Proceedings of the 59th Annual Convention of the American Association of Equine Practitioners - AAEP -

December 7-11, 2013
Nashville, TN, USA

Next Meeting :

Dec. 6-10, 2014 - Salt Lake City, Utah, USA

Reprinted in the IVIS website with the permission of the AAEP
How to Repair Eyelid Lacerations

Diane V.H. Hendrix, DVM, Diplomate ACVO

1. Introduction

Eyelid lacerations are common in horses and should be regarded as surgical emergencies to prevent undesirable tissue devitalization, infection, scarring, corneal desiccation, and corneal ulceration. Lacerations usually can be repaired in the standing, heavily sedated horse. General anesthesia may be required when there is extensive trauma or with an unruly horse. Even when horses are not evaluated immediately after the trauma and infection may have begun, repair should always be attempted immediately and with minimal debridement to prevent further tissue damage. Although a complete ophthalmic examination should be performed in all horses with eyelid lacerations, ocular examination usually reveals a normal globe; however, it is not unusual to have two lacerations, with one being much smaller than the other. Lacerations usually are caused by nails and hooks protruding from boards in the barn or stall, from fence wire or tree branches, or from sharp metal protuberances in trailers. Unfortunately, even with extensive study of the horse’s surroundings, the cause of the laceration is rarely determined.

An understanding of eyelid anatomy and physiology is imperative for proper surgical repair because of the importance of perfect alignment of the eyelid margin and the close proximity of sutures to the cornea. A normal eyelid margin is crucial for globe health. The eyelid margin prevents hair from contacting the cornea and allows the lids to have perfect contact with the corneal surface. This normal eyelid contact during blinking removes precorneal debris and spreads the tear film over the cornea to prevent desiccation. Under normal conditions, there are no hairs or cilia on the eyelid margin. Meibomian gland openings form a row of tiny spots along the lid margins. These glandular openings serve as an important landmark for the figure-eight suture.1 The haired eyelid skin is very thin, with no redundancy. The palpebral conjunctiva lines the bulbar side of the eyelid and is also very thin, approximately 10 cell layers thick. The tissue between the skin and the palpebral conjunctiva from superficial to deep contains the orbicularis oculi muscle, the stroma (which contains the levator palpebral superioris muscle in the upper lid), and thin, fibrous tissue referred to as the tarsus. For the purpose of this report the layers of the eyelid will be referred to as the skin, stroma, and conjunctiva. Whereas the muscles that open and close the eyelids are important physiologically, they are not easily visible when the eyelid is lacerated and do not require special attention during the repair.

Knowledge of eyelid innervation is also important for laceration repair. A branch of the facial nerve (auriculopalpebral nerve) controls the orbicularis oculi muscle, which closes the eyelids. This nerve
HOW-TO SESSION: OPHTHALMOLOGY

must be blocked to assist in ocular examination and eyelid repair. Local anesthesia of the auriculopalpebral branch of the facial nerve only suppresses motor function to the eyelids and does not block sensation. Sensation to the eyelids and corneal surface is provided by branches of the trigeminal nerve, which must also be anesthetized to facilitate laceration closure.

Eyelid laceration repair is relatively easy as long as several key points are followed. The purpose of this report is to provide step-by-step instructions on eyelid laceration repair that will leave the horse with anatomically and physiologically normal eyelids.

2. Materials and Methods

Initial Ocular Examination

The first part of the examination, including external examination and reflexes, should be performed before sedation and nerve blocks are administered. An external examination of the head is necessary for any horse that has had trauma. Symmetry of the orbits and sinuses and globe position should be evaluated. Palpation of the orbital rim may reveal fractures. Eyelid swelling is common with eyelid lacerations, but more diffuse severe swelling may indicate blunt trauma in addition to the sharp trauma that caused the laceration.

The menace response and palpebral reflexes are evaluated next. The menace response involves making a sudden hand motion near the eye being tested and is confirmed with closure of the eyelid or shying of the head away from the motioning hand. It is usually obvious in adult horses, but foals may not have a fully developed menace response until 9 days of age. Some foals may have a partial response a day before showing a complete response, or they may have an asymmetrical response initially.2

Sedation and Local Anesthesia

After the initial ocular exam and physical exam, sedation should be used to facilitate the remainder of the ocular examination. Sedation is imperative in almost all horses with a painful eye. Detomidine (10–20 µg/kg IV) is very effective because it provides analgesia as well as sedation. Xylazine (0.5–0.75 mg/kg IV) is effective in horses that only require sedation. If analgesia becomes necessary, butorphanol (0.01–0.02 mg/kg IV) can be administered in conjunction with the xylazine. These sedatives generally act for the duration necessary to do a complete ophthalmic exam. Additional sedation probably will be necessary if eyelid repair is performed after the examination.

