

OPHTHALMIC PATIENTS, NEUROMUSCULAR BLOCKERS, C-SECTION & ANESTHESIA

Lyon Lee DVM PhD DACVA

Ophthalmic Patients & Anesthesia

- Trauma to the eye during recovery will have a negative impact on the prognosis of the case.
- Rough recovery characterized by whining, yelping, barking, and thrashing should be prevented.
- Ophthalmic procedures can be severely painful and adequate perioperative pain relief must be ensured
- Vomiting, coughing, and excitement at the time of induction or recovery will increase intraocular pressure
- Most ophthalmic patients are old and may have some degree of compromise in different organ systems
- Patients may have residual neuromuscular blockade

Anesthetic plan

- Uneventful preanesthetic, induction and recovery period should be accomplished.
- Benzodiazepine and opioid combination (neuroleptanalgesia) is useful as preanesthetic medication
- Opioid will provide better degree of sedation in the presence of tranquilization and additional analgesia.
- Neuroleptanalgesic combination induces varying degree of sedation depending on the dose rate, drug choice and temperament of the animals, but provide good cardiovascular stability.
- Morphine tend to cause meiosis and vomiting which increases intraocular pressure and must be carefully assessed before routine use in ophthalmic patients.
- Oxymorphone induces vomiting much less commonly than morphine and thus could be a better choice in this patient group to provide analgesia. Alternatively, butorphanol can be used, but analgesia may be less predictable.
- Induction is best achieved using intravenously administered ultrashort acting agents such as thiopental and propofol. Ketamine can increase intraocular pressure so better to avoid in this patient group.
- Inhalation anesthetic maintenance using isoflurane or sevoflurane is commonly employed for ophthalmic procedures
- Use neuromuscular blockers for optimal surgical condition when needed.
- To ensure there is no residual neuromuscular blockade, patient should be closely monitored and use of pulse oximetry is recommended throughout the recovery period.
- Slow and smooth recovery from anesthesia is preferable than rapid and rough recovery. Unnecessary stimulation at the time of recovery should be avoided.
- The recovery room should be kept quiet.
- Acepromazine can be administered postoperatively at 0.02 mg/kg IV if signs of rough recovery are seen.

- Protection of eyeball from hitting the wall of cage or animal's paw should be better managed by placing an E-collar or manual restraint at the time of recovery.

Neuromuscular blockers (NMBs) & its use in anesthesia

- Classified into depolarizing and non-depolarizing NMBs (refer to CNS and anesthesia lecture notes for further details)
- Indications
 - To produce central fixation of eyeball for ophthalmic procedures.
 - As part of balanced anesthesia so that concurrent anesthetics, particularly inhalants, can be reduced for better cardiovascular stability (most useful in sick and geriatric patient).
 - To assist reduction of dislocated joints and displaced fractures.
 - To relax skeletal muscle for better surgical condition.
 - To completely overtake ventilation when initiating intermittent positive pressure ventilation (IPPV) using a mechanical ventilator.
 - To prevent reflex movement in delicate surgeries

Commonly used NMB

Atracurium

- Non-depolarizing
- Few cardiovascular effect, however histamine release when given rapidly and in larger doses may cause transient fall in blood pressure and increase in heart rate.
- Metabolized in plasma by the Hoffman elimination process (depend on body temperature and pH) and to a lesser extent by ester hydrolysis, and thus safer in hepatic/renal diseased patients
- Dogs and cats: 0.1 – 0.3 mg/kg IV
- Duration: 20 – 30 minutes

Pancuronium

- Non-depolarizing
- Excreted unchanged in urine so avoid use in renal diseased patients
- Vagolytic induced tachycardia
- Does not cause histamine release
- Dogs and cats: 0.02 – 0.1 mg/kg IV
- Duration: 30 – 60 minutes

The sequence of muscle group paralysis

- Muscles of face, jaw and tail > neck muscles and distal limbs > proximal limb muscles > muscles of the pharynx and larynx > abdominal muscles > intercostal muscles > diaphragm

Prerequisite for using neuromuscular blockers

- Available facility for administering intermittent positive pressure ventilation (IPPV)
- Animal must be adequately anesthetized for surgical and other noxious procedures

Techniques of relaxant anesthesia

- Muscle relaxant is commonly administered just prior to the start of surgery to best utilize the period of paralysis, IPPV is instituted as soon as relaxant takes effect
- In balanced anesthesia muscle relaxant is given as soon as at the time of induction to spare concurrent maintenance anesthetic drugs
- Muscle relaxant is usually given by slow IV injection using the indicated dosage.
- Under neuromuscular blockade, typical indices can not be used, as animals will be absent of jaw tone, palpebral reflex, limb withdrawal reflex, and breathing, and eyeballs remain central. However, animals may not be fully anesthetized and feel pain.
- Possible signs of awareness of pain in not fully anesthetized patient include tachycardia, hypersalivation, tear formation, curling of the tip of the tongue, pale mucous membrane and severe hypotension from pain, hypermetabolism manifested as increased end tidal CO₂.
- Animal's anesthetic depth should be deepened in these patient group by giving additional intravenous anesthetics (eg., thiopental, propofol), increasing vaporizer setting, or administering analgesics.

