

Pediatric Patient Evaluation/Selection

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How do we deal with this??



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Plan and Assumptions

Focus on open airway anesthetics

Dentoalveolar surgical procedures

- Duration up to 45 minutes (planned)
- Extractions
- Canine expose and bond

Healthy patients (in general)

Differentiating healthy vs. non healthy



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What is a Pediatric Patient?

Age based

- Physiologic differences
 - Airway issues
 - Drug distribution/metabolism
 - Cardiac issues
- Psychologic differences
 - Ability to cooperate
 - Perioperative
 - Postoperative



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Office Preparation

Correctly sized equipment:

Masks, airways

AED correctly sized pads

Smaller IV catheters

Emergency drug dosing information



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Smart Tray



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Urgent IV access



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Distal Femur Site Identification - Pediatrics

- Secure the leg out-stretched
- Ensure the knee does not bend



EZ I/O



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ARROW® EZ-I/O® Needle Set Selection

Clinical judgment should be used to determine appropriate needle set selection based on patient weight, anatomy and tissue depth overlying the insertion site



15 mm
15 gauge
Indicated for patients
weighing 3-39 kg



25 mm
15 gauge
Indicated for patients
weighing 3 kg or
over



45 mm
15 gauge
Indicated for patients
weighing 40 kg or over,
excessive tissue depth

FLUSH

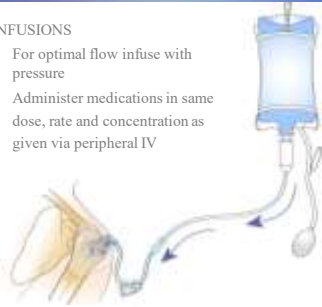
Adults: 5-10 mL

Infants/Children: 2-5 mL



INFUSIONS

- For optimal flow infuse with pressure
- Administer medications in same dose, rate and concentration as given via peripheral IV



MC-00655

Initial Assessment of the Pediatric Patient

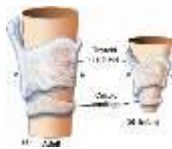
- Review of medical history
 - Via parents
- Activity level
 - Basic issues of cardio-pulmonary reserve



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Anatomy and assessment of the pediatric airway



Pediatric Anesthesia
page 1-8, 17-20, 2009 DOI: 10.1111/j.1469-9592.2009.03012.x
<http://onlinelibrary.wiley.com/doi/10.1111/j.1469-9592.2009.03012.x/fulltext>

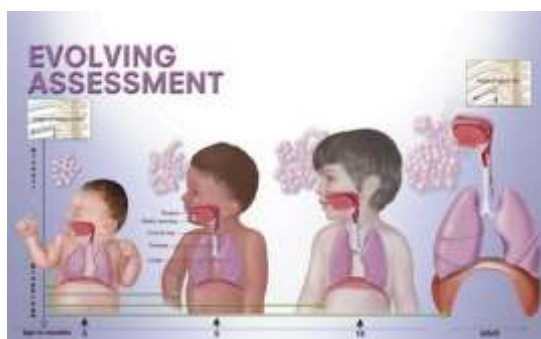
Initial Evaluation of the Pediatric Patient

- Physical assessment
- Body habitus
 - Include observation of arm for IV access
 - During obtaining of blood pressure
- Airway issues
 - Careful auscultation indicated
 - Stuffy nose=complicated anesthetic



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Seems Obvious BUT....

- Ability to open mouth
- Ability to flex/extend neck
- Presence of loose deciduous teeth



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Airway Obstruction During Anesthesia

Primarily soft tissue
Relaxation of the upper airway musculature
Level of soft palate and pharynx

Pay Close Attention to:

- Cough
 - Dry cough indicative of reactive airway
 - Productive cough: URI
- Airway sounds
- Hypernasal speech
- Nasal flaring during inspiration
- Obligate mouth breathing
 - Indicative of large tonsils/adenoids
 - May not be suitable for office anesthetic



Table 3

Perioperative Respiratory Adverse Events (PRAE)

Predictors	OR	95% CI	P value
Age (y)	0.96	0.94-0.98	0.0002
Sex (F vs M)	1.01	0.84-1.20	0.95
ASA physical status (II vs I)	1.80	1.47-2.20	0.0001
ASA physical status (III vs I)	2.37	1.86-3.03	<0.0001
Preexisting pulmonary disease	3.95	3.27-4.77	<0.0001
Preexisting neurologic disease	1.41	0.96-2.01	0.05
Morbid obesity	3.05	1.94-4.81	<0.0001
Surgery vs radiology	2.71	2.09-3.52	<0.0001

CI = confidence interval; F = female; M = male; OR = odds ratio.

