revealed about 4-6 cm of distal nasolacrimal duct atresia.
Surgical treatment and outcome A novel technique was attempted with the horse under standing sedation using an urinary catheter and a 980 nm diode laser with a 600 μm diameter flexible bare quartz fiber. A nasolacrimal orifice was successfully created by ablating the nasal mucosa directly over the tip of the urinary catheter, and patency was maintained with a soft catheter sutured in place for 4 weeks. At 3 months re-evaluation, the left nasolacrimal duct was patent and functional.
Conclusion This case report describes a successful novel surgical technique used to correct congenital distal nasolacrimal duct atresia in an adult horse under standing sedation. Advantages over conventional surgical techniques are shorter operating time and limited hemorrhage.

Key Words: Dacryocystitis, dacryocystorhinography, diode laser photoablation, horse, nasolacrimal duct atresia, nasolacrimal orifice

INTRODUCTION

The excretory portion of the nasolacrimal system is the normal route for drainage of tears. It begins at the level of the palpebral lacrimal puncta, located just inside the mucocutaneous junction of the eyelid margin, 8–9 mm temporal from the medial canthus.[1,2] Two small canaliculi develop from these palpebral puncta and join in the nasolacrimal sac, which is a small dilatation of the nasolacrimal duct adjacent to the lacrimal bone. The nasolacrimal duct (NLD) continues distally, 7–8 cm within the osseous lacrimal canal of the lacrimal and maxillary bones, and then, it courses in the submucosa along the nasal wall of the lateral aspect of the middle meatum. Finally, it dips ventrally at its entrance into the ventral or basal fold, where it is pressed by a flat extension of the sigmoid or medial accessory cartilage, then curves laterally over the nasal process of the incisive bone and exits on the floor of the vestibule at the mucocutaneous junction with the nasolacrimal orifice.

Atresia of the nasolacrimal orifice is the most frequently reported congenital anomaly of the NLD in the horse.[3,4] Typical clinical signs associated with this congenital defect include chronic epiphora, mucopurulent ocular discharge, and secondary dacryocystitis and appear typically in 3- to 6-month-old foals.[1–3] Contrast radiography (e.g., dacryocystorhinography [DCR]) is useful in identifying the congenital defect and to determine the type of surgical correction required. If imperforate nasolacrimal orifice is the only anomaly present, manifested as a mucosal membrane covering the orifice, surgery may be performed using standing sedation. If distal segment NLD atresia is present, general anesthesia is likely required for surgical correction. Surgical correction of an imperforate nasolacrimal orifice or distal NLD atresia may result in profuse hemorrhage.[1,3,5–8]

CASE REPORT

History

An 8-year-old Hanoverian mare was referred for an ophthalmic consultation due to a chronic mucopurulent ocular discharge at the left eye (OS). The mare was purchased by the new owner 5 months prior to presentation. During this period, the unilateral chronic mucopurulent discharge improved with topical antibiotic therapy, but recurred when topical therapy was discontinued.

