Out Patient Anesthesia in Children

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Selection Criteria

- ASA 1-2
- ASA 3-4
  - Medical condition is stable and well controlled
  - Appropriate resources in case of complications
  - Willing and able parents
  - Procedure with minimal physiologic derangements

The Child With a Runny Nose

- “although anesthesia is not good for the common cold, might it not be a good way of passing the time till the cold is gone?”
- Acute respiratory tract infections (RTI’s) are no longer a reason for automatic cancellation
  - Although there is an increased anesthetic risk most are minor and easily managed
  - Intubation increases risk

Cohen and Cameron: >20,000 children
  - 2-7 x increased risk of respiratory complications with URI
  - 11 x increased risk if they were intubated
  - Study criticized for incomplete documentation as to signs and symptoms of URI


Tait et al examined >1000 children for elective surgery. Risk factors for increased complications included:
  - Use of ETT in child < 5 yrs
  - H/O prematurity or RAD
  - Paternal smoking (?)
  - Airway surgery
  - Copious secretions and/or nasal congestion

The Child With a Runny Nose

- Parnis et al examining predictors of complications in 2051 patients found that the risk increased with:
  - ETT > LMA > mask airway
  - Parent’s report that child has a “cold”
  - H/o snoring, passive smoking
  - Presence of sputum and or nasal congestion
  - Induction with STP > halo > sevo > propofol
  - Non-reversal of muscle relaxant


The Child With a Runny Nose

- The increased risk associated with RTI’s seems to be minimal
  - No closed claims cases
  - There are a few cases of increased atelectasis
  - In Tait et al’s study of >1000 pts, 3 required admission post-op, 2 for pneumonia, 1 for stridor
  - One case report of death related to laryngospasm and cardiac arrest after extubation in a 15 month old child with a URI

Tait and Malviya. Anesthesia with Upper Respiratory Tract Infection, A&A 100, 2005

The Child With a Runny Nose

- 95% of RTI are viral—wide spectrum of species and respiratory tract involvement
- Hyper-reactivity of airways is common for several weeks
- Airways may be more sensitive to “irritants” (secretions, anesthetic agents etc.)

The Child With a Runny Nose

- Pulmonary function tests abnormalities are not uncommon, including ↓ FVC, FEV₁, and PEF
- ↓ Diffusion capacity and ↑ desaturation after apnea

The Child With a Runny Nose

- Consider child’s age, need for procedure, comorbidity, frequency of RTIs, family’s circumstances etc.
- Discuss increased incidence of adverse events with family
- Fever, mucupurulent cough, lethargy & signs of pulmonary involvement are indications to postpone surgery for at 3-4 weeks
The Child With a Runny Nose

Anesthetic Management
- Avoid irritants!!! (ETT, excessive secretions)
- Keep child well hydrated, consider humidification
- Consider anticholinergics
- Ensure adequate anesthetic depth before any airway manipulations
- Awake or deep extubation per practitioner’s preference

Premedication

Indications
- ↓ separation anxiety
- ↓ general anxiety
- Improve induction
- Minimize emotional trauma and post-operative behavioral changes

Premedication

Midazolam

Midazolam is the most commonly used premedication for children prior to surgery in the US
- Recent attention on pH, composition, and dosage of oral form

Côté et al.
- Comparison of 3 doses of commercially prepared oral midazolam
- 405 children ages 6 mos-16 yrs in a multi-institutional study
- They found dose as low as 0.25 mg/kg effective and blood levels 36% higher than expected

Midazolam

Composition of commercially prepared midazolam and pH may be factors
- Other studies have found that mixing IV midazolam with Syrpalt® syrup has a faster onset than commercially available midazolam
- Sodium citrate added to midazolam may speed onset of the medication

Midazolam

Midazolam exists as equilibrium between a water soluble and lipophilic form. The proportion of each is pH dependant. At a pH < than 2.5 the water soluble form predominates, at a pH > 4.5 the molecule exists almost entirely in the lipophilic form.
- The lipophilic form may increase oral mucosal absorption, thus decreasing first pass metabolism and increasing palms levels.
Midazolam

- Large doses of oral midazolam may prolong recovery after sevoflurane or desflurane anesthesia.
- Smaller doses of intranasal or transmucosal midazolam seem to be as effective.

Kain et al. and others have found a lower incidence of negative postoperative behaviors in children who received midazolam, 1-2 weeks after surgery and a lower incidence of EA, but at least one other study showed the opposite.

Other Premedication

Clonidine

- Fazi et al.
  - 134 patients children ages 4-12 for T&A
  - Clonidine 4ug/kg vs. midazolam 0.5mg/kg
  - Standardized anesthetic technique with desflurane and low dose morphine
  - Clonidine → pre-op anxiety compared to M and a higher incidence of postoperative pain and excitement.

