Pediatric Airway Emergencies

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Pediatric Airway Management

- Relevance of airway emergencies
- Case Based Review
- Pediatric Airway Assessment
- Laryngospasm: Prevention and Treatment
- Difficult Airway Adjuvants
- Case Report Conclusion
ASA Closed Claims

532 Pediatric Closed Claims reviewed from 1973-2000

1970-1980: Respiratory Complications made up 50% of Closed Claims

1990 to 2000: Respiratory Complications decreased to 23%

Why? Decrease in claims related to inadequate ventilation and oxygenation
Formally published by the ASA in October of 1986
Laryngospasm the most common precipitating event (37 cases)

Difficult Intubation...........?
POCA: 80 North American Institutions

397 Arrests reported

193 related to anesthesia

Initial Findings 1994-1997
Medicine related causes were most common cause of arrest (often Cardiovascular depression from Halothane)
Respiratory Events: 27%

Laryngospasm: 11 cases

6 on emergence, 1 on transport to PACU

No deaths

3 cases of negative pressure pulmonary edema
Houston we have a problem....
3 y.o. girl with tongue swelling and stridor apparent anaphylaxis
Pediatric Airway Assessment
Adults vs Children

- Large tongue
- Larynx often appears more anterior
- Vocal cord attachments
- Epiglottis Shape
- Head Size
- Effects of Age

Saturday, October 25, 14
Physical Exam

- Ascultation
- Presence of nasal flaring
- Respiratory Rate
- Loose or missing teeth
- Size of the mouth and opening ability
History vs. Physical Exam

- Cough, Cold, Pneumonia history
- Anesthetic History
- Atopy or Allergies
- Asthma History
- Sleeping position and breathing habits
- Feeding Habits
- Syndromes
ER Stat

- 3 y.o. female, 11 kg; NKDA
- No IV access
- Received IM Dexamethasone on arrival
- VS: HR 121; NIBP 104/62; O2 Saturation 99%
- NPO?
- Trisomy 21
PMH

- Cardiac: Small secundum ASD, normal RV and LV fxn, trivial Tricuspid valve regurgitation
- Surgical hx: Myringotomy tubes at 2 y.o.
- Interval history
Trisomy 21

- Most common chromosomal defect
- Present in 1 in every 600-800 births
- Cervical Spine Instability
- Macroglossia
- Smaller tracheal caliber
- Cardiac Defects
- Prone to Bradycardia
Anterior Atlantodental Interval

Anatomy Review
Cervical Spine Considerations in Trisomy 21

**Anatomy Review:**

- Atlas (C1) and Axis (C2) is designed to facilitate flexion and extension
- Motion of the Occiput and C1 is extension (15-20 degrees)
- Large Funnel Shaped Canal from Foramen Magnum to C2 which minimized chord compression
- 1/3 CSF, 1/3 Spinal Chord, 1/3 Odontoid process of C2
Anterior Atlantodental Interval
Perioperative Screening?

- Special Olympics requires plain films prior to participation

- American Association of Pediatrics recommends screening between 3 and 5 years of age

- Incidence?

- Best assessment?
Obstructive Sleep Apnea

- Habitual Snoring occurs in about 10% of school age children

- 2-3% or 1 out of every 3-5 who snore have OSA

- Obesity may be changing this ratio

- Symptoms

- Treatment

- Anesthetic Implications?
OSA and Opiates

- Increased risk for respiratory complications
- Careful observation with premedication
- Prepare to support ventilation on induction
- Lower Opiate requirement
Opiate Sensitivity and OSA

- Animal studies

- Brown et al.: 22 children divided into 2 groups
  - Based on oxygen saturation nadir on sleep study
  - Blinded administration of Morphine either 0.05mg/kg or a derived dose
  - Morphine titrated in the PACU based on pain score
  - Children with OSA required a 50% reduction in analgesic dosing
• Identifying patients to be admitted
• Consider regional anesthesia
• Non Opiod Analgesics
• Removal of Codeine from use
Environmental Tobacco Exposure

- WHO estimates 57% exposure rate in children
- 15% mainstream smoke/85% side stream smoke
- Total deposition of toxins may be 50% greater than in adults
- 3 to 5 times more likely to experience complications

ETT vs. LMA

- ETT vs. LMA with an active or recent URI
  - 82 pts (ages 3 m.o. to 16 y.o.) presenting with a URI
  - Randomly assigned to LMA vs ETT
  - No Difference in cough, breath holding, excessive secretions, or arrhythmia.
  - One pt in the ETT arm received Succ. for laryngospasm, otherwise overall incidence was similar
  - Greater incidence of mild bronchospasm, major oxygen desaturations, total number of adverse events in ETT arm
Adenotonsillectomy

ETT or LMA?

- Advantages of LMA?
  - No need for NMB
  - Can be placed lighter
  - Protect the glottis from secretions
  - Less stimulating to trachea
Adenotonsillectomy

ETT or LMA?

- Advantages of ETT?
  - Mouth gag
  - Resection quality
  - Inability to evacuate the stomach
  - Cost?
Adenotonsillectomy

ETT or LMA?