The auriculopalpebral nerve block is generally the only injectable local anesthesia needed to assist with the ocular examination. Akinesia of the auriculopalpebral nerve prevents active closure of the palpebral fissure, thus facilitating ocular examination. The nerve block is performed by injection of 1 to 2 mL of 2% lidocaine subcutaneously near the branch of the auriculopalpebral nerve. The nerve branch is located by running the index finger over the anterior aspect of the zygomatic arch. The nerve can be strummed where it runs perpendicularly across the zygomatic process of the temporal bone. A 25-gauge needle is inserted superficial to and parallel to the nerve. The syringe is attached, and lidocaine is injected. Gently rubbing the area after removing the needle will facilitate diffusion of the lidocaine into the tissue. Avoid the artery and vein that run with the nerve. If the block is successful, the lid movement and strength will be impaired.

Complete Ocular Examination

In addition to sedation and the auriculopalpebral nerve block, a good light source, darkened examination area, and magnification source are necessary for complete ophthalmic examination. A direct ophthalmoscope and Finoff transilluminator are excellent rechargeable light sources. Bright penlights can also be used. The direct and consensual pupillary light reflexes are evaluated with the use of the strong focal light source. When a horse is seen for an eyelid laceration, special attention is paid to the eyelid margins, with evaluation for multiple lacerations and the presence of foreign bodies (Fig. 1). If a foreign body is present, Graefe fixation forceps or thumb forceps may be used to grasp the object after administration of topical anesthetic. The normal conjunctiva is glistening, very thin, translucent, and pale pink. When the eyelid is lacerated, the conjunctiva often becomes chemotic, hyperemic, or hemorrhagic. The conjunctiva should also be evaluated for foreign bodies or extensive trauma.

Fluorescein staining should be performed on all eyes that have received an eyelid laceration. Whereas large ulcers are easily visualized with white light, small corneal ulcers are more easily visualized with
the use of magnification and a cobalt blue filter. Depth of any ulcers or corneal lacerations should be determined. If a full-thickness corneal laceration is present, fibrin, blood, or iris usually comes from the wound. Some cases with evidence of severe trauma will also have orbital fractures. Generally if the cornea does not have signs of trauma, the anterior chamber, lens and posterior segment will be spared as well. However, at least a brief examination of the anterior chamber, iris, and lens should be performed with the use of a focal light source. The anterior chamber is evaluated for aqueous flare, blood, fibrin, and hypopyon. Occasionally, miosis will be present with no other anterior chamber signs; this is still indicative of mild uveitis. With the great majority of eyelid lacerations, the eye itself is completely normal because the eyelids have successfully protected the globe and absorbed the brunt of the trauma.

Preparation for Surgery
After sedation and akinesia of the auriculopalpebral nerve, the next step in preparing for laceration repair is the surgical preparation and analgesia of the eyelids and cornea by anesthetizing the trigeminal nerve. The affected area should be prepped with dilute betadine solution and saline. Betadine scrub and alcohol should not be used because they are toxic to the corneal epithelium and can cause corneal ulceration. After surgical preparation, the palpebral branch of the trigeminal nerve is blocked. The easiest way to block the palpebral branch of the trigeminal nerve is to perform a line block with 2% lidocaine and a 25-gauge needle in the skin just peripheral to the affected part of the eyelid. This ensures that anesthesia of the lacerated portion of the eyelid that will be sutured. The bulbar conjunctiva and cornea should also be anesthetized with the use of 0.5% proparacaine hydrochloride ophthalmic solution to diminish responses if the globe is accidently contacted with instruments or sutures during the repair. This is best applied by spraying the solution from a tuberculin syringe in which the tip of a 25-gauge needle has been broken off. Always keep this syringe at least 6 inches from the cornea because the broken needle tip is still sharp.

