Almost all of pediatric codes are due to respiratory origin.

80% of pediatric cardiopulmonary arrest are primarily due to respiratory distress.

Majority of cardiopulmonary arrest occur at <1 year old.
Funneled shape larynx
- Narrowest part of infant’s larynx is the undeveloped cricoid cartilage, whereas in the adult it is the glottis opening (vocal cord)
- Tight fitting ETT may cause edema and trouble upon extubation
- Uncuffed ETT preferred for patients < 8 years old
- Fully developed cricoid cartilage occurs at 10-12 years of age

Signs of Impending Respiratory Failure
- Increase work of breathing
- Tachypnea/tachycardia
- Nasal flaring
- Drooling
- Grunting
- Wheezing
- Stridor
- Head bobbing
- Use of accessory muscles/retraction of muscles
- Cyanosis despite O₂
- Irregular breathing/apnea
- Altered consciousness/agitation
- Inability to lie down
- Diaphoresis

Airway Evaluation: Physical Exam
- Facial expression
- Nasal flaring
- Mouth breathing
- Drooling
- Color of mucus membranes
- Retraction of suprasternal, intercostal or subcostal
- Respiratory rate
- Voice change
- Mouth opening
- Size of mouth
- Mallampati
- Loose/missing teeth
- Size and configuration of palate
- Size and configuration of mandible
- Location of larynx
- Presence of stridor (inspiratory/expiratory)
- Baseline O₂ saturation
- Global appearance (congenital anomalies)
- Body habitus

Poiseuille’s law
\[ R = \frac{8nl}{\pi r^4} \]
If radius is halved, resistance increases 16 x

Physiology: Effect Of Edema
- Normal
- Edema
- \[ R = \frac{s}{\text{radius}^4} \]
- Infant
- 8 mm
- ↑ 16x
- ↓ 75%
- Adult
- 8 mm
- ↑ 3x
- ↓ 44%

Airway Management Predictors or Difficulty

- BVM
- Intubation
- Extraglottic Device (Rescue Airway)
- Surgical Cricothyroidotomy

Bag Valve Mask

“MOANS”
M: Micrognathia, Macroglossia, Midface Hypoplasia
O: Obstruction
A: Atresia Chonae
N: Neck Immobility
S: Stridor (supraglottic edema / FBAO)

Laryngoscopy

“LEMON”
L: Look
E: Evaluate
M: Mallampati
O: Obstruction
N: Neck Immobility

EGD “Rescue Airway”

“RODS”
R: Restricted Mouth Opening
O: Obstruction
D: Distortion of Anatomy
S: Stiff Lungs or Cervical Spine
**Cricothyroidotomy**

“SHORT”

S: Surgery

H: Hematoma

O: Obstruction / Obesity

R: Radiation

T: Tumor

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**Don’t Forget The Basics**

- Positioning

- Adjuncts
  - OPA - good choice if tolerated
  - NPA - easy to tear mucosa

- Effective BVM use is most important skill
  - Get a good seal (two person better)
  - Don’t over ventilate

- Don’t forget the suction

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**Difficult Airways**

-Assess the Risks-

“The difficult airway is something one anticipates.....the failed airway is something one experiences.”  
-Walls 2002

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**Airway Management**

Classification of Abnormal Pediatric Airway

- Congenital Neck Masses
- Congenital Anomalies
- Congenital Syndromes
- Traumatic/Foreign
- Metabolic
Complete nasal obstruction of the newborn (per 6th wk GA)
Occurs in 0.82/10,000 births
During inspiration, tongue pulled to palate, obstructs oral airway
Unilateral nare (right-left)
Bilateral choanal atresia is airway emergency
Death by asphyxia
Associated with other congenital defects

Bucconasal Membrane

Preoperative view
**Pierre Robin Syndrome**

- Occurs in 1/8500 births
- Autosomal recessive
- Mandibular hypoplasia, micrognathia, cleft palate, retraction of inferior dental arch, glossoptosis
- Severe respiratory and feeding difficulties
- Associated with OSA, otitis media, hearing loss, speech defect, ocular anomalies, cardiac defects, musculoskeletal (syndactyly, club feet), CNS delay, GU defects

*Tewfik, T. “Pierre Robin Syndrome” emedicine.com
http://www.emedicine.com/ent/topic150.htm

**Treacher Collins Syndrome**

- Mandibulofacial dysostosis
- Occurs in 1/10 000 births
- Cheek bone and jaw bone underdeveloped
- External ear anomalies, drooping lower eyelid, unilateral absent thumb
- Respiratory difficulties
- Underdeveloped jaw causes tongue to be positioned further back in throat (smaller airway)
- Associated with OSA, hearing loss, dry eyes

*www.cakids.com/syndrome/treacher.pdf*
**Congenital Syndrome: Down’s Syndrome**

- Trisomy 21
- Occurs in 1/660 births
- Short neck, microcephaly, small mouth with large protruding tongue, irregular dentition, flattened nose, and mental retardation
- Dislocation can occur during intubation due to congenital laxity of ligaments


