

Pediatric Airway and Respiratory Emergencies

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Objectives

- Review the anatomical differences between adult and pediatric airways
- Recognize different causes of respiratory compromise in pediatric patients and their treatments
- Discuss the approach of establishing emergent airway in pediatric patient

Pediatric Airway Differences

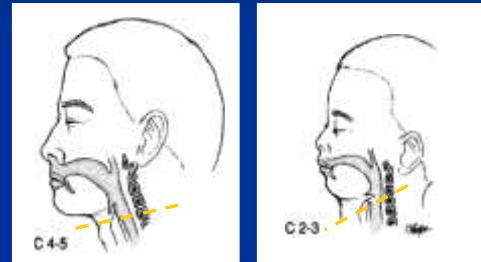
- Large head
 - Prone to flexion/obstruction when supine
 - May need to place towels/padding beneath torso to account for big head & maintain c-spine
- Large tongue for size of mouth
 - Obstruction
 - Difficult to get out of the way when intubating



Pediatric Airway Differences

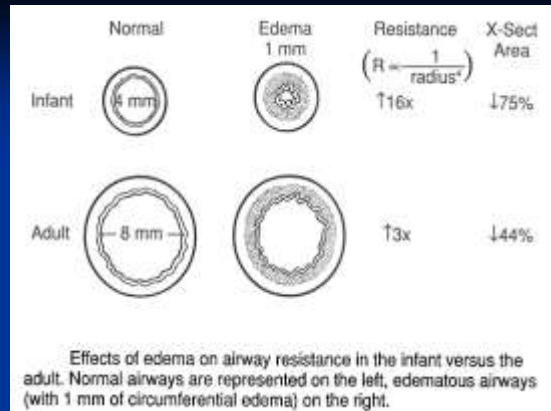
- Nose breathers/small nares
 - Infants are primarily a nasal breather, thus any obstruction of the nasopharynx results in significant increase in WOB
- Larynx
 - More anterior and cephalad
 - High position
 - Infant: C 1
 - 6 months: C 3
 - Adult: C 5-6
 - Narrowest part is cricoid cartilage below cords (adult, glottis)
 - Smaller tidal volumes

Children are different



Anatomy

- The pediatric airway is much smaller than that of the adult, therefore small amounts of edema or obstruction can significantly reduce the diameter and increase resistance.



Respiratory Distress

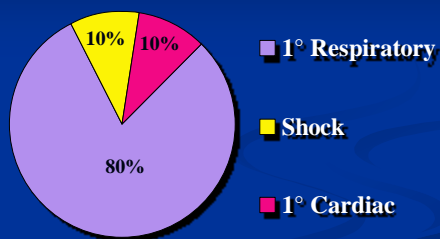
- Cough
- Increased RR
- Difficulty with bottle feeding
 - dyspnea w/exertion
- Use of accessory muscles
 - Nasal flaring
 - Retractions
 - Paradoxical abd breathing
- Cyanosis



Work of Breathing

- In infants and young children, respiratory movement is more noticeable in the abdominal region, because:
 - intercostal muscles are relatively weak,
 - ribs are horizontally aligned, extremely compliant and cannot adequately support lung expansion;
 - Thus, infants and young children rely on diaphragmatic contraction to pull air into the lungs (“belly breathing”).
- As the child grows older, the ribs become less flexible and the chest muscles strengthen, so that chest expansion rather than abdominal expansion is more noticeable.

Pediatric Cardiopulmonary Arrests



Stridor

- A 2 y.o. girl presents w/ stridor, fever and marked increased WOB
- URI symptoms and sore throat for past 4-5 days
- Has not wanted to drink for past 6 hours
- PMHx:
 - Full term. No prior hospitalizations/surgeries
 - Immunizations: UTD

- PE: T=40.2 HR=150 RR=42 Pox=90% RA
- Markedly anxious
- Muffled voice
- Stiff neck
- Mild inspiratory stridor
- Moderate tracheal tug
- Lungs are clear

Differential of Stridor

- Infection
- Foreign Body
- Laryngomalacia/Tracheomalacia
- less common causes:
 - vocal cord paresis,
 - subglottic hemangioma,
 - causes rapidly progressing stridor, sometimes associated with a facial hemangioma
 - vascular ring, vascular sling, fixed mediastinal mass

