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ENUCLEATION: A SIMPLE PROCEDURE I STILL DON'T FEEL COMFORTABLE DOING

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Overview

Many practitioners, particularly new graduates, often do not feel comfortable removing a blind, painful eye that warrants enucleation, evisceration and prosthesis, or exenteration. This lecture will provide an overview of these three procedures and provide some useful tips to making each procedure a more comfortable experience for both patient and veterinarian alike.

ENUCLEATION VIA SUBCONJUNCTIVAL APPROACH

Enucleation, or removal of the eye, is indicated in cases of severe ocular trauma with rupture of the globe, fulminating ocular inflammation (endophthalmitis or panophthalmitis), ocular tumors, chronic glaucoma, or phthisis bulbi. Enucleation is distinct from exenteration and evisceration. Exenteration refers to the removal of all orbital contents including the adnexal tissue, globe, extraocular muscles and orbital glands. Evisceration of the globe refers to removal of the contents of the eye while leaving the cornea and sclera. Evisceration is performed prior to implantation of an intraocular prosthesis for cosmetic purposes. There are several techniques that can be used for enucleation, including the lateral approach, transpalpebral approach, and subconjunctival approach. The subconjunctival approach will be discussed, as it allows better visualization of the tissues, and often causes less intraoperative hemorrhage. More tissue tends to be left in the orbit, giving a better cosmetic outcome. Disadvantages of this technique include possible contamination of orbital contents with organisms from an infectious keratitis, and the possibility of orbital mucocele. This last complication can be prevented by removal of conjunctiva following enucleation.

SUBCONJUNCTIVAL APPROACH TO ENUCLEATION

1. A retrobulbar block can be performed prior to enucleation to reduce hemorrhage, reduce plane of anesthesia needed and to reduce pain upon recovery from surgery. See information below and reference # 4.
2. Perform a lateral canthotomy to increase exposure.
3. Grasp the bulbar conjunctiva near the limbus and make a 360-degree perilimbal incision. The plane of dissection should be down to the level of the sclera. Ensure enough tissue is left in the perilimbal area to allow manipulation of the globe (using forceps to grasp perilimbal tissue).
4. The conjunctiva, Tenon's capsule and extraocular muscles are reflected back from the sclera using curved Metzenbaum scissors. The extraocular muscles are identified and transected as close to their insertions in the sclera as possible, to minimize hemorrhage. The dissection is carried posteriorly until all the conjunctival and muscular attachments are free, including the retractor bulbi. **Be careful not to put too much forward traction on the globe as you continue the dissection.** Traction on the optic chiasm may damage the contralateral optic nerve. This is of concern especially in cats, but should be considered in all species.

5. Once the globe is relatively free, the optic nerve can be transected. There is no clinical indication for clamping of the optic nerve prior to transaction in domestic animal species. However, ligation of the optic nerve and associated vessels are indicated during enucleation of primates. It is preferable to leave at least a 1-2mm stump of optic nerve on the globe for histopathologic examination.
6. Remove the nictitans at its base, being careful to remove the entire gland and T-cartilage. This step can be done prior to globe removal to improve exposure of the globe.
7. Excise the eyelids approximately 2-3mm from the lid margins, including the base of the meibomian glands and the medial caruncle. You may use either a scalpel blade or scissors.
8. Remove conjunctiva to prevent mucocele formation.
9. The site is then closed in 3-4 layers. An absorbable suture such as 3-0 or 4-0 Vicryl is used to close deep and superficial orbital fascial layers in a simple continuous pattern. Subcutaneous tissue is closed in a simple continuous pattern using an absorbable suture and then skin is closed in a simple interrupted or cruciate pattern with 4-0 non-absorbable suture.
10. The globe should be submitted for histopathologic examination.

LOCAL ANESTHESIA IN VETERINARY OPHTHALMOLOGY

Local anesthetic (LA) techniques can provide an invaluable adjunct to general anesthesia. Addition of local anesthesia to a general anesthetic protocol has many benefits, including:

- minimal equipment required
- minimal systemic effects when delivered peripherally
- reduced inhalational/ intravenous anesthetic requirement
- reduced sympathetic response to surgical stimulation
- improved post-operative analgesia

Local anesthesia is commonly used for retrobulbar blocks prior to enucleation and to provide eyelid akinesia when examining/treating horses. Retrobulbar anesthesia provides excellent extraocular muscle akinesia. Additionally, it has the benefit of providing local analgesia that may help reduce the need for perioperative administration of systemic analgesics such as opioids or non-steroidal anti-inflammatory drugs. Finally, without the specific need for a mechanical ventilator (as is often needed with the use of systemic non-depolarizing neuromuscular blocking agents commonly used in veterinary ophthalmology), additional monitoring equipment, and associated personnel, the overall operative cost of commonly performed ophthalmic procedures may be reduced. Retrobulbar blocks are also used by some veterinary ophthalmologists prior to cataract surgery.