Clonidine

- Nishina and Mikawa have done a series of studies showing:
  - Oral clonidine 4ug/kg to be superior to placebo.
  - May ↓ PONV in strabismus patients, after propofol anesthesia
  - May be as effective as IV fentanyl for providing analgesia after T&A

- Other studies have shown oral clonidine (4ug/kg) to be as effective as valium 0.2mg/kg
- Several studies have shown that there is a lower incidence of emergence agitation with clonidine.
### Ketamine

- Ketamine - 3-6mg/kg po is effective
- However side effects of oral ketamine are often unacceptable
  - Sedation, dysphoria, dizziness and hallucinations
- May be better when used in combination with midazolam

### Oral Transmucosal Fentanyl Citrate

- All studies have shown taste and form are more acceptable than oral midazolam
- But with a higher incidence of preoperative N&V
- Anxiolysis is similar

### Parental Presence at Induction

- Premedication is probably better for anxiolysis than PPIA in otherwise healthy children having minor surgery
- The combination of PPIA and midazolam has no additional benefits
- However parents want to be with their kids
- Parents are more satisfied feel less anxious if allowed PPIA

### The Studies of Kain et al.

- 93 ASA I-II pts, 2-8 yrs, outpt surgery
- Randomized to parents only in OR, midazolam 0.5mg/kg only, or neither
- Multiple anxiety scales and coping and temperament measures prior to intervention
- Lower anxiety at induction in midazolam group

### Dexmedetomidine

- 1ug/kg intranasal 20-60 minutes prior to induction in children <5
- Sleepy patient, but may still have anxiety with mask placement
- 2ug/kg intranasal in older children

Kain et al.

- 103 pts, 2-8 yrs, ASA I-II outpt surgery
- Randomized to midaz or midaz + PPIA
- Multiple anxiety scales and coping and temperament measures prior to interventions
- Anxiety and compliance scores were equal between the 2 groups, but parental satisfaction was higher

2000 Apr; 92(4): 939-46

PPIA

- If given a choice, the majority parents will choose PPIA, even if their child had minimal or no anxiety on a previous surgery
- PPIA is associated with ↑ HR and skin conductance level, but no EKG changes in the parents

Anesthesiology. 2003 Jan; 98(1): 58-64

Induction and Maintenance

- Halothane- cheap, "gold Standard" for > 30 years
- Increased cardiac depression and arrhythmias
- Least associated emergence agitation

- Isoflurane- cheap, long track record
- Deep extubation is comparable to sevo and halothane, ?↑ incidence of coughing and desaturation with awake extubation vs. halothane
- Less emergence agitation than desflurane

Induction and Maintenance

- Sevoflurane– great induction agent
- Minimal airway irritability
- Emergence agitation

- Desflurane- great for maintenance has the least hemodynamic effects
- Airway irritant
- Emergence Agitation

Studies have shown that for non-painful short procedures, 1ug fentanyl helps ↓ EA. For short painful procedures 2-3 ug/kg fentanyl helps ↓ EA. Pre-operative midazolam may also help

Induction and Maintenance

- Propofol has gained popularity, esp for strabismus surgery
  - Less PONV
  - Lower incidence (although frustratingly still not 0) of EA, esp after T&A
  - Not cheap, a little more labor intensive
  - Can be combined with remifentanil in varying doses to provide smoother emergence

Induction and Maintenance

- Combined general-regional techniques are very common
  - Caudal epidurals, ilioinguinal/iliohypogastric nerve blocks, dorsal penile nerve block are the most common
  - Blocks of the upper extremity and lower extremities are gaining popularity.
  - Most blocks are placed after the child is anesthetized.
  - Ultrasound has made this easier and more practical

CRASH 2013
Post-operative Pain Management

- Fentanyl can be used intra-nasally if no IV access. Blood levels appear to be equivalent to IV.
- Morphine 0.05-0.1 mg/kg
- Ketorolac 0.5 mg/kg IV, 1mg/kg IM max doses 30 and 60 mg respectively

Post-operative Pain Management

- Acetaminophen (A) up to 45 mg/kg p.r.
- Bolton et.al measured serum levels in 55 pts undergoing T&T, who received 40 mg/kg p.o. pre-operatively.
- Levels did not reach toxicity in any pts
- Efficacy, esp post discharge was deemed greater (although no control group)

PONV

- Eberhart et.al have developed a score to determine the risk of POV in children. Four independent factors were found:
  - Duration of surgery > 30 minutes, age ≥ 3yrs (and the risk increases with increasing age), strabismus surgery + h/o prior POV or a relative with a h/o POV

PONV--Treatment

- Keeping the patient well hydrated
- Don’t force oral intake
- Minimize use of volatile agents
- Medications
  - Dexamethasone has been shown to be anti-emetic in doses of 0.05-1mg/kg
  - Ondansetron, granisetron etc are all effective esp in combination with Dex

Respiratory Complications

- Perioperative respiratory complications occur in about 10-30% of patients in the peri-operative period
- Bronchospasm, laryngospasm, airway obstruction, oxygen desaturation and stridor are the most commonly seen complications
- Deep vs awake extubation is not implicated as a risk factor
Respiratory Complications

- Incidence ↑ with:
  - URI -- most studies
  - Trainees
  - ENT procedures
  - Passive smoking
  - Intubation without muscle relaxants
- The risk for laryngospasm is reported to be ~1.7 – 4.2%
  - Magnesium 15 mg/kg prevented laryngospasm in one study, although lidocaine 1.5mg/kg did not

Laryngospasm-Treatment

- 100% oxygen + Fink maneuver (painful jaw thrust)
- Positive pressure ventilation to PIP of 20cm H2O
- Propofol 0.8mg.kg has been shown to help in ~78% of patients
- Sux 10-20% of intubating dose

Selected References


Conclusion

- Presence of URI is not an automatic cancellation
- While premedication has many beneficial effects especially during induction and post-operatively, it may prolong emergence in selected patients
- Parents want to be with their children
- Sevo and des have many advantages over the older volatile agents, however both are associated with a high incidence of emergence agitation

Conclusion

- A new scale has been developed to help assess the risk of PONV in children
- Respiratory complications are fairly common, but easily treated