Retropharyngeal abscess



Retropharyngeal abscess



Retropharyngeal abscess

- Patients younger than 3 years
 - Older patients with hx of penetrating injury to posterior oropharynx
- Organisms:
 - Group A Beta-hemolytic Strept
 - Staph
 - anaerobes

Retropharyngeal abscess

- Treatment
 - Severe airway obstruction
 - Buy time with racemic epi neb
 - Intubate via direct visualization (avoid abscess rupture)
 - Operative drainage of abscess
 - Clindamycin or Unasyn

Stridor

- A 6 m.o presents w/ stridor, increased WOB, nasal discharge and tactile fever
- URI symptoms started prior to bedtime
- PMHx:
 - Full term. No prior hospitalizations/surgeries
 - Immunizations: UTD

- PE: T=38.2 HR=150 RR=42 Po₂=90% RA
- Intermittent barking cough
- No drooling
- Severe inspiratory stridor at rest
- Moderate tracheal tug and retractions
- Lungs are clear



Croup

- Accounts for over 90% of stridor with fever
- Subglottic stenosis secondary to edematous, inflamed mucosa
- Most commonly caused by parainfluenza >>> RSV, adenovirus, and influenza

Croup

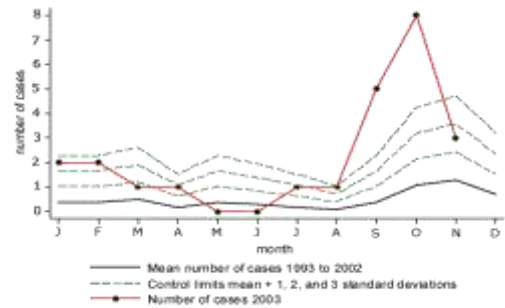
- Treatment:
 - Mild-Barky cough, no stridor at rest
 - Decadron: standard dose 0.6mg/kg (max 8mg)
 - Studies have shown as doses as low as 0.2 mg/kg are just as affective
 - No studies have shown benefit from 2nd dose
 - Cool mist-no study to show this is beneficial
 - Severe-Stridor at rest and/or severe distress
 - Racemic epinephrine(0.5 ml of 0.25% solution dissolved in 2.5ml of NS)-may repeat as needed
 - Heliox-Use limited by hypoxia

Epiglottitis vs Croup

Stridor	Quiet	Loud/Wet
Toxicity	+++	—
Fever	+++	+
Dysphagia	+	—
Barky Cough	—	++
Voice	Muffled	Hoarse
Age	2-7 yrs	3 mo-5yrs
Frequency	Very rare	>90% of stridor w/fever

Bacterial Tracheitis

- Infection of subglottic region
- Same age group as croup patients
- Toxic appearance compared to usual croup patient
- Prolonged course of croup that is not getting better
- Organisms:
Staph>Strept>H.influenzae>pneumococcus



Bacterial Tracheitis

- Can quickly progress to full airway obstruction
- Airway management best done in OR
- When intubating see:
 - Normal epiglottis
 - Subglottic pus, inflammation and/or pseudomembrane
- Treatment:
 - Broad spectrum abx (ceftriaxone).

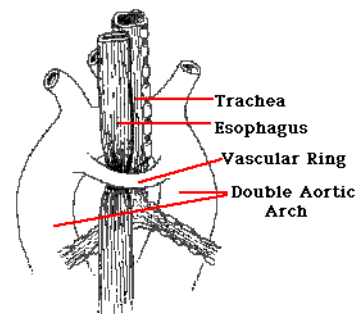
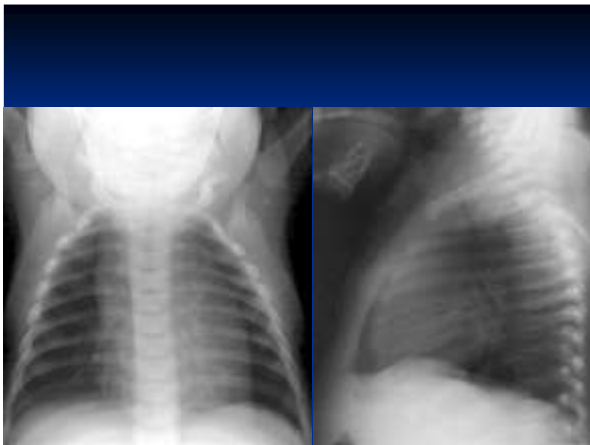
Stridor