**Inflammatory**

- **Etiology:** Haemophilus influenzae type B
- Occurs in children ages 2-6 years
- Progresses rapidly from a sore throat to dysphagia and complete airway obstruction (within hours)
- Signs of obstruction: stridor, drooling, hoarseness, tachypnea, chest retraction, preference for upright position
- OR intubation/ENT present for emergency surgical airway
- Do NOT perform laryngoscopy before induction of anesthesia to avoid laryngospasm
- Inhalational induction in Range of ETT one-half to one size smaller

**Metabolic: Beckwith-Wiedemann Syndrome**

- Occurs in 1/13000-15000 births
- Autosomal dominant
- Macroglossia, Exomphalos, Gigantism
- Associated with mental retardation, organomegaly, abdominal wall defect, pre- and postnatal overgrowth, neonatal hypoglycemia, earlobe pits, Wilms tumor

For details, see: http://www.nlm.nih.gov/medlineplus/ency/article/0000997.htm
Plan “A”

- Different:
  - Size of blade
  - Type of blade
    - Miller
    - Macintosh
    - Specialty
  - Position (patient & provider)
- Hockey stick bend in ETT or Directional tip ETT
- Gum Elastic Bougie
- Remove the stylette as you pass through the cords
- “BURP”
- Have someone else try

Selection of laryngoscope blade: Miller vs. Macintosh

- Miller blade is preferred for infants and younger children
- Facilitates lifting of the epiglottis and exposing the glottic opening
- Care must be taken to avoid using the blade as a fulcrum with pressure on the teeth and gums
- Macintosh blades are generally used in older children
- Blade size dependent on body mass of the patient and the preference of the anesthesiologist
If unable to intubate, immediately go to plan: “B”

Plan “B”:
(BVM and BACKUP AIRWAY Techniques)

- Can you ventilate with a BVM?
  - (Consider an OPA, + Cricoid pressure w/ gentle ventilation)
- Combitube
- KING – LT-D
- LMA

Know Your Options!!!
& Don’t hesitate to use them!
King-LT-D

Curved Design

The KING LT-D supraglottic airway has been designed with a straightened, beveled distal tip that assists in directing it posterior to the larynx and into the upper esophagus. Due to this unique configuration, there is minimal risk of the device entering the trachea.

LMA

- Used in any age
- Easy to place
- Few complications
- Contraindications:
  - Gag reflex
  - FBs
  - Airway obstruction
  - High ventilation pressure
- Does not secure airway

LMA Sizing

<table>
<thead>
<tr>
<th>LMA Size</th>
<th>Patient Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Neonate / Infants &lt; 5 kg</td>
</tr>
<tr>
<td>1 ½</td>
<td>Infants 5-10 kg</td>
</tr>
<tr>
<td>2</td>
<td>Infants / Children 10-20 kg</td>
</tr>
<tr>
<td>2 ½</td>
<td>Children 20-30 kg</td>
</tr>
<tr>
<td>3</td>
<td>Children/Small adults 30-50 kg</td>
</tr>
<tr>
<td>4</td>
<td>Adults 50-70 kg</td>
</tr>
<tr>
<td>5</td>
<td>Large adult &gt;70 kg</td>
</tr>
</tbody>
</table>

Combitube

- Two sizes
  - Small (4 to 5.5 feet tall)
  - Regular (over 5.5 feet tall)
- Easy to place
- Contraindications
  - Gag reflex
  - Esophageal disease
  - Caustic ingestions
  - FBs/Airway obstruction
Plan “C”:

- Surgical Cricothyroidotomy
- MUST BE > 12 YEARS OLD (Follow Protocol)
  - Last resort...

Cricothyrotomy: Complications

- Bleeding
- Laryngeal or tracheal injury
- Infection
- Pneummediastinum
- Subglottic stenosis

Continue to monitor the Patient

- Cardiac monitor
  - Monitor for dysrhythmias
    - bradycardia, tachycardia, ectopy
- Blood Pressure monitoring (manual or NIBP)
  - Monitor for hypo- or hypertension
- Pulse oximetry
  - Monitor for hypoxia
- Capnography
  - Monitor for hypo- or hypercarbia
**Proof of Placement**

**OBJECTIVE**
- Direct visualization
  - BEST
- CXR (in hospital)
- Pulse oximetry
- Capnography
- CO₂ detectors
  - Easy Cap - colormetric
- Self-inflating bulb

**SUBJECTIVE**
- Absence of abdominal sounds while ambu-bagged
- Mist in the tube
- Bilateral breath sounds
- Rise/fall in chest

Confirm placement using at least 3 methods, including capnography waveform.

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**Capnography**

- Capnography
- Capnography
- Capnography
- Capnography
- Capnography

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**DID I MENTION,**

CAPNORGRAPHY ???

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**After confirming placement:**

- Secure airway device
- Immobilize the head
- **Verify correct placement each time the patient is moved**
- Document appropriately
In Summary

Rapid recognition of a difficult airway is paramount! Now you are armed with the knowledge to predict the challenging RSI.

Thank You!!!

Works Cited

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References

- Attending ED Physician, Albany Medical Center
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