ANESTHESIA CONSIDERATIONS IN GLAUCOMA SURGERY

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• Pertinent ocular and orbital anatomy
• The glaucoma damaged optic nerve
• Pre-operative factors
• Modification of common methods of ocular anesthesia
• Considerations for specific procedures
Sectional Anatomy of the Eye

- Pupil
- Anterior cavity
- Posterior chamber
- Anterior chamber
- Cornea
- Iris
- Canal of Schlemm
- Ciliary body
- Ora serrata
- Suspensory ligaments
- Posterior cavity (Vitreous chamber)
COMPROMISED OPTIC NERVE

• Mechanical compression
  • Mass Effect
    • Retrobulbar hemorrhage
    • Hyaluronidase orbitopathy

• Perfusion
  • Compartment syndrome with local block
  • Optic nerve perfusion
    • Perfusion pressure/hypotension
    • Oxygenation
    • Oxygen carrying capacity

• Interruption of nerve transmission
  • RBB, sub-Tenons, infiltration
ANESTHETIC OBJECTIVES
GLAUCOMA SURGERY

• Anesthesia
  • Absence of pain/discomfort

• Amnesia
  • Absence of memory

• Akinesia
  • Absence of surgeon anxiety
• Communication
  • Pre-operative considerations
  • Intra-operative interventions
  • Post-operative requirements
Individualization Glaucoma Surgery

- Dictates anesthetic choices
- Physical requirements
  - Patient positioning
- Emotional requirements
  - Anxiety
- Surgeon requirements
  - Angle surgery
  - Patient movement
  - Reverse Trendelenberg position
  - "Open eye"
  - Valsalva, “bucking”
Systemic Medications

Glaucoma Surgery

• Anticoagulants
• Antiplatelet agents
  • Retrobulbar hemorrhage
  • Choroidal hemorrhage
  • Hyphema
  • Subconjunctival hemorrhage

“For more complex [non-cataract] surgery with a higher risk of bleeding, anticoagulants and antiplatelet agents may compromise surgical outcome and influence the choice of anesthesia. Currently, there is insufficient evidence to make anesthesia-specific recommendations regarding continuation or cessation of these drugs. Each patient and procedure should be treated on its own merits with multi-disciplinary input as required”.

Topical Medications
Glaucoma Surgery

- Beta blockers
  - Bradycardia/bronchospasm

- Alpha adrenergic agonists
  - Brimonidine crosses blood-brain barrier
  - Hypotension
  - Somnolence in children

- Acetazolamide (Oral CAI)
  - Hypokalemia
  - Metabolic acidosis

- Ecothiophate Iodide
  - Binds irreversibly to cholinesterase
  - D/C 6 weeks before GA with succinylcholine
  - Pralidoxime antidote
ANESTHETIC TECHNIQUES
GLAUCOMA SURGERY

- Sedation
- Topical
- Local
- General
  - Inhalational
  - Ketamine
SEDATION
GLAUCOMA SURGERY

- Fentanyl
  - Paradoxical reaction
  - Chest wall rigidity
- Midazolam
  - Disinhibition
- Propofol
**TOPICAL GLAUCOMA SURGERY**

- Proparacaine 0.5%
  - Amino ester, shorter acting

- Tetracaine 0.5%
  - Amino ester, longer acting

- Lidocaine liquid and gel

- Intracameral
  - 1% to 4% non-preserved lidocaine

- Shugarcaine
  - Preservative, bisulfite-free 1:1000 epinephrine
  - 4% non-preserved lidocaine
  - BSS plus to buffer
• Eye movement
  • Especially problematic with angle based procedures

• Photophobia

• May need repeated administration with longer procedure
LOCAL GLAUCOMA SURGERY

- **Retrobulbar block**
  - Shorter acting faster onset + longer acting slower onset
  - Orbital compartment syndrome in eye with compromised optic nerve

- **Peribulbar**

- **Sub-Tenon’s**
  - Prior to or during procedure

- **Agents**
  - Avoid epinephrine around optic nerve
  - Hyaluronidase orbitopathy
Local - Complications

- Brainstem Anesthesia
- Direct optic nerve injury
  - Hemorrhage/hematoma
- Globe perforation
- Retobulbar hemorrhage
• LMA/GET

• Maintain systemic blood pressure and optic nerve perfusion

• pCO2 concentration effect on choroidal venous pressure
  - A decrease in the partial pressure of CO₂ has been associated with decreased choroidal volume and lower IOP in adults under general anesthesia.