Monitoring neuromuscular blockade

- A peripheral nerve stimulator is commonly used to monitor the degree of neuromuscular blockade.
- A group of skeletal muscles will move in response to an electrical stimulus in a patient without neuromuscular blockade.
- In the presence of neuromuscular blockade the transmission of nerve impulses will not initiate the paralyzed muscles.
- Two electrodes are placed along the peripheral nerves such as ulnar, peroneal or facial nerve.
- **Train of four (TOF)** is the most commonly used method. Four impulses at every 0.5 seconds (2 Hz) are fired, and if the blockade is present and complete, there will be no muscle twitching. As the muscle blockade wanes, the twitches reappear. For surgical purposes, it is considered optimal if the fourth twitch is absent while the other twitches are present.
- The presence of spontaneous ventilation does not necessarily indicate that the animal has fully recovered from NMB.
- The chest movement may not be adequate and hypoventilation may occur due to residual blockade.
- Ventilation must be controlled or supported if there is a sign of cyanosis at this point. Alternatively reversal agent (**antiacetylcholinesterase**) can be given to reverse non-depolarizing agent with **edrophonium**, **neostigmine**, pyridostigmine, or physostigmine.
- Reversal agent (antiacetylcholinesterase) acts by inhibiting the enzyme acetylcholinesterase (Achase) which breaks down the Acetylcholine (Ach), thereby allowing more Ach at the neuromuscular synapses, restoring neuromuscular transmission. Side effects include bradycardia, hypersalivation, urination and defecation, and pre-treatment with anticholinergics (e.g., atropine, glycopyrrolate) will reduce the side effects.
- The action of non-depolarizing NMB must start to dissipate before effective reversal can be instituted.
- Premature reversal in completely blocked patient will be refractory, and it is recommended reversal is attempted following showing signs of partial recovery.

Cesarean section & anesthesia

Anesthetic goals

- Deliver viable newborns with minimal depression both to the mother and offspring
- Provide adequate analgesia or anesthesia to perform the operation
- Return the mother and newborn to their environment as quickly as possible.

Physiologic changes during parturition

- The mother have increased respiratory rate (hyperventilation) due to distress and pain
- Tidal volume could be decreased due to anterior displacement of the diaphragm by the gravid uterus
- Heart rate and cardiac output may be increased as a result of pain and catecholamine release
- Venous return could be decreased when placed dorsally due to compression of vena cava by the gravid uterus which will result in decreased cardiac output and hypotension

Specifics to C-section

- Greater blood loss than normal parturition
- All anesthetics cross the placenta to some degree and thus affect the newborn

Anesthetic techniques

- Placental transfer of drugs will depend on lipid solubility, molecular size, degree of protein binding, and concentration gradient across placental membrane
- Drugs that are highly protein bound do not readily cross the placenta
- Epidural anesthesia provides supplementary analgesia in addition to general anesthesia.
- Minimize use of drugs that will have a prolonged duration, greater degree of cardiovascular or respiratory depression.
- Use of neuroleptanalgesia and inhalation anesthesia maintenance can be quite useful
- Preanesthetic metoclopramide, cimetidine and anticholinergics are recommended to reduce the risk of regurgitation related complications
- Ultrashort acting injectable anesthetic agents such as thiopental (15 mg/kg IV titrate to effect) or propofol (6 mg/kg IV titrate to effect) may be used as the effect on the newborn is minimal, and patient maintained on inhalation anesthesia.
- Ketamine may be used in low dose (2-6 mg/kg) in combination with diazepam (0.2-0.5 mg/kg) intravenously for induction prior to inhalation anesthesia in dogs and cats.
- Xylazine, detomidine, medetomidine may be used in low dose to sedate animals (especially large animals), high dose of alpha 2 agonist may cause uterine contraction and uterine arterial constrictions, and therefore decrease blood flow and oxygen supply to the fetus.
- Specific alpha 2 antagonist can be utilized to reverse sedation both for the mother and the newborns.
- Opioids provide excellent analgesia but cross the placenta and affect the fetus.
- Antagonists will reverse opioid induced respiratory depression.
- Isoflurane and sevoflurane may be better choice than halothane due to better cardiovascular stability and quicker recovery so that the mother can quickly nurse the newborn
- All inhalation anesthetics cross the placenta and affect the fetus
- In cows paravertebral lumbar block or line block is routinely used for standing C-section
- In sheep, goats and sows local anesthetic techniques using line blocks or lumbo-sacral epidural blocks for standing or recumbent C-section are commonly utilized.

Management of newborns

- Deliver the fetus as quickly as possible
- Fetal oropharyngeal cavities must be cleaned to avoid any upper airway obstruction
- Opioid antagonist/alpha 2 antagonist should be administered to the newborn if agonists were included in the anesthetic protocol.
- Naloxone is preferred opioid antagonist and readily absorbed from mucous membrane by placing a drop or two in under the newborn's tongue.
- Analeptic such as doxapram can be used to stimulate respiration in the newborn administered sublingually.
- Vigorously rub the newborn to stimulate breathing and movement.
- Supplement with oxygen using face mask or in oxygen chamber.
- Atropine and glycopyrrolate can be given to treat severe bradycardia.
- The newborn must be kept warm and return to the mother to get nursed as soon as possible.