Initial ophthalmic examination and diagnostic exams

A complete ophthalmic examination, performed using direct and indirect ophthalmoscopy, slit-lamp biomicroscopy, and applanation tonometry, was within normal limits in both eyes (OU), except for the presence of mucopurulent discharge emanating from the inferior lacrimal palpebral puncta OS. Fluorescein staining of the cornea was negative OU, and passage of fluorescein dye (Jones test I) was present within 5 min in right nostril but not in the left one. Upon inspection of the floor of the nasal vestibules, at the level of the mucocutaneous junction, the nasolacrimal orifice was present in the right nostril, but was absent in the left nostril (Fig. 1–2). Bacterial culture and cytology of the mucopurulent discharge were not performed at this time. The horse was sedated with intravenous detomidine 0.01 mg/kg (Domosedan®; Janssen Cilag SpA, Orion Corporation, Espoo, Finland), an auriculopalpebral nerve block was performed with 2.5 mL of lidocaine 2% (Lidocaina 2%; Pfizer Olot S.L.U., Girona, Spain), and corneal topical anesthesia was achieved with instillation of 0.3–0.5 mL of oxybuprocaine HCl (Benoxinato Cloridrato®; Alfa Intes, Casoria, NA, Italy). A 56 cm long and 1.2 mm wide urinary catheter (Sovereign Polypropylene Catheter 3 ½ French size; TM Covidien Hanimal Health, Mansfield, MA, USA) was introduced into the inferior palpebral puncta, and the nasolacrimal duct was irrigated with 20 mL of physiologic saline solution to remove the mucopurulent discharge. No fluid passage was present in the nostril, and the mucopurulent material exited through the superior nasolacrimal puncta. Furthermore, the tip of the urinary catheter could not be palpated in the nasal vestibule through the nasal mucosa. Six to 10 mL of iodate contrast medium (Omnipaque™ 300; GE Healthcare Ireland, Cork, Ireland) was then injected through the urinary catheter, and gentle manual pressure was applied to the superior palpebral puncta until reflux of contrast medium was present. At this time, a lateral DCR was obtained with a portable digital radiology system (Cuattro DR Equine; Cuattro Veterinary USA, Loveland, CO 80538 USA).[2,3] Approximately 4–6 centimeters of atresia of the distal NLD portion and a reduced NLD dilation in proximity of the alar cartilage (Fig. 3) was visible in the DCR.

Surgical procedure and outcome

Six weeks following the first examination, the horse was moved in a Private Equine Clinic, and surgical correction of the left NLD defect was planned. A novel technique was attempted with the horse under standing sedation. The horse was placed in stocks and premedicated with acepromazine M. 0.03 mg/kg IV (Prequillan; FATRO S.p.A, Ozzano Emilia, BO, Italy). Local nerve blocks were performed, including auriculopalpebral nerve block with 2.5 mL of lidocaine 2% (Lidocaina 2%, Pfizer Olot S.L.U.) and ultrasound guided infraorbital nerve block with 8.0 mL of mepivacaine 2% (Mepivacaina Cloridrato 2%; Galenica Senese s.r.l., Monteroni d'Arbia, SI, Italy) injected directly around the infraorbital foramen.[9] This block results in desensitization of the skin around the muzzle and the nostrils, and it should be used when surgical procedures and manipulation are required in the distal nostril segment in standing sedated horses. Corneal topical anesthesia was achieved with topical 0.5 mL of oxybuprocaine HCl (Benoxinato Cloridrato®; Alfa Intes). Sedation was increased with 0.01 mg/kg IV detomidine HCl (Domosedan®; Janssen Cilag SpA) and butorphanol tartrate 0.02 mg/kg (Dolorex®; Intervet International B.V., Boxmeer, Netherlands). A polypropylene male urinary catheter 56 cm long and 1.7 mm wide (Sovereign Polypropylene Catheter 5 French size, TM Covidien Hanimal Health) with the distal end manually trimmed

Figure 1. Nasolacrimal orifice is clearly visible in the right nostril.

Figure 2. Nasolacrimal orifice is absent in the left nostril.

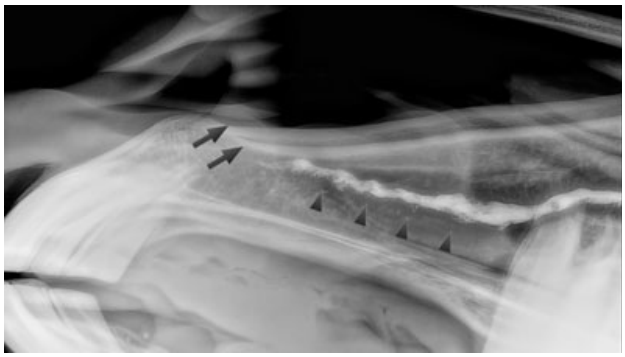

Figure 3. DCR image shows the atresia of the distal nasolacrimal duct (NLD) (arrow) portion and a reduced NLD dilation in proximity of the alar cartilage (arrowheads).