Perioperative Respiratory Adverse Events in Pediatric Ambulatory Anesthesia: Development and Validation of a Risk Prediction Tool.

Subramanyam, Rajeev, MBBS, DNB, MHAAS, MD; Varmanan, Suresh, MBBS, PhD; Hosain, Mohamed; Annalakshmi, Arun, Vardhane, Arun, MD, MPH

Anesthesia & Analgesia, 122(5):1578-1585, May 2016. DOI: 10.1016/j.ana.2016.05.011

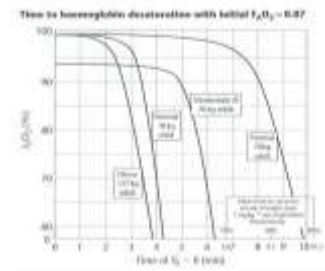


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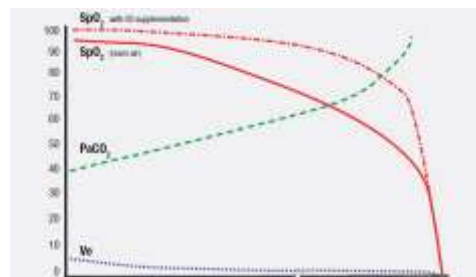
Do you have enough time ??



Benumof, 1998 Critical Hemoglobin Desaturation Will Occur before Return to an Unparalyzed State following 1mg/kg IV succinylcholine.

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CO₂ narcosis



Respiratory Emergencies: "Its always the airway"*

- Airway obstruction
- Laryngospasm
- Bronchospasm
- Emesis / Aspiration
- Respiratory Depression/Arrest
- Hyperventilation

*Bob Bosack



IS THERE ANYTHING ELSE BESIDES ASA AND MALLAMPATTI SCORE?

NARCO-SS

Better correlation of complications in pediatric anesthesia than ASA



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NARCO-SS

N	No neuro impairment	Mild cognitive disorder, controlled seizures	Severe cognitive impair, uncontrolled seizures, unresponsive
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NARCO-SS

	0	1	2
Airway	Normal airway anatomy, normal neck flexion	Possible ET difficulty but mask vent expected to be easy	Known difficulty with ET or mask vent, mand/max hypoplasia



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NARCO-SS

	0	1	2
Respiratory	No signs or symptoms of resp illness	Mild resp illness, current URI, Well controlled non active asthma	Steroid dep asthma, COPD, lower resp infect, +lung sounds auscultation



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NARCO-SS

	0	1	2
Cardiac	No cardiac disease	Corrected CHD, stable non sinus rhythm, controlled HTN, compensated CHF	Uncorrected/partially corrected CHD, CHF, req vasoactive drugs



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NARCO-SS

	0	1	2
Organ	No hepato-renal issues, born full term, no reflux	BMI>30, controlled endocrine dis, freq reflux, mild hepatic, renal dis, Mild coag defect	BMI>35, poorly controlled or active endocrine, hepatic, renal dis etc

NARCO-SS

SS: Surgical severity

A= minimally invasive, minimal blood loss

B= invasive diagnostic or therapeutic procedure, moderate blood loss, emergent procedure

C= major intrabdominal/thoracic procedure, anticipated excessive blood loss

NARCO-SS

Class I: total score 0-3 with no single >1,

low risk suitable for ambulatory procedure

Class II: total score 4-5, no single >1

moderate risk, may not be suitable for ambulatory. More intensive monitoring and observation in recovery

Class III: total score 6-8 or any category 2 or greater.

severe risk

NARCO-SS Conclusions

NARCO-SS showed greater discrimination for adverse events than ASA-PS scores

Poor calibration though amongst observers therefore NEITHER can predict adverse events

Least predictable: airway and neurologic

Udapa, et al Paediatr Anesth 2015, p 309

Other "Tools"

STBUR: sleep disordered breathing

- Snoring
- Trouble Breathing
- UnRefreshed sleep

PRAE increased 3 fold with one positive and 10 fold with all symptoms.