• Strategy to limit valsalva and bucking during emergence from anesthesia
PEDIATRIC GLAUCOMA

- GET/LMA
- Frequently bilateral
  - Break down room and rescrub
- Accurate IOP measurement
- Ketamine less IOP effect than sevoflurane
  - The Effects of Sevoflurane and Ketamine on Intraocular Pressure in Children During Examination Under Anesthesia.
  - Blumberg D, et al.
  - Develop consistent technique to measure IOP at repeated EUA
- Oculo-cardiac reflex
  - Bridle sutures
  - Tube shunts
  - Grasping muscles for angle procedures.
FILTERING PROCEDURES
TRABECULECTOMY/EXPRESS SHUNT

- Topical
  - Lidocaine gel
  - Proparacaine

- Intracameral
  - Discomfort from iris contact or PI
  - Non-preserved 1% - 4% lidocaine

- Sub-Tenon’s infiltration
  - Conjunctival incision
  - Non-preserved lidocaine
  - With conjunctival dissection
FILTERING PROCEDURES
TRABECULECTOMY/EXPRESS SHUNT

• Retrobulbar, peribulbar block
  • Infiltration may lead to loss of nerve transmission

• GET

• No evidence that type anesthesia type has effect on post-operative success or final IOP
TUBE SHUNT INSERTION

- Similar considerations as filtration surgery
- Posterior dissection with muscle manipulation
  - More with Baerveldt vs Ahmed
  - Oculo-cardiac reflex
  - Discomfort with tube insertion
SUPRACHOROIDAL HEMORRHAGE

- Intraoperative or perioperative
  - Rupture of atherosclerotic choroidal blood vessels
  - Pain, increased blood pressure, increased heart rate
- High IOP to very low IOP
  - Open eye during surgery then low post-op IOP after procedure
  - Older patients with atherosclerotic vascular disease

**SUPRACHOROIDAL HEMORRHAGE INTERVENTIONS**

- Control systemic blood pressure
  - Surrogate for fragile choroidal vessels

  “Uncontrolled hypertension may increase the risks of systemic and ophthalmic complications. However, there is insufficient evidence to support a specific value above which surgery should be deferred. Patients who are taking anti-hypertensive medication should continue their drugs up to and including the day of surgery. Rapidly lowering BP immediately prior to surgery is not advised”.

- Reverse trendelenberg positioning
- Slowly reduce IOP prior to surgery/incision
- Hyperventilation
  - Decrease pCO2 and choroidal blood volume
- Squeezing/bucking/coughing
ANGLE BASED PROCEDURES

• Trabecular meshwork and Schlemm’s canal
  • iStent
  • Hydrus
  • Trabectome
  • GATT
  • Ab interno canoplasty

• Suprachoroidal space
  • Cypass
    • Mild discomfort with insertion
    • Reported oculo-cardiac reflex
ANGLE BASED PROCEDURES

- InnFocus Micro Shunt
  - Subconjunctiva to anterior chamber

- Xen45 Gel Stent
  - Anterior chamber to subconjunctival space
    - Ab interno
Cyclodestructive Procedures

- Cyclocryotherapy
- Cyclophotocoagulation
- Endocyclophotocoagulation
  - ECP
  - Combination of sedation and RBB
  - SubTenon’s corticosteroid
COMBINED PROCEDURES

- Phaco +
  - iStent
  - Cypass
  - ECP
  - GATT
  - Trab/Express shunt
  - Tube insertion
- Avoid eye pressure after LA
  - No Honan Balloon or ocular massage after LA
COMBINED PROCEDURES

- Longer procedure time
- May require manipulation of patient/microscope position
POST-PROCEDURE PAIN CONTROL
GLAUCOMA SURGERY

- Most procedures have little to no post-operative pain
  - Cyclodestructive with most discomfort
  - Residual local anesthetic agent

- Pain as an indicator
  - Call if more than Tylenol or ibuprofen

- No routine prescription for opioid pain meds
• Pertinent ocular and orbital anatomy
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THANK YOU!

• Questions?