In most cases, the eyelid is only lacerated, and no tissue has been ripped away. Severe swelling and congestion in the lacerated tissue can alter its appearance and give the illusion that tissue is missing, but the lid should be closed as a simple apposition until one is sure that tissue is missing. Unfortunately, the horse has very little extra eyelid skin, which makes it difficult to perform blepharoplasty procedures. Keeping this in mind, preparation of the surgical bed should be minimal. If there is question as to the viability of the lacerated tissue, it can be scarified with a dry, sterile 4 × 4 gauze pad or a scalpel blade until bleeding is observed. Avoid excising tissue that has any potential for viability. Because the eyelid is so well vascularized, the tissue may recannulate. The edges of the laceration are often jagged. This should be pieced together with suture rather than being excised to make a clean edge. An eyelid pedicle created by a laceration should never be simply excised because exposure keratitis and ulceration probably will occur. If the nasal canthus is involved, the nasolacrimal system should be evaluated for patency. If the nasolacrimal system has been damaged, general anesthesia may be required for the repair.

Special Surgical Considerations
The eyelids are extremely vascular, and hemorrhage from incisions may be profuse. However, cautery should never be used because excessive scarring can lead to conformational changes of the eyelid. Suture choices that would be considered contraindicated at other locations are routinely used for the eyelids because of the copious blood supply. For example, polyglactin 910 is the preferred suture for eyelid lacerations. Characteristics of polyglactin 910 that make it favorable for eyelid margin apposition include excellent knot security and handling and the fact that it becomes soft when wet. Additionally, because they are absorbable, polyglactin 910 sutures do not need to be removed; this is a desirable feature when removing very small sutures in the equine eyelid. Some texts mention burying the suture knots or suturing the conjunctiva. Although it is important to close gaping distances between the lacerated conjunctival edges, one must avoid closing the conjunctiva in a way that the suture might contact the cornea and cause ulceration. The conjunctiva heals very quickly, even when it is not in perfect apposition.

Simple Two-Layer Closure
The instruments needed for eyelid laceration repair include Bishop-Harmon forceps or other fine-toothed forceps, Derf or Castroviejo needle holders, and Stevens tenotomy scissors. The preferred suture is 5–0 polyglactin 910 with a spatula or cutting needle. First, the stroma, which is the tissue between the conjunctiva and skin that contains the tarsus and orbicularis oculi muscle, is apposed with simple continuous or simple interrupted sutures such that the deep aspect of the suture does not protrude through the conjunctiva and contact the cornea. The knot of this suture must be oriented away from the conjunctiva and toward the skin. This step can be skipped with very small lacerations and may even hinder perfect apposition in these situations. Next, the eyelid margin is apposed with a figure-eight suture (Fig. 2A). Bites should be small (approximately 2 mm), and bites on one side of the laceration should mirror those on the opposite side. If the eyelid margin is not squarely apposed, the figure-eight suture should be redone. Suture tags are left long and pulled away from the eye by incorporating them into the simple interrupted su-
ture that is used to appose the skin distal to the eyelid margin (Fig. 2B). The tails of the figure-eight suture must be situated on top of one square knot and below at least one additional square knot. If the lacerated margin affects the canthus, a horizontal mattress suture or simple interrupted suture may be placed in the margin, still incorporating the tags into the first simple interrupted skin suture to avoid corneal contact by the knot. The remainder of the lacerated tissue is apposed with simple interrupted sutures. The pieces often must be “quilted” together because the edges may be jagged or narrow (Figs. 3 and 4). Excision of any skin should be avoided if possible.

Complicated Lacerations

When a portion of a lid or an entire upper or lower lid has been torn away, there are few options. If the lower eyelid is affected rather than the upper eyelid, the cornea is more likely to remain healthy because the upper eyelid more actively protects the eye. Even portions of the temporal or nasal upper eyelid can be absent and the cornea remains healthy. After the laceration edge heals, removing skin hairs that contact the cornea may be beneficial if the horse is painful or has keratitis (Fig. 5). Cryotherapy of offending hairs can be attempted but may not be effective. Electrolysis may be necessary. Although it may be tempting to perform a modified Hotz-Celsus procedure to remove a crescent of tissue to roll the haired skin away from the cornea, this generally is not beneficial and allows for more corneal exposure. Blepharoplasty techniques such as H-plasty can be attempted, but contracture of the surgery site tends to occur.

If the nasal canthus is involved in the laceration, the nasolacrimal duct may be damaged. In these cases, general anesthesia probably will be necessary to repair the nasolacrimal duct or to place a stent. Damage to the nictitating membrane can be repaired with the use of a simple interrupted pattern of 6-0 polyglactin 910, once again, taking care to avoid suture contact with the cornea.
If the surgical repair dehisces within a day or two of repair, it can often be repaired again with freshening of the laceration edges. If the dehiscence is not treated immediately, the eyelid will be disfigured and a wedge resection may be necessary (Fig. 6). Alternatively, small areas of dehiscence may heal with granulation tissue.