Better prediction than PSG

Cardiac Lesions and Risk

Low Risk:

Repaired ASD or VSD

Single valve stenosis

Mitral Regurgitation

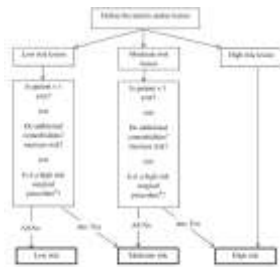
Moderate Risk:

Any conduction abnormality (WPW, long Qt)

Unrepaired ASD, VSD

Pulmonary HTN (severe risk if signs of HF)

Heart or lung transplant



*Considerable airway obstruction is clearly not shown. Considerable airway obstruction is suggested by the FEV1/FVC ratio being less than 0.8. Considerable airway obstruction is clearly shown.

*High risk of persistent obstructive disease. Considerable airway obstruction is suggested by the FEV1/FVC ratio being less than 0.6.

Journal of Clinical Anesthesia, Volume 35, 2015, 479-484



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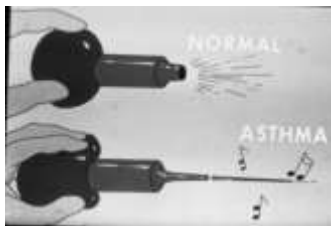
Asthma

Syndrome of reversible airway obstruction



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Airway Effect of Asthma

Bronchospasm
Mucosal edema
Increased luminal secretions

Asthma: triple threat



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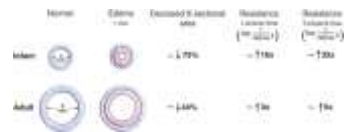
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Asthma

Increased incidence of significant bronchospasm for 2-4 weeks following upper respiratory infection

- In intubated patients



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Treatment of Acute Asthma

Beta agonist inhalers
Epinephrine
Steroids

Response to Epinephrine

Clearing of wheezing
Reduction of expiratory effort
Decreased respiratory rate



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Asthmatic Triad

Nasal polyps
Sinusitis
Aspirin allergy

- 2-12% of asthmatics are aspirin allergic
- Some pediatricians recommend no ASA for asthma patients
- If no ASA then no NSAID's

Drug Effects in Children



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Factors affecting drug activity: increased profundity

- ↑ Increased Cardiac output
- ↓ Decreased plasma proteins
Redistribution to inactive spaces



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Factors affecting drug activity: decreased profundity

- ↑ Increased Vd



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Pediatric Medical Conditions Affecting Intravenous Anesthesia

Asthma

- Optimize preoperatively
- Consider bronchodilators
- Consider steroids

Diabetes

- Child diabetics can be more brittle
- Caution with hypoglycemia during anesthesia

Oncologic conditions

- Pulmonary evaluation with methotrexate, bleomycin
- Cardiac evaluation (esp with RT; e.g. lymphoma)
- Possible coagulopathies



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Anesthetic Agents to Consider

Benzodiazepine

- Midazolam

Ketamine

Propofol

Opioids

- Fentanyl
- Meperidine

Inhalational agents

- Risk of MH with potent agents



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Pediatric Medical Conditions Affecting Intravenous Anesthesia

Seizure disorders

- Caution with ketamine and narcotics



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Pediatric Use of Midazolam

Redistribution of drug similar to adults

Clearance rate is faster

Terminal elimination is shorter or the same as in adults



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Midazolam

Consider anxiolytic doses only

- 0.10 mg/kg
- Paradoxical responses without concomitant opioid (15-20%)

Higher doses associated with increased reactivity

Useful in combination with ketamine, Propofol and/or narcotic

Elimination half life is much shorter in children

- 1.2 hrs vs 1.7-4 hrs

Mild negative inotrope

- Insignificant in absence of cardiac disease

Pediatric Intravenous Midazolam

Younger children need higher mg/kg doses

- < 5 years 0.6 mg/kg to total of 6 mg max
- 5-12 years 0.05-0.1mg/kg
- 12 years and older 0.01-0.05 mg/kg to maximum 10 mg

