

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

Selection Criteria

- Older than 44 weeks PCA if full term
- Older than 60 weeks PCA if preemie
- OSA???
- Age
- Documentation of symptoms
- Co-morbidity
- Surgery

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 ↑ anesthetic risk most are minor and easily managed
- Intubation increases risk



Ellis. Anaesthesia 10:78-9, 1955

The Child With a Runny Nose

- 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



Tait et.al. Anesthesiology 95:299-305, 2001

The Child With a Runny Nose

- 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



Cohen and Cameron. Anesth Analg 72: 282-8 1991

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

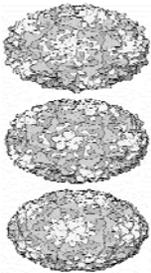
Parnis et.al Paed Anaesth 11:29-40,2001

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

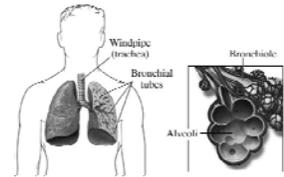
The Child With a Runny Nose



- 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

- Assessment:
 - History of "cold" by parents better predictor of laryngospasm than reliance on symptoms
 - Presence of sputum, nasal congestion and RAD ↑ incidence of adverse resp events
 - ✓ for fever, dyspnea, lethargy, wheezing, productive cough and lung field abnormalities
 - Labs, CXR, naso-pharyngeal swabs, rarely practical or helpful

The Child With a Runny Nose

- Consider child's age, need for procedure, co-morbidity, frequency of RTIs, family's circumstances etc.
- Discuss increased incidence of adverse events with family
- Fever, mucopurulent 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 is the most commonly used premedication for children prior to surgery in the US
- Recent attention on pH, composition, and dosage of oral form



Midazolam

- Coté 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

Anesth Analg 94:37-43, 2002

Midazolam

- Composition of commercially prepared midazolam and pH may be factors
- Other studies have found that mixing IV midazolam with Syrpalta® 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 plasma levels.

Midazolam

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



Anesth Analg. 2003 May;96(5):1320-4
Anesth Analg. 1999 Jul;89(1):75-9

Midazolam



- Midazolam may or may not decrease the incidence of emergence agitation
- Kain et.al and others have found a lower incidence of negative post operative 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

Anesth Analg. 1999 May; 88(5): 1042-7, Anesthesiology. 1999 Mar; 90(3): 758-65

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.

Anesth Anal 92: 56-61,2001

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

Clonidine

- 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

Ketamine



- 2 studies have found that adding either 1.8mg/kg or 3 mg to 0.5 mg/kg of midazolam provides better anxiolysis than either alone
- Side effects were minimal
- Emergence was not delayed
- There did not appear to be any long term (1 week) problems

Oral Transmucosal Fentanyl Citrate

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



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

A randomised comparison of two intranasal dexmedetomidine doses for premedication in children. Yuen VM, Hui TW, Irwin MG, Yao TJ, Chan L, Wong GL, Shahnaz Hasan M, Shariffuddin II. Anaesthesia. 2012 Nov;67(11):1210-6

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

Anesthesiology. 1998 Nov; 89(5): 1147-56

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

- | | |
|---|---|
| <ul style="list-style-type: none"> ■ Halothane- cheap, "gold Standard" for > 30 years ■ Increased cardiac depression and arrhythmias ■ Least associated emergence agitation | <ul style="list-style-type: none"> ■ 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

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Sevoflurane– great induction agent ■ Minimal airway irritability ■ Emergence agitation | <ul style="list-style-type: none"> ■ 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 remifentanyl in varying doses to provide smoother emergence

Post-operative Pain Management

- 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

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)

Bolton et.al. Paed Anaesth 12:29-35,2002

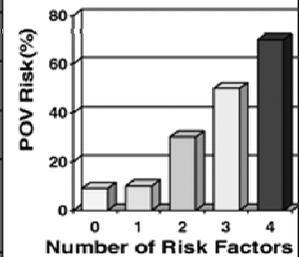


PONV

- 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

Eberhart et.al Anesth Analg 99: 1630-7,2004

Risk Factors	Points
Surgery ≥ 30 min.	1
Age ≥ 3 years	1
Strabismus surgery	1
History of POV or PONV in relatives	1
Sum =	0 . . . 4



- Gan, T. J. et al. Anesth Analg 2007;105:1615-1628

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

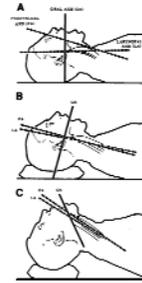
- Perioperative respiratory complications occur in about 10-30% of patients in the peri-operative period
- Bronchospasm, laryngospasm, airway obstruction, oxygen desaturation and stridor are the most commonly seen complications
- Deep vs awake extubation is not implicated as a risk factor

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

- Risk factors for laryngospasm in children during general anesthesia. Flick RP, Wilder RT, Pieper SF, van Koeveden K, Ellison KM, Marienau ME, Hanson AC, Schroeder DR, Sprung J. Paediatr Anaesth. 2008 Apr;18(4):289-96
- Screening by pulse CO-oximetry for environmental tobacco smoke exposure in preanesthetic children. Cardwell K, Pan Z, Boucher R, Zuk J, Friesen RH. Paediatr Anaesth. 2012 Sep;22(9):859-64
- Risk assessment for respiratory complications in paediatric anaesthesia: a prospective cohort study. von Ungern-Sternberg BS, Boda K, Chambers NA, Rebmann C, Johnson C, Sly PD, Habre W. Lancet. 2010 Sep 4;376(9743):773-83

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

