Article

Standing enucleation in the horse: A report of 5 cases

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Abstract — Enucleation was performed in 5 horses under local anesthesia and sedation with the horse standing. Minimal hemorrhage occurred during the surgical procedure, and there were no other reported complications. Standing enucleation is a surgery that is safe to perform in horses.

Résumé — Énucléation en position debout chez un cheval : rapport de 5 cas. L'énucléation a été réalisée chez 5 chevaux en position debout sous anesthésie locale et sédation. Une hémorragie minime est survenue pendant la procédure chirurgicale et il n'y a pas eu de complications rapportées. L'énucléation debout est une chirurgie sécuritaire chez le cheval.

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Introduction

Enucleation, transpalpebral or subconjunctival, is the surgical removal of the globe, conjunctiva, and nictating membrane. For transpalpebral enucleation, the eyelids are closed to prevent orbital contamination. It is performed when severe ocular injury is present, such as severe corneal infection, endophthalmitis, corneal or adnexal neoplasia, or severe corneal lacerations (1–5). Enucleation is also performed in cases of severe ocular trauma or in horses with a painful, blind eye (2). In subconjunctival enucleation, the globe is removed prior to removal of the eyelid margin, allowing for decreased surgical time and hemorrhage, but increased contamination from the globe than with the transpalpebral technique (1–5).

Although enucleation in the horse has been described as a surgery to be performed under general anesthesia, (7), surgery under sedation and with local anesthesia to remove corneal foreign bodies, perform nictitans surgery, repair eyelids, or excise tumors has been done with the horse standing (6).

A retrospective study was performed to document cases of standing transpalpebral enucleation in the horse. Our hypothesis was that enucleation could be performed safely in the standing, sedated horse.

Materials and methods

The medical records of all horses requiring an enucleation at the Marion DuPont Scott Equine Medical Center (MDSEMC) between March 1, 2005, and March 1, 2006, were reviewed to determine whether the procedure had been performed under standing sedation or general anesthesia. Horses that received standing sedation for the enucleation were included and for them, the age, sex, breed, history, previous treatment of the eye, clinical findings, medical treatment, and outcome of the enucleation were recorded.

All horses had been sedated with a single administration of xylazine hydrochloride (Anased; BenVenue Laboratories, Bedford, Ohio, USA), 0.3–0.4 mg/kg bodyweight (BW), IV, and detomidine hydrochloride (Dormosedan, Pfizer, New York, New York, USA), 0.01 mg/kg BW, IV, and then placed in standing stocks. Additional doses of xylazine hydrochloride, 0.2–0.3 mg/kg BW, and detomidine hydrochloride, 0.01 mg/kg BW, were administered, IV, as needed to keep the patient sedated throughout the procedure. The horses received 1 dose of flunixin meglumine (Vetagesic; Vedco, St. Joseph, Missouri, USA), 1.1 mg/kg BW, IV, preoperatively. One horse received 1 dose of gentamicin sulfate (GentaVet100; Vedco), 6.6 mg/kg, IV, prior to surgery.

The periorbital area around the affected eye had the hair removed with a #40 clipper blade before being aseptically prepared with chlorhexidine and sterile water. A nose twitch was applied prior to the administration of local anesthesia and then removed for the surgery.

Analgesia for the eye was provided by administration of local anesthetic, mepivacaine hydrochloride (Carbocaine V (2%); Pharmacia Upjohn, North Chicago, Illinois, USA), around the frontal nerve in the supraorbital foramen, around the lower lid with a line block, and with a 4 point block along the dorsal, medial, ventral, and lateral aspects of the orbital rim to desensitize the zygomatic nerve, lacrimal nerve, and infratrochlear nerve, respectively (6). The frontal nerve was blocked by placing a 23 gauge, 2.5-cm long needle fully into the supraorbital foramen and injecting 3.5 mL there and 1.5 mL, SC, over the foramen. The lower lid was blocked with 5.0 to 10.0 mL by

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inserting a 23 gauge, 2.5-cm long needle at the lateral canthus and advancing it along the lower eyelid to the medial canthus. For the 4 point block, an 18 gauge, 8.75-cm spinal needle was slightly bent to curve around the shape of the globe. The needle was placed at the midline of the dorsal orbital rim and then guided along the orbital rim until the needle was two-thirds of the distance around the globe; anesthetic was injected at this location and as the needle was being removed for a total of 10.0–15.0 mL. This procedure was repeated at the midline of the ventral orbital rim and at the medial and lateral canthi, with 10.0–15.0 mL being injected at each site (8). If the upper eyelid was not blocked with the supraorbital injection, a line block was performed around the upper eyelids with a 23 gauge, 2.5-cm long needle from the lateral canthus along the eyelid margin to the medial canthus with 5.0 mL of anesthetic (this was performed in 1 horse due to swelling).