Onset is 2-5 minutes

Give additional doses after 10 minutes prn



Narcotics for Pediatric Intravenous Sedation

By 2 months of age clearance rate equals that of adults

Meperidine

- Concern with asthma patient
- Longer duration of action than fentanyl
- Antisialagogue activity may be useful with ketamine

Fentanyl

- Shorter duration of action (15-20 min)
- No cases of stiff chest with sedative doses
- 1 ug/kg doses

Pediatric Fentanyl Usage

< 6 years 0.3 to 1.5 ug/kg

> 6 years 1 ug/kg

Repeat doses every one hour

Duration of action 30-45 minutes in children



Pediatric Propofol Usage

No difference in recovery based on sex

- In adults Females recover quicker
- 10% lower plasma level with equivalent weight dosage

Base dose on actual weight (not ideal)

Egg allergy patients?

- Egg allergy: ovalbumin, ovomucoid, conalbumin (not found in lecithin)
- Only 2% of pediatric patients with egg allergies showed allergic response
- No cases of anaphylaxis

Soy allergy patients?

- Soya oil is refined, i.e. no soy proteins are present

Pediatric Propofol Usage

Dose:

- Infants and young children
 - 2mg/kg bolus followed by 1 mg/kg
- Children to teenagers
 - 0.5mg/kg to 1 mg/kg bolus followed by 0.5 mg/kg



Propofol

Most commonly used IV induction agent in children
Excellent in combination with narcotics
Also good combination with Ketamine
Avoid "prolonged" sedation in children under 12

Ketamine

1-2 mg/kg IV dose
10-15 minutes of dissociative anesthesia within seconds

- Repeated doses 20-30 minutes

Dreams and hallucinations

- 5-10% prepubescent children
- 15-30% of older patients
- Pretreat with midazolam

Contraindications

- Preop URI
- Increased intracranial pressures
- Caution with seizure disorders and psychiatric issues

Ketamine

Delay to discharge
Nausea/Vomiting

- Esp children >10 years of age
- Consider Ondansetron
- Dexamethasone

Recent studies fail to demonstrate hypersalivation
Emergence phenomenon

- 2% in cases of sole agent use (requiring transient physical restraint)
- Relative contraindication with psychiatric disease

Post Operative Nausea and Vomiting

40-50% of all pediatric general anesthetics
Increased incidence with nitrous oxide
Pre treatment with antiemetics

- Serotonin antagonists (ondansetron, dolasetron)
- Additive effect with dexamethasone
- IV metoclopramide

Home: try diphenhydramine (Benadryl)

Combination of Agents

Study of Ketamine and Propofol:

- 14% decreased adverse events
- 35% decrease in oxygen desaturation requiring PPV
- 9% decrease in PONV

Combination Drug Studies

Ketamine and Midazolam vs. Ketamine and Fentanyl

- 6% hypoxia vs. 24%
- 10% supplemental oxygen vs. 20%
- 9% PONV vs. 2%
- 14 min longer recovery time

Ketamine/Midazolam vs. Propofol/Fentanyl

- 7% desaturation vs. 31%
- 2% respiratory maneuvers vs 25%

Ketamine/Propofol vs. Ketamine alone

- Less PONV

Ketamine/Propofol vs. Propofol alone

- Less respiratory issues, less hypotension

Avoiding Oversedation

Academy of Pediatrics: Committee on Drugs

Preoperative medical evaluation and focused airway assessment
Appropriate interval of fasting
Sedative medications given under supervision (i.e. not at home) and by trained personnel
Must be trained in pediatric airway and CPR protocols
Age and size appropriate emergency medications and equipment are on hand
Continuous monitoring (pulse oximetry, ET CO₂)
A trained individual who's only responsibility is monitoring and recording vital signs
Specific discharge criteria

Conclusions

Intravenous access is more difficult in the child
Consider adjuncts

- EMLA cream
- Oral sedation
- I.M./intranasal

Consider combination of Ketamine and Propofol

- My regimen
 - Low dose midazolam (1-2 mg)
 - 0.5 mg/kg IV ketamine (subdissociative dose)
 - 10-20 mg boluses of propofol

Consider avoiding narcotics
Consider minimizing midazolam



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