"Once you do it standing, you will never want to do it laying down again"

How to Perform Standing Enucleation in the Horse

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Indications for Enucleation:
- Painful eye (non visual or minimally visual)
  - Glaucoma
  - Uveitis
  - Cataracts
- Severe corneal disease refractory to treatment
  - Ruptured globe or in danger of rupturing
  - Finances?
- Traumatic ruptured globe
- Phthisis bulbi – especially if painful and/or non-visual
- Neoplasia – Squamous cell carcinoma most frequently
  - Retrobulbar neoplasia or mass

Indications for Enucleation:

Glaucoma:
- If non-responsive to topical and systemic treatment
- If poor owner compliance with treatment/management
- Complications of corneal ulceration and painful uveitis flare ups
- Most likely signalment is older appaloosa horse, but all breeds and ages can be affected
- Consider leptospirosis in young, non-appaloosa horse as a source of acute uveitis

Indications for Enucleation:

Severe Corneal Disease
- Corneal ulceration with melting desmetecoele or corneal perforation
- Corneal infection (bacterial or fungal) refractory to treatment
- No owner finances to properly treat severe corneal disease (conjunctival flap, SPL, etc)
- Poor prognosis for long term comfort and vision

Indications for Enucleation:

Traumatic Rupture of Globe
- Painful
- Unlikely to regain vision
Indications for Enucleation: Phthitic Non-visual or Painful Eye
- Many causes – some traumatic
- Orbital fracture?
- Previous rupture
- Severe corneal disease
- Horses are more comfortable post-operatively

Indications for Enucleation: Ocular or Corneal Neoplasia
- Squamous cell carcinoma most frequently
- If involving cornea, or severe infiltration of lids/adnexa

Indications for Enucleation: Retrobulbar Neoplasia or Mass
- Most common presenting complaint is exophthalmos
- Usually non-painful and visual in early stages – most owners are reluctant to pursue diagnosis or treatment at this stage
- More advance stages – severe exophthalmos, non-visual eye, still usually “non-painful”.

Retrobulbar Tumors:
- May see exposure keratitis and corneal ulceration

Ultrasound
- Can often confirm retinal detachment = blindness
- Lack of PLR or menace can also confirm complete blindness
- May see destruction of optic nerve by mass
Indications for Enucleation: Retrobulbar neoplasia or mass
- Radiographs rarely useful, but they are indicated to rule out primary sinus or ethmoid origin of mass
- CT is ideal pre-op, but not often possible
- Generally good long term prognosis if complete exenteration is performed while the bony orbit is intact and no neurological signs are present at the time of surgery.

Historical Perspective on Equine Enucleations:
- Traditionally performed as a surgical procedure under general anesthesia
- Risks of “vagal” (oculocardiac reflex) response under anesthesia causing anesthetic complications
- Historically poorer recovery from anesthesia than other surgeries
- More movement reported during anesthesia than other procedures

Historical Perspective:
- Historical reports of hypotension being a common complication during enucleation, possible related to the deep plane of anesthesia required and/or excessive bleeding from the surgery site
- Risk of disrupting surgery site during recovery
- Risk of limb injury during recovery from anesthesia

Historical Perspective on Equine Enucleations:
- Standing enucleation is common in cattle due to economic reasons, but is tolerated well
- Sedation and local anesthetic options for horses have improved dramatically over the past 20 years
- More and more equine head and sinus surgeries are being performed under sedation and local anesthesia – so called “standing surgery”

Historical perspective on standing enucleations
- First literature report of standing enucleation in horses was 2007 – 5 cases (Hewes et al) followed quickly in 2008 (Pollock et al) which reported a larger number of cases – 40 cases.
- Soon after these reports were published and established clinical evidence of safety and efficacy of standing enucleation in horses, many more practitioners began performing standing enucleations as a “routine” procedure.
Advantages of Standing Enucleation vs. General Anesthesia

- Less cost generally due to lack of anesthesia, less need for facilities and support staff
- Less risk associated with sedation compared to general anesthesia
- No “recovery” from anesthesia risk of injury to patient and disruption of the surgery site
- Less concern about “vagal” response complications
- Less bleeding due to head being elevated
- Better visualization due to positioning and reduced bleeding
- Additional benefits: Surgeon comfort!

