Pediatric Respiratory Emergencies
