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STRABISMUS SURGERY

Surgical Specialty:	Ophthalmology
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Background:

- General Considerations
  - Most common pediatric eye surgery.
  - Early surgical correction (<10 months of age) has been advocated for the best outcomes.
    - The prognosis is good if corrected before eight years of life.[1]
  - Increased risk of postoperative nausea and vomiting (PONV).
    - Requires at least two prophylactic antiemetics, such as dexamethasone and ondansetron.[2]
  - Higher incidence of oculocardiac reflex(OCR) and oculorespiratory reflex (ORR).[1, 4]
  - The choice of anesthetic technique can alter the incidence of complications.
  - Multimodal pain management is recommended for perioperative analgesia.
  - Patients are usually discharged on the day of surgery.
    - PONV is a known factor resulting in delayed discharges as well as unexpected admissions.[4, 5]
- Patient Considerations
  - The majority of patients have strabismus as an isolated defect with no other anomalies.
    - A small percentage has risk factors like prematurity, family history, smoking during pregnancy, low birth weight, and cerebral palsy.[1, 3]
    - Other causes may include head trauma, tumor, infection, hydrocephalus, and cranial nerve palsy.
  - Very rarely associated with myopathy.
  - It can also be one of the clinical features associated with some syndromes.
- Associated Comorbidities/Syndromes
  - Craniofacial syndromes: Apert, Crouzon, Goldenhar, Moebius, Stickler syndrome.
  - Other Syndromes: Cri du chat, Downs, Fetal alcohol, Marfan, and Turner syndrome.
  - Based on the primary syndrome, the patient may have a difficult airway, cardiac abnormalities, and/or musculoskeletal anomalies.

Anesthetic Planning:

- Pre-Anesthetic Evaluation
  - A detailed pre-anesthetic evaluation, including optimization of comorbid conditions and abnormalities as mentioned above.
  - Additional labs/test/imaging is dependent on the primary cause of strabismus (if any) and may include CXR, PFTs, cardiac echocardiogram, etc.
  - Discussions to have with surgeon/family:
    - Possibility of unplanned admission secondary to uncontrolled PONV.
    - Potential difficult airway and its complications if the patient has any of the above-mentioned craniofacial syndromes.
    - The severity of OCR ranges from no hemodynamic instabilities to reduced arterial pressure, arrhythmia, asystole, and even cardiac arrest.
    - Peribulbar block by the surgeon (not commonly performed).

- Specific or Unique Room Set-up Requirements
  - Airway
    - General anesthesia with a supraglottic airway or endotracheal tube based on the airway risk of the patient.
    - Difficult airway equipment with additional anesthesia personnel in case of known or anticipated difficult airway.
  - Drugs/Infusions
    - Preoperative Anxiolysis – if needed:
      - Midazolam (0.25 – 0.75 mg/kg PO)
    - PONV:
      - Ondansetron (0.1-0.15mg/kg IV – max 4mg)
      - Dexamethasone (0.15mg/kg IV – max 8 mg)
      - Second-line antiemetics – Droperidol (25mcg/kg IV), Diphenhydramine (0.25-0.5 mg/kg)
      - Low-dose propofol infusion (10-25 mcg/kg/min)
      - Transdermal scopolamine patch in adolescent patients, preferably before induction of anesthesia.
    - Emergence Delirium Prophylaxis*:*
      - Dexmedetomidine (0.5mcg/kg IV)
    - OCR:
      - Anticholinergic prophylaxis is usually effective.
      - Atropine (10-20 mcg/kg IV) or Glycopyrrolate (10 mcg/kg IV)
    - Antibiotics: Usually not indicated.
  - Monitors
    - Standard American Society of Anesthesiologist monitors.
  - Blood Availability
    - Usually not required.
  - PICU Bed Availability
    - Not typically required unless indicated by existing co-morbidities.

Intraoperative Considerations:

- General
  - Absorption of topical vasoconstrictors used during surgery may result in elevated blood pressure, arrhythmia, and pulmonary edema.
  - Oculocardiac reflex (OCR) often results in sinus bradycardia and is relieved by immediate cessation of muscle traction, but ventricular arrhythmias, asystole, AV, and complete heart block have been reported.[1]
    - Hypercarbia, hypoxemia, light anesthesia, intraoperative use of rapid-acting opioids, and ketamine may potentiate OCR.
    - Peribulbar block is known to significantly reduce the incidence of OCR as well as PONV.
    - OCR may resolve spontaneously with the release of muscle traction, not requiring any pharmacological treatment.
    - OCR decreases with repeated stimulus.
    - Traction of extraocular muscles can also result in ORR.
  - Oculorespiratory reflex (ORR) may result in bradypnea, hypercarbia, and even respiratory arrest secondary to traction of extraocular muscle.[1]
- Induction
  - Usually, inhalational induction with sevoflurane in this age group unless otherwise contraindicated.
  - Avoid succinylcholine as it can delay the "Forced Duction Test" (FDT).
    - FDT is used by ophthalmologists right after induction to differentiate between restrictive vs. neurologic causes of strabismus.
    - Non-depolarizing muscle relaxants can be used safely as they do not interfere with FDT.
  - Avoid ketamine as it can result in nystagmus and interfere with the surgical procedure.
- Positioning
  - Supine with the bed frequently turned 90°.
- Maintenance
  - Inhalational or total intravenous anesthesia (TIVA) using propofol.
    - TIVA for maintenance reduces the incidence of PONV and emergence delirium but increases the incidence of OCR.
    - Minimal use of opioids to avoid PONV.
- Hemodynamic/Physiologic goals
  - Standard goals are used based on age and co-morbidities.
  - Minimize hypercarbia and hypoxemia to prevent potentiation of OCR.
  - Adequate hydration with intravenous crystalloids (15-30mL/kg) to prevent PONV.
- Surgical Considerations
  - Frequent communication with the surgeon regarding OCR and hemodynamic instability secondary to extraocular muscle traction.
  - Muscle relaxation is usually not required unless indicated for existing co-morbidities.
  - Minimal blood loss.
- Emergence/Disposition
  - Extubation - deep or awake as indicated by the degree of airway difficulty.

- Post-op Care
  - Multimodal analgesic regime including acetaminophen, Non-steroidal anti-inflammatory drugs, topical local anesthetic or regional block by the surgeon, and minimal use of opioids is recommended.
  - Continue aggressive hydration in PACU if not done in the OR to prevent PONV.
  - Ondansetron can be repeated every 4-8 hours for PONV.
  - Emergence delirium may occur.

Case-Specific Complications/Pitfalls

- PONV
  - Strabismus is a high-risk procedure for PONV.
  - Prevention with prophylactic medications and hydration should be the goal.[2, 4, 5]
  - Beware of black box warning for Droperidol as it prolongs QT interval.
  - Treatment with anticholinergics may also result in unwanted side effects like dry mouth, vision changes, sedation, and delayed gastric emptying.
- OCR
  - Severe arrhythmias and cardiac arrest can occur.
  - Prevention and timely resolution of bradycardia/arrhythmia is important.[5]
- ORR
  - Anticholinergics have no effect on ORR.[1]
- Unplanned Admission
  - May occur due to uncontrolled PONV requiring admission.

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