Patient Selection:

- Ideally a docile horse what will tolerate palpation of the eye with IV sedation
- Responds well to intravenous sedation
- Note – I have not encountered a horse that would not tolerate this procedure, however an extremely fractious horse that won’t allow palpation of the orbit even with IV sedation or a horse who won’t stand well under IV sedation would be challenging.

Facilities:

- Good footing that will not be too slippery when wet (rubber mats ideal for me, but a stall with mats and shavings or pellets are also acceptable)
- Not bare concrete – will get slippery with blood/urine
- Ideally inside out of the wind

Equipment and Supplies

- Routine surgical instruments (make sure curved mayos and metzemaums are sharp!)
- 10 blade or 15 blade depending on preference
- Suture – absorbable and non-absorbable monofilament or coated braided
  - 2-0 absorbable
  - (biosyn, monocryl, vicryl etc) – prefer not to use PDS
  - PDS too long acting and risk of suture reaction
- 0 or #1 non-absorbable
  - Supramid, prolene, visipro

Advantages of standing enucleation

- Most likely patient signalment for enucleation is an aged and possibly arthritic horse who is not the most ideal anesthetic candidate
- Despite relative “safety”, many owners perceive that their “old” horse cannot or should not undergo general anesthesia
- Procedure can be performed easily “in the field” and does not require specialized facilities or a surgical suite.
Equipment and Supplies:
- Sterile gauze squares, Elastic tape
- Sterile gauze rolls (AMD kerlix?)
- Sterile gloves
- 22 or 20 ga 3.5” spinal needles
- Head lamp
- +/- IV catheter
- +/- fluid line & supplies for CRI

Patient Preparation Tip:
- Make sure if patient is on aspirin as a part of treatment/management of uveitis/glaucoma that they **discontinue aspirin at least 5 days prior** to surgery!
- Aspirin has non-reversible inhibition of platelet aggregation for 72 hours!
- Will bleed/ooze a lot post-operatively

Drugs and Medications:
- NSAID
  - Flunixin meglumine 1.1 mg/kg IV (500 mg/1000 lb horse) or phenylbutazone 4.4 mg/kg IV (2 g/1000 lb horse)
- Tetanus toxoid booster
- Pre-op antibiotic
  - Ceftiofur crystalline free 6.6 mg/kg IM once pre-op single dose
  - Excede R 1.5 ml/100 lbs
  - Other options: PPG/Gent or Sulfas
- Carbocaine/mepivacaine +/- Sodium bicarbonate injectable
- Buprenorphine
- Detomidine +/- butorphanol

Sedation:
- Detomidine bolus as needed to effect
  - Usually start with 6-8 mg IV before starting surgery prep and then redose another 5-8 mg IV after blocking and before performing surgery.
  - Rarely need redoses– once horse is blocked they are often extremely calm and cooperative.
  - Slower surgeons or more temperamental horses may need more redosing.
  - Consider placement of IV catheter if you will have a tech or assistant re-dose for you.

Sedation:
- Butorphanol
  - +/- depending on preference
  - Added short term analgesia
  - May result in undesirable head shaking and twitching – makes surgery hard!
  - Consider IM to reduce twitching at least 10 minutes after initial dose of detomidine
  - Can also use IV morphine

Sedation:
- Dormosedan CRI
  - Advantages
    - no need for redosing
    - Steady plane of sedation
  - Considerations
    - More supplies and cost (minimal)
    - More time to place and remove catheter
    - Need to have someone to monitor drip rate!
    - Need somewhere to hang fluid bag/bottle
Detomidine CRI:
► Place IV catheter in jugular vein (14-18 gauge)
► 10 mg (1 ml) detomidine in 250 ml of saline or LRS
► Start with IV bolus 5-10 mg detomidine IV
► Drip CRI to effect through a macrodrip set (60 drops/ml)
► 1 drop per second = 2.4 mg detomidine per hour
► 2 drop per second = 5 mg detomidine per hour
► Adjust as needed and can add IV bolus if needed

Patient Preparation and Blocking:
► Place patient head on whatever means of head restraint you have chosen. Cover halter with (sterile?) towels.
► After IV bolus of sedation – light skin prep around eyelids with betadine scrub and alcohol or saline.
► Clip eyelids/lashes and large square around the eye

Patient Preparation and Blocking:
► Local ring block in upper and lower eyelids using carbocaine and 25 or 22 ga needle. Place block approximately 1 cm from lashes.
► Tip: 1 ml Sodium Bicarbonate per 10 ml lidocaine can reduce the “sting” in injection and increase patient compliance for lid block. (Pain on injection is due to extreme acidity of local anesthetic).