The upper and lower eyelids were then apposed with penetrating towel clamps, and a routine enucleation performed (2). An elliptical incision was made through the skin 1 cm from the margin of the eyelid with a #10 blade. The angularis oculi vein was avoided near the medial canthus. Blunt and sharp SC dissection was performed with Metzenbaum scissors carefully around the conjunctival sac to avoid breaking into it. The medial and lateral canthal ligaments were transected with the Metzenbaum scissors. The dissection was continued around the conjunctival sac to remove the attachment of the extraocular muscles (dorsal rectus, ventral rectus, lateral rectus, medial rectus, dorsal oblique, ventral oblique, and retractor bulbi) from the globe. When all the muscular attachments had been transected from the globe, a gauze sponge soaked in mepivacaine hydrochloride (20 mL) was placed adjacent to the optic nerve for 3 min to provide additional anesthesia. Care was taken to avoid traction on the optic nerve. The optic nerve was transected with Metzenbaum scissors and another gauze sponge soaked in mepivacaine hydrochloride (20 mL) was placed adjacent to the stump of the optic nerve. The optic nerve was not clamped or ligated. The orbit was rinsed with sterile saline (2).

The deep fascia and SC tissue were apposed with 2-0 polygalactin 910 (Vicryl; Ethicon, Somerville, New Jersey, USA) (2 cases) or 2-0 poliglecaprone 25 (Monocryl; Ethicon) (3 cases) in a simple continuous pattern. The skin was apposed with 2-0 nylon (Ethilon, Ethicon) in simple continuous pattern (2 cases) or in a cruciate pattern (3 cases.) Sterile gauze sponges were placed over the incision and held in position with an elastic adhesive bandage (Elastikon; Ethicon).

All horses were administered flunixin meglumine (Vetagesic; Vedco), 1.1 mg/kg BW, PO, q12h for 5 d, and 2 horses received the antibiotic doxycycline hyclate (Doxycycline Hyclate USP; Westward Pharmaceutical, Eatontown, New Jersey, USA), 10 mg/kg BW, PO, q12h for 5 d.

Results

Records of 14 horses were reviewed; 5 adult horses (4 geldings and 1 mare, average age 20 y, reference range, 4–33 y) met the criteria for the study: 2 American paint horses, 1 Thoroughbred-cross, 1 Tennessee walking horse, and 1 quarter horse. Enucleation was performed due to severe corneal ulceration (n = 2), severe uveitis with an anterior chamber infection (n = 1), phthisical eye (n = 1), and a ruptured globe from trauma (n = 1.)

Table 1. Sedation amounts for surgery

	Preoperative[a]		During surgery	
Horse	Zylazine	Detomidine	Xylazine	Detomidine
1	150 mg	10 mg		
2	150 mg	10 mg		
3	150 mg	10 mg		
4	200 mg	10 mg	150 mg	10 mg
5	200 mg	15 mg	150 mg	

[a] Preoperative — The period of being placed into the stocks and standing surgery room, hair removal, surgical preparation, and local anesthetic administration

The horses required a nasal twitch for administration of the local anesthesia. Once the area had been anesthetized, that and the sedation maintained surgical analgesia throughout the procedure and minimized response to surgical manipulation.Three horses were sedated with 10 mg detomidine hydrochloride and 150 mg xylazine hydrochloride prior to surgery, without additional sedation being required during the procedure. One horse received 10 mg detomidine hydrochloride and 200 mg xylazine hydrochloride prior to surgery and an additional 10 mg detomidine hydrochloride and 150 mg xylazine hydrochloride during surgery. The 5th horse received 15 mg detomidine hydrochloride and 200 mg xylazine hydrochloride prior to surgery and 150 mg xylazine hydrochloride during surgery (Table 1). The initial response to sedation with the detomidine hydrochloride determined the additional amounts and type of sedation. Xylazine hydrochloride was administered as an additional sedative, if the surgery was almost complete, or if the horse became very sedate with the detomidine hydrocholoride, or both. If the horse was less sensitive to the initial dose of the detomidine hydrochloride, a 2nd dose of detomidine was given.

Minimal hemorrhage occurred during the dissection and transection of the optic nerve and artery in all surgeries. None of the horses developed blindness in the contralateral eye from trauma to the optic nerve. No adverse effects were seen from the sedation used. Minimal swelling or hemorrhage was seen postoperatively.

The horse with severe uveitis and an anterior chamber infection and the horse with the ruptured globe received doxycycline, while the other 3 horses did not.