131 Children (60 to LMA vs. 71 to ETT)

Laryngospasm

Time to Extubation

Conversion
LMA Inflation

Seet et al., 2010.

Pharyngolaryngeal adverse events

200 patients

Mean cuff Pressure?
LMA Cuff Pressure and Seal

Licina et al, 2008
- Studied 200 Children
- Inflated to clinical endpoints
- Then reduced to 60 cmH2O
- Median initial cuff pressure?
- Reduction in leak?
No Manometry?

*Briacombe et all, 1999*

- 20 Adult Cadavers
- Assessing gag placement on seal quality
- Passage of water from mouth to trachea
- 12cm/H20 yielded a 5% aspiration rate
Laryngospasm

- Protective Mechanism
- If persistent can lead to bad things
- Self Limiting
- Patient Factors

- Anesthetic Factors
Prevention

- Anticholinergics
- Nitroglycerin and Magnesium
- Lidocaine?
  - 2% Lido Gel
  - Mixed Data on IV Lidocaine
Lidocaine

- Baraka et al. Anesthesia & Analgesia 1978
  - 40 T&A's, 20 received 2mk/kg Lidocaine
  - Decreased incidence of Laryngospasm (0% vs 25%)

- Lecht et al. Anesthesia & Analgesia 1985
Baetra et al. Paediatric Anesthesia 2005

- 120 Children undergoing T&A
- Assigned to 0.5mg/kg Propofol vs placebo
- Extubated 60 seconds after drug administration
- Laryngospasm in 20% of the control group and 6% in the Propofol group

- 70 Healthy children randomized to extubation awake vs asleep (2% ET Sevo)

- Cough, hypersalivation, and ETT displacement occurred more frequently in the awake group

- Upper Airway obstruction occurred more frequently in the deep group (68.6% vs. 31.4%)

- UA obstruction easily resolved with chin lift
Deep Extubation

- Meticulous suctioning
- Adequate spontaneous ventilation
- Oropharyngeal Airway
- PACU consideration
“No Touch” Technique

- 2004 Tsui et al. Anesthesia & Analgesia
- 20 T&As
- Lateral positioning following surgery
- Pt allowed to waken with no stimulation
- ETT removed when eyes open
- No incidence of Laryngospasm
TREATMENT FOR LARYNGOSPASM

- Call for Help
- Remove the stimulus
- Improve Obstruction
- Positive Pressure Ventilation
- “Laryngospasm Notch”
- Pharmacological Treatment
**Laryngospasm Notch**

- Apply intense pressure to the notch while lifting at a 90 degree angle
- Forward displaces the Mandible
- Causes intense pain
Pharmacological Intervention

- Propofol
  - 0.25-0.8 mg/kg has been shown effective in treating 77% of cases (Afshan et al)
  - Best choice when Succ should be avoided

- Succinylcholine
  - Gold Standard
IM Rocuronium


• 45 unpremedicated patients in 2 phases, both anesthetized to a “light plane” with Halothane and Nitrous.

• First 25 patients to determine dosing based on twitch suppression

• Second 20 patients given “optimal dose” and time to optimal intubating conditions was measured
• Results

• Deltoid injections achieved a faster onset (all patients developed 50% twitch suppression at 3.2 min in children vs. 2.8 min in Infants.

• Doses determined were 1 mg/kg in infants and 1.8 mg/kg in Children

• Phase 2: Good to excellent intubating conditions were achieved at 2.5 min in infants and 3 min in children

• Discussion: Adductor Pollicis vs. Vocal chords, Pain on injection, Duration
HAVE A PLAN

- Call for help
- Improve Obstruction
- Positive Pressure Ventilation/Laryngospasm Notch
- Propofol
- Low Dose Succ
- Succ and Atropine
Back to the ER

- IV Placed
- Neck Films acquired
- ORL consulted
- Transported to Children's Hospital
ASA Difficult Airway Algorithm

- Multiple Devices
- Anticipate difficulty before it arrives
- Do what you do best
- If suspicious secure airway awake
- Have an exit strategy
The Difficult Intubation

- Induction Technique
- Device Selection
- Back up plan
## Airway Techniques

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<td>Laryngeal Masks</td>
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<td>Specialty Blades</td>
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<td>Digital</td>
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**Combined Techniques**
Induction Techniques

- Preserve ventilation
- Awake but sedated
- Mask Induction
- Ketamine
- Dexmedetomidine
- Topical Lido
Combined LMA and Fiberoptic
Difficult Airway Conclusion

- Admitted from ER directly to OR with ORL available
- Plan to secure airway, perform flexible bronchoscopy and Esophagoscopy
- Glyco 5mcg/kg IV
- IV induction with Dex (1.5 mg/kg over 10 min?)
- Failed Fibroptic
- Mask Sevo/O2
- ORL performed nasal flexed bronch and intubated
Conclusion

- Caustic Injury to tongue and oropharynx from fertilizer that had spread to the driveway

- Intubated for 3 days in the ICU due to soughing of tongue tissue

- Extubated on POD #4

- Discharged POD#6
Acknowledgments

- Pete Kovatsis MD and Janet Valicente CRNA

Questions?????????????
References


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