- A 5-month-old girl presented with biphasic stridor (ie, stridor present during inspiration and expiration).
- “always been noisy breather”
- URI symptoms for past 2 days
- PMHx:
 - Feeding difficulties since birth w/ frequent vomiting
 - RAD diagnosed by family doctor and treatment with bronchodilators, inhaled corticosteroids and courses of oral steroids were prescribed in past.
 - Admitted for bronchiolitis at 3 months of age.
 - There was no other significant perinatal or other medical history.

- PE: T=37.2 HR=150 RR=42 P_ox=92% RA
- Biphasic stridor
- Mild tracheal tug and chest wall recession.
- Lungs are clear

Work-up

- When **biphasic stridor** is detected in an infant, CXR is indicated as first diagnostic test
- The CXR may show a right-sided aortic arch, a poorly visualized distal trachea, or another cause for tracheal compression or deviation (e.g., a mediastinal mass)
- Barium swallow may be need to look for abnormal indentations on the posterior esophageal wall. If these abnormalities are detected, referral for more detailed investigations (including bronchoscopy and magnetic resonance angiography)



Vascular Ring - The esophagus and trachea are both compressed by the vascular ring made by malformation of the brachial arch vessels.

Laryngomalacia

- Most common cause of neonatal inspiratory stridor
- Commonly occurs after several weeks of age
- Usually limited to inspiration and varies with posture and airflow
 - Louder when crying
 - Improves when in prone position
- Unlikely cause of biphasic stridor from birth, unless it is very severe
- Gradually resolve w/out treatment by 12 to 18 months of age

Oral airways

- Avoid oral airway in the patient that is not unconscious...the patient will puke, aspirate, then you'll have a huge mess on your hands



Nasal airways



- Nasal airways should be avoided if there is significant amt of facial trauma/midface fracture

Bag Valve Mask Ventilation

- The proper facemask size is selected to provide an airtight seal. The mask should extend from the bridge of the nose to the cleft of the chin, enveloping the nose and mouth but avoiding compression of the eyes.



Proper area of the face for face mask application. Note that no pressure is applied to the eyes.

Intubation: Indications

- Failure to oxygenate
- Failure to remove CO₂
- Increased WOB
- Neuromuscular weakness
- CNS failure
- Cardiovascular failure

Intubation Preparation

- Have Available:
 - O₂...preoxygenate w/ 100% oxygen
 - Sxn...emesis likely, increased secretions
 - Laryngoscope
 - ET Tubes (size above & below)
 - ET CO₂ detector
 - Broslow tape will help w/ sizes, doses, etc.
 - TAPE!!!!!!

Endotracheal Intubation



- Have correct size tube available
 - BROSLOW TAPE
 - ETT size = $\frac{16 + \text{age}}{4}$
 - Depth = ETT size x 3

The Endotracheal Tube (ETT)

- < 8 years old - The normal anatomic narrowing at the cricoid cartilage provides a functional “cuff.”
- > 8 years old - A cuffed ETT with an audible air leak at 20 - 30 cm water is appropriate.
- PALS now says can use cuffed ETT for any age

The Laryngoscope

- Newborn – Miller 0
- 1 month to toddler – Miller 1
- 18 months - 8 years – Miller 2, Macintosh 2
- > 8 years – Macintosh 3

Preparation for Intubation

- All equipment should be prepared and checked for function.
- Intubation attempts should last 30 seconds or less since the infant’s or child’s small lung volumes and high oxygen requirements rapidly deplete oxygen reserves.