and rounded was inserted in the inferior palpebral puncta and advanced until it reached the end of the NLD. A 980 nm diode laser with a 600 μm flexible bare quartz fiber (GAP Laser & Photonics, Sesto Calende, VA, Italy) was used in the surgical procedure. The flexible laser fiber was introduced in the urinary catheter (Fig. 4) and advanced until resistance of the fiber tip by the soft tissues was perceived by the surgeon. The movement of the end of the catheter, with the laser fiber inserted, could be digitally palpated through the nasal mucosa, proximally to the cartilaginous extension of the sigmoid cartilage, where normally the NLD presents a spiraling course through the basal fold. Then, with the laser power set at 18 W in continuous mode, both the catheter and the laser fiber were gently advanced until no tissue resistance was present. A total time of 3–5 s was required to create a nasolacrimal orifice with minimal hemorrhage (Fig. 5). The catheter was then replaced with a 1.1 mm Ø silicone feeding tube (Eruplast® feeding tube; LTDA, Rush, Uruguay) that was sutured and left in place for 4 weeks (Fig. 6). A protective mask was also used to prevent self-trauma during this time (R/Hood-Airlite Mesh/Cup; Zilco International, Sydney, NSW, Australia). Postsurgical therapy included 4.4 mg/kg PO q 24 h phenylbutazone (Bute®; ACME S.r.l., Cavriago, RE, Italy) for 2 days and topical tobramycin drops q 6 h (Tobral®; Alcon Italia SpA, Milan, Italy) OS for 2 weeks. Tobramycin–dexamethasone (Tobradex®, Alcon Italia SpA) ophthalmic solution was administered q 8 h OS 1 week before removing the silicone feeding tube to reduce possible NLD inflammation and prevent nasolacrimal orifice closure. At the 3 month follow-up examination, the OS was within normal limits, with no ocular discharge and positive Jones II test. No further ocular discharge was reported by the owner during the following year.

DISCUSSION

The most frequent congenital anomaly of the NLD is atresia, typically manifested as a mucosal membrane covering the nasolacrimal orifice. Additionally, the final 4–8 cm of the nasolacrimal distal portion may be missing.[3] However, an incomplete formation of the duct may occur anywhere along its course. The etiology of this condition in animals is unknown, but it is likely related to a lack of cannulization or extension of the surface ectoderm in the facial groove during embryogenesis.[3] Other nasolacrimal congenital anomalies, such as imperforate proximal puncta or anomalous openings, are uncommon in horses.[1,10,11] Acquired problems of nasolacrimal duct include rupture secondary to facial fractures, calcification, dacryocystitis secondary to periapical tooth root infections and obstruction secondary to suture exostosis.[12–17] Clinical examination and further diagnostic exams (i.e., dacryocystorhinography, computed tomography dacryocystography) are necessary, in case of suspected NLD atresia or obstruction, to accurately identify the atretic or stenotic point before attempting surgical intervention.[1,2,18–21] In case of proximal nasolacrimal duct obstruction, canaliculorhinostomy and conjunctivorhinostomy have been described.[22,23] Clinical signs of congenital imperforate nasal orifice, including chronic epiphora and mucopurulent discharge due to secondary dacryocystitis, appear typically in 3- to

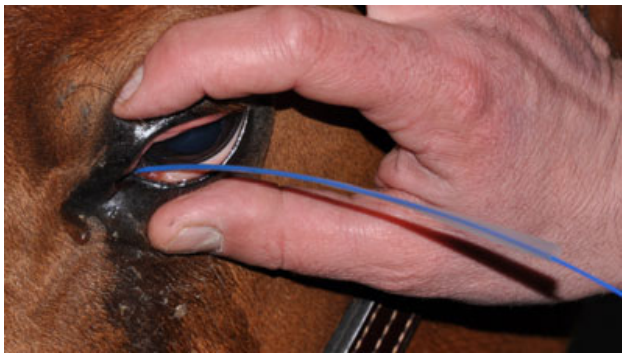

Figure 4. A polypropylene urinary catheter with a 600 μm flexible bare quartz fiber was inserted in the inferior palpebral puncta and advanced until the nasolacrimal duct end.