None of the horses had signs of incisional problems. According to the owners, the horses had minimal to no ocular pain after the surgical procedure. Although the orbit had a sunken appearance postoperatively, owners were pleased with the procedure.

Discussion

The 2 main reasons for performing the surgery with the horse standing were the risks to the horse of general anesthesia and the financial costs associated with anesthesia. Since the horses in the study were primarily older animals, the owners did not want the horse to undergo general anesthesia if it was not necessary. Additionally, the cost of standing sedation is significantly less than that of general anesthesia at MDSEMC. When a horse is being selected as a candidate for standing enucleation, it should respond well to IV sedation and allow palpation of the area

around the affected eye once it has been sedated. If a horse does not allow palpation of the eye despite sedation and application of a nose twitch, the procedure should not be performed standing. This did not occur in any of our cases or potential cases.

Anesthesia associated complications, such as movement during surgery, transient hypertension, and poor recovery scores have been reported with ocular surgeries, including enucleation (9). Parvianinen and Trim (9) reported that horses undergoing an enucleation were 6.1 times more likely to move under anesthetic than were those undergoing other ocular surgeries, and 3.1 times more likely to move than were horses undergoing splint bone excision (9). The use of a gas analyzer decreased the movement under anesthesia in horses undergoing ocular surgery by facilitating adequate analgesia and anesthetic depth during the surgery. Transient hypertension also occurred in horses on which enucleation was performed. For horses on which ocular surgery, including enucleation, was performed under anesthesia, the recovery score (based on agitation and the number of efforts to stand) was 4.4 times worse than the recovery score for horses with splint bone excision, as determined by the increased number of efforts to stand and the agitation (9). Since horses move under a lower plane of anesthesia and have inferior recoveries, adequate pain control is necessary to perform enucleations. General anesthesia provides improved monitoring and treatment of pain, but it involves incurring additional risks during recovery. Although recovery is not involved in the standing procedure, adequate analgesia is important.

To control pain in the standing surgical cases, desensitization of the frontal nerve, lacrimal nerve, zygomatic nerve, and infratrochlear nerve is important to anesthetize sensation in the upper and lower eyelids, lateral canthus, medial canthus, nictating membrane, and lacrimal glands (6,8). In these cases, a supraorbital nerve block, a line block for the lower lid, and 4 point block was performed and found to be adequate for enucleation. An auriculopalpebral nerve block was not necessary to prevent motion of the upper eyelid, but a line block was necessary in 1 case for upper lid anesthesia.

If required, further anesthesia for the globe can be provided with a retrobulbar block (10). Nonsteroidal anti-inflammatory medications are also necessary to alleviate ocular pain and minimize the inflammatory response to surgery (6). Nonsteroidal anti-inflammatory medications were used preoperatively and postoperatively. Additional analgesia could have been provided with butorphanol, morphine, or continuous IV infusion with lidocaine (6). Systemic opioids were not used in this surgery due to the adverse effect of head jerking that can occur with butorphanol. For additional pain control, continuous infusion of lidocaine should be considered in future cases (12). Systemic lidocaine has not been used in ophthalmic cases during surgery, during hospitalization, or for additional pain control at our hospital, and it has not been proven to control ophthalmic pain. To improve pain control, blood pressure and heart rate changes could be monitored in future cases, although alpha 2 drugs can cause hypertension.

The horses in this study received multiple IV injections for sedation during the surgical procedure. An alternative to repeated doses of xylazine hydrochloride or detomidine hydrochloride would have been a continuous IV infusion of detomidine, which has been shown to provide reliable sedation in standing horses (11). Since continuous IV anesthesia is not often used at MDSEMC, it was not used in these cases.

Orbital implants were not placed in the horses in our study. Orbital implants have previously been placed in horses requiring enucleations (3,5,13,14). To prevent the sunken globe appearance, an orbital implant, orbital implant beneath a corneoscleral shell, or a corneoscleral shell alone can be used (5). In the standing procedure, the orbital implant could be placed without the careful dissection required with the presence of a corneoscleral shell.

Standing enucleation was a successful procedure in the 5 horses in this study. It is a good alternative for horses that cannot undergo general anesthesia due to health problems or for other reasons. Since there was minimal hemorrhage with the surgical procedure in the standing horse compared with the recumbent horse, the dissection was simpler than in the anesthetized horse. Decreased hemorrhage is thought to be a result of enhanced venous return in the standing animal, similar to the decreased hemorrhage seen with sinus surgery in the standing horse versus the recumbent horse (15). Although there were only 5 cases in this study, the authors will continue to perform standing enucleations in future cases. Standing enucleation should be considered a safe surgery for horses, although not all horses are safe candidates for "standing" surgery. CVJ

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