**Postoperative Care**

Postoperative care for eyelid lacerations often includes a protective hood with a hard cup over the eye to minimize self-trauma. Additionally, a topical broad-spectrum ophthalmic antibiotic ointment is used to lubricate the cornea and prevent secondary infection of the repaired laceration. Most commonly, triple antibiotic ophthalmic ointment (neomycin, polymyxin, and bacitracin) is applied to the laceration site and the cornea. Flunixin meglumine, or phenylbutazone should be administered every 12 hours for 2 to 5 days, depending on the degree of swelling and severity of the laceration.

Fig. 4. A, This horse had a laceration of the upper eyelid with multiple tears in the skin. No skin was excised from this eyelid before repair. Pedicles of skin were incorporated into the sutures. B. The same horse immediately after repair. Repair was successful in restoring eyelid integrity and function. Swelling was resolving the following day.

Fig. 5. This horse lost the temporal aspect of its upper eyelid. Trichiasis is present, but the cornea appears normal.

Fig. 6. This horse’s eyelid was lacerated and repaired 2 weeks before evaluation. Repair had been attempted but appeared to have dehisced. A wedge resection to remove the tissue from the last visible meibomian gland in the lower eyelid to the lateral canthus with a two-layer figure-eight closure was recommended, but the owners declined. No keratitis is present, but an immature cataract and evidence of previous posterior synechia is seen.
If the horse received tetanus toxoid 6 months or longer before injury, it should be revaccinated. Treatment with systemic trimethoprim sulfamethoxazole is indicated when infection is present.

If any other ocular trauma is found, it should be treated appropriately. A superficial ulcer should be treated with triple antibiotic ophthalmic ointment every 6 to 8 hours, and ophthalmic atropine every 12 to 24 hours and the already prescribed nonsteroidal anti-inflammatory drug (NSAID) should be given. Mild anterior uveitis probably will respond to the systemic NSAID and ophthalmic atropine given every 12 to 24 hours. For treatment of more severe ocular diseases such as corneal lacerations, ophthalmic texts should be consulted.

3. Results
With just a few key techniques as described above, the vast majority of eyelid lacerations can be easily and successfully repaired. There are no retrospective studies discussing equine eyelid laceration repair in the peer-reviewed literature; however, years of experience have shown that use of the described technique produces excellent results. The figure-eight suture has been published in multiple texts, and procedures similar to those described here have been published.\textsuperscript{1,6–7} With the use of the described technique, complications are rare. Occasionally, the tip of the lacerated eyelid margin will become necrotic. If the area is located at the lateral canthus, it may heal with granulation tissue without further complication. Alternatively, the necrotic tissue may need to be excised and the figure-eight suture replaced. Several horses have been seen that were not repaired in the described manner, or veterinary care had not been sought. Some were seen in which conjunctival sutures had been “buried,” with the knot toward the cornea rather than toward the skin side of the eyelid. In these cases, the cornea was ulcerated, and the horses were very painful. In some cases, it was possible to remove only the offending sutures, but in others, the entire primary surgical repair had to be removed to access the offending sutures.

4. Discussion
Eyelid laceration repair according to this described technique is effective for several reasons. First, apposition of the eyelid margin with the figure-eight suture ensures that there will be no defects in the eyelid margin that would allow for corneal trauma or desiccation. Second, the palpebral side of the eyelid is closely apposed with the placement of more superficial stromal sutures rather than conjunctival sutures, which allows for quick healing by migration of conjunctival epithelial cells without the danger of corneal ulceration from conjunctival sutures. Last, the use of a small needle and fine sutures allows for precise suture placement without excessive damage to the tissue. The only pitfalls to this procedure are the need for good lighting, getting accustomed to the smaller suture, and the learning curve associated with placing a proper figure-eight suture. The lighting can be provided with a surgery light or headlamp. Handling the small suture with a small needle and placing the figure-eight suture can be frustrating initially, but, with practice, good lighting, and heavy sedation, the apposition that can be obtained is well worth the effort.

References and Footnotes

\textsuperscript{a}Vicryl, Ethicon Inc, Somerville, NJ 08807.
\textsuperscript{b}Eye Saver, Jorgensen Laboratories, Loveland, CO 80538.