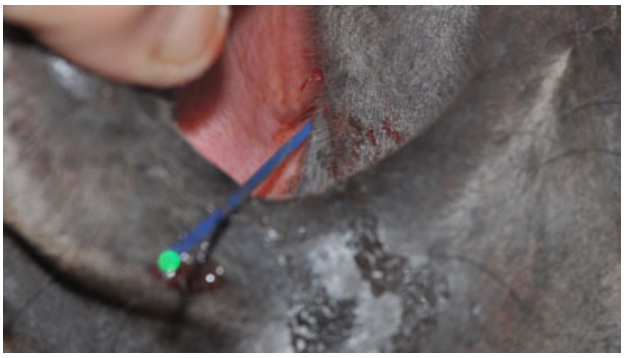

Figure 5. Urinary catheter and flexible bare quartz fiber advancement in the left nostril with minimum bleeding.

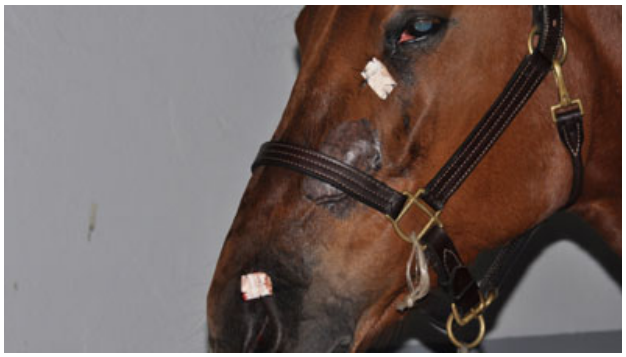

Figure 6. 1.1 mm Ø feeding tube sutured for 4 weeks to maintain the nasolacrimal orifice functional.

6-month-old foals, but in some cases clinical manifestation is delayed to adult age.[1–3] Surgical opening of the atretic orifice is required to resolve secondary dacryocystitis. Due to the sensitivity of the nasal mucosa, the manual attempt to localize the distal atretic meatum through anterograde (from proximal to distal) cannulation with silastic or urinary catheter often requires deep sedation or general anesthesia. If the end of the catheter can be palpated through the nasal mucosa in the nasal meatum, an incision of the mucosa, using a scalpel blade or electrocautery unit, can be attempted, but normally an extensive hemorrhage is expected.[1,3,5–8,24] The palpation of the catheter in case of distal segment NLD atresia can be more difficult, as was the case in the present report. Palpation of the catheter is not possible in the distal portion of the NLD tract, where its course is covered by the cartilaginous extensions of the sigmoid or medial accessory cartilage and the basal fold. Conventional surgical procedures performed under general anesthesia are complicated due to the reduced working space. Using a scalpel blade or electrocautery unit to perform an incision of the nasal mucosa to create a NLD orifice can also be difficult because the incision must be made without direct visualization. This procedure also normally creates a considerable nasal hemorrhage.[2–8,10]Few descriptions of this condition and surgical resolution are reported in the literature.[1,5–7] The clinical case in the present case report describes atresia of the distal NLD segment in an adult horse referred for a chronic dacryocystitis at the left eye. The surgical technique described was performed in an attempt to reduce the risks associated with general anesthesia and to reduce the surgical time. The size of the proximal lacrimal puncta in this adult horse permitted the cannulation with a 1.7 mm diameter semi-rigid urinary catheter that has an internal lumen large enough to permit the passage of the diode laser 600 μm flexible bare quartz fiber. The rigidity of the catheter did not allow it to pass through the curvature and flattening of the NLD in correspondence of the cartilage plate. In this location, the tip of the catheter was digitally palpable. The use of a diode laser allowed creation of a nasal orifice in a more proximal location resolving the dacryocystitis. This novel technique was also easily performed in a standing sedated horse with very limited hemorrhage and short working time. Due to the catheter size required, this technique will probably not be appropriate in foals, but surgical correction of imperforated nasolacrimal orifice may be delayed by controlling possible secondary dacryocystitis with topical antibiotic therapy.

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