Blocking & Surgery Prep
► After ring block around eyelids, suture eyelids closed using suture of your choice in a simple continuous pattern
► Can alternatively use towel clamps
► Once eyelids are apposed, complete a thorough surgical prep of the entire peri-orbital region

Four-point Retrobulbar Block:
► 22 ga or 20 ga 3.5” spinal needle
► Bend it into a curve
► Apply local skin block at 4 points around the eye
► Above – (12 O’clock)
► Below – (6 o’clock)
► Medial and lateral canthi (3/9 o’clock)

Four-point Retrobulbar Block:
► Carbocaine/mepivacaine 60-100 ml
► Add 0.2 cc buprenorphine per 30 ml mepivacaine***
► Using the curved spinal needle advance through the skin following the curvature of the orbit behind the eye to deposit block behind the eye at each position
► 15-25 cc carbocaine per site
► Inject several cc of carbocaine as slowly pulling the needle out at each location
► ***Note: adding buprenorphine to the mepivacaine can substantially increase the duration of the block 2-3x longer and provide lasting analgesia for the patient. Highly recommend for your block!
Four-point Retrobulbar Block

- Eye should be "bulging" out when you have enough block!
- Repeat aseptic skin prep after blocking
- Ready for routine transpalpebral enucleation procedure!

Anatomy Review:

Transpalpebral Enucleation

- Full thickness skin incision around both upper and lower eyelids meeting at medial and lateral canthus.
- Tip: cut lower incision first so upper incision is not bleeding on your incision
- Tip: Cut deeper than you think and make sure you are completely through the skin – especially at the canthi

Transpalpebral Enucleation:

- Using curved mayos or Metzenbaum scissors begin dissection around the eye, attempting to keep the conjunctival sac intact
- Most important to keep sac intact for infections (ulcers) and neoplasia
- Not the end of the world if you penetrate it – don’t panic!
- Blunt and sharp dissection blindly until the eye is "loose"
- May use fingers to feel where tissue is still holding
- **Tip:** Use caution at medial canthus as there is thick connective tissue and a large artery that sometimes bleeds. I usually dissect ventrally, then dorsally and cut the tissue at the medial and lateral canthus last.
Transpalpebral Enucleation:

- Towel clamps on eyelid margin can be helpful to maneuver and hold eye as it loosens.
- Tip: **Avoid placing too much outward traction on the eye – traction on the optic chiasm can cause blindness in the opposite eye**
- Rare! Don’t fret, but do be careful

- Once the eye is “loose” except for optic nerve attachments at the back of the eye – cut the optic nerve with curved mayos
- No need to ligate or clamp optic vessels
- May bleed before dissection is complete – speed up dissection!

- Rinse socket/orbit with saline +/- antibiotic (gentocin or ampicillin 1-2 ml per 100 ml saline)
- Apply digital pressure at the back of the orbit with sterile gauze for several minutes if excessive bleeding

- If retrobulbar tumor or ocular neoplasia, complete exenteration of orbital contents is indicated (as much as you can)
  - Note - retrobulbar tumors will bleed expulsively!!
  - May need an assistant to hold pressure while you start appose skin and remove gauze as last sutures are placed.
  - Run IV fluids to combat hypovolemia and hypotension.
  - Work fast! Skin sutures only. Pressure wrap to combat bleeding

- Appose eyelids
- Subcutaneous layer using 2-0 absorbable suture in a simply continuous pattern if you feel the procedure was “clean” and bleeding is not excessive.
  - Not necessary! Can close skin only
- Appose skin with non-absorbable sutures – simply interrupted, cruciate, etc. (Usually cruciates)

- Apply sterile gauze pads across incision/suture site and bandage head using elastikon
  - Not necessary unless excessive bleeding, but does apply pressure and reduce bleeding and blood filling socket post-operatively
  - May be necessary for retrobulbar tumors with expulsive bleeding
  - Remove in 24-48 hours and replace with fly mask for 14 days
Post-Operative Management

- Bute 4.4 mg/kg PO BID x 3 days, 2.2 mg/kg PO SID x 3 days
- No need for prolonged antibiotics unless complications.
- Remove sutures in 10-14 days.

References:

- Frank SG, Lalonde DH. How acidic is the lidocaine we are injecting, and how much bicarbonate should we add? Can J Plast Surg. 2012 Summer; 20(2): 71-73.