POTENTIAL APPLICATIONS AND TECHNIQUES

Retrobulbar block

When performing a retrobulbar block, the practitioner should have a thorough understanding of orbital and ocular anatomy. The target cranial nerves when performing a retrobulbar block include CN III, IV, V, VI and the ciliary ganglion. Local anesthetic may be placed either internal or external to the retrobulbar muscular cone. Injection into the intraconal space is preferred, as it will result in the most rapid and consistent analgesic effect with the least volume of drug(s) required. Extraconal injection is considered safer by some ophthalmologists because the needle is not as close to the globe as with intraconal injections, however this technique

requires a higher volume of anesthetic to be used with multiple injections and typically has a longer onset of action. Regardless of what technique is employed, the practitioner should be cognizant of possible complications, including retrobulbar hemorrhage, intravenous injection, globe perforation, damage to the optic nerve, extraocular muscle myopathy, and intrathecal injection with possible seizure or cardiorespiratory arrest. Despite the risks associated with retrobulbar injection, it can be argued that these risks may be less than the effects of inappropriate ventilation secondary to the use of systemic neuromuscular blockers without adequate monitoring or attempting ophthalmic surgery on eyes not centrally rotated and paralyzed.

There is no real consensus among veterinary ophthalmologists about the optimal approach to local anesthesia for various ophthalmic procedures and the technique that is employed is largely surgeon preference. One study has determined that the most reliable technique to obtain an intraconal distribution of local anesthetic material is the inferior-temporal palpebral approach. For this technique, a 20 degree angle is created by mechanical bending at the midpoint of a 1.5 inch (3.81 cm), 22 gauge spinal needle. The needle is then positioned at the inferior orbital rim and inserted through the inferior lid at the junction of its middle and the temporal third and advanced until a slight “popping” sensation is noted. This indicates that the needle tip has pierced the orbital fascia. The needle is then directed slightly dorsally and nasally towards the apex of the orbit and advanced approximately 1-2 cm. Using this technique with lidocaine, the authors successfully induced changes that were favorable for ophthalmic surgery such as pupil dilation, central rotation of the eye, inhibition of globe movement and no significant effects on intraocular pressure. The duration of effect is approximately 2 hours at the reported anesthetic dose (2 ml of 2% lidocaine hydrochloride; see table below for additional doses) and was sufficient for a variety of commonly performed ophthalmic procedures.

Perilimbal injection

Local infiltrative anesthesia is also useful when administered prior to enucleation to facilitate hemostasis during surgery and a smooth recovery during the postoperative period. In this technique, a subconjunctival perilimbal injection around the circumference of the globe can be made using a mixture of bupivacaine and lidocaine. When used in conjunction with a retrobulbar block prior to enucleation, the analgesic effect may last for several hours after surgery and, in this author’s opinion, remarkably improves post-operative comfort.

Eyelid surgery

This author has found local / regional anesthesia, commonly administered via a “line block”, to be extremely useful after eyelid surgery in the small animal patient. Common surgeries in which this technique is useful include the Hotz-Celsus, wedge resection, and lateral canthotomy. Benefits include improved comfort post-operatively and a “space occupying effect” useful for those entropion cases with a significant spastic component to their entropion.

DOSE:

This author likes to use equal parts 2% Lidocaine mixed with 0.5% Bupivacaine. More recently, I have begun using Ropivacaine.

Caution: Do not exceed the maximum IV dose for Bupivacaine in any patient (I do not exceed 1 mg/kg). If maximum IV dose is exceeded, it may potentiate arrhythmias and seizures. Delayed wound healing has been reported as a complication with large volumes; however I have not found this to be a problem with the volume of drug I administer to my ophthalmic patients.

PHARMACOLOGY REVIEW

Local anesthetics are classified as esters and amides. The local anesthetics used in veterinary practice (lidocaine, bupivacaine, mepivacaine) are amides. Local anaesthetics are predominantly metabolised by the liver.

Agent	Recommended dose (mg/kg)	Toxic dose (mg/kg)	Onset time (mins)	Duration (hours)
lidocaine	5	10 – 20	10 – 15	1 – 2
mepivacaine	5		15 - 20	1.5 - 3
bupivacaine	2	3.5 – 4.5	20 - 30	2.5 - 6
ropivacaine	2	4.9	20 - 30	2.5 - 6

AMINO ESTERS – procaine, 2-chloroprocaine, tetracaine

AMINO AMIDES – lidocaine, mepivacaine, ropivacaine, bupivacaine

- Clinical differences between the ester and amide LA's involve their potential for producing adverse effects and the mechanisms by which they are metabolised.
- Half-life of esters is only a few minutes, and of amides is a few hours
- Esters are metabolised by para-amino benzoic acid (PABA). Patients with reduced cholinesterase activity (newborn and pregnant) may have increased potential for toxicity from ester LA's. Amides are mainly metabolised by the liver – so risk with severe hepatic disease.
- Block nerve conduction through two mechanisms – by impairing propagation of the action potential in the axon; by interacting directly with specific receptors on the sodium channel, inhibiting sodium ion influx.

Esters and amides differ with respect to their chemical stability, biodegradation and allergenicity. Esters have short shelf lives and are degraded in plasma by pseudo-cholinesterases. Amides are very stable and are metabolised by hepatic microsomes. The potential allergenicity of the ester LA's is a result of production of PABA as a primary product of biotransformation. Amides aren't broken down to PABA, so that allergic reactions are very rare.

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