Pre-Medication/Induction

- *Never sedate or paralyze a patient who you may not be able to ventilate!*

RSI

- | | |
|--|---|
| <ul style="list-style-type: none"> ■ Vecuronium (defasciculating dose): 0.01 mg/Kg ■ Atropine: 0.02 mg/Kg (min 0.1 mg, max 1 mg) ■ Midazolam: 0.1 mg/Kg ■ Succinylcholine: 1 mg/Kg | <ul style="list-style-type: none"> ■ Atropine: 0.02 mg/Kg (min 0.1 mg, max 1 mg) ■ Etomidate: 0.4 mg/Kg ■ Rocuronium: 1mg/kg |
|--|---|

Suspected Head Trauma

- Lidocaine: 1 mg/Kg
- Thiopental: 4 mg/Kg
- Neuromuscular blocker of choice

Asthma

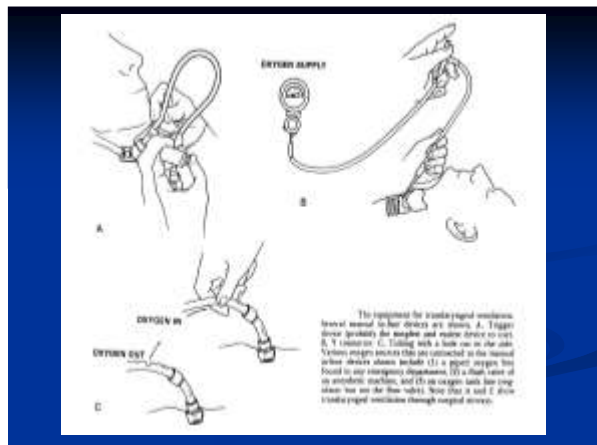
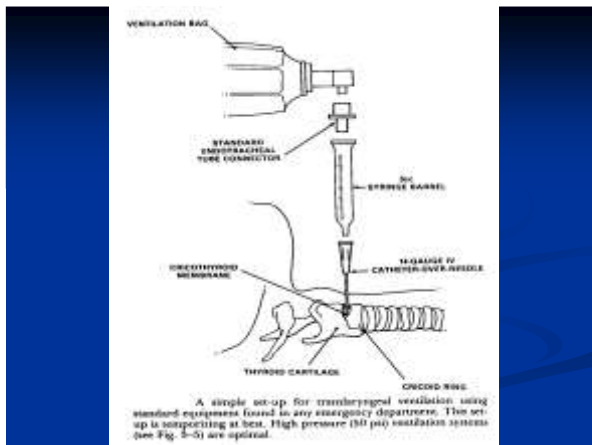
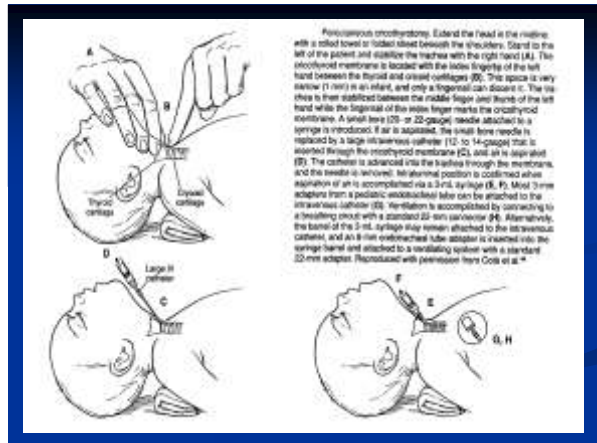
- Ketamine: 1 mg/Kg
 - pretreat with atropine to decrease secretions
 - consider midazolam to minimize “emergence reactions”
- Neuromuscular blocker of choice

Difficult Airway



Needle Cricothyroidotomy

- 12 or 14 G needle attached to 5cc syringe
- Insert cannula at 45 degree angle downward through the cricothyroid membrane until pop is felt (rush of air)
- Slide cannula off needle into trachea
- Aspirate air
- Attach hub of needle to 3.0 ETT adapter
- Connect to O2 tubing w/ Y-connector
- Flow meter at 15 L/min
- Intermittent occlusion 1 second, release for 4 secs



- 7 mo male transferred from PCP office for increased WOB
- Treated with albuterol x3 prior to transfer
- On arrival to ED:
 - HR=185 RR=40 labored
 - Pox=93% on RA Cap refill>3sec
 - No stridor
 - Lungs clear

- What is going on?
- What do you want to do?
 - More treatments?
 - Labs/imaging?
 - Meds?

- Labs:
 - VBG: pH=7.02 Bicarb=7
 - Blood glucose=784
- DX: DKA
- **REMEMBER NOT ALL “BREATHING PROBLEMS” ARE DUE TO AIRWAY/LUNGS**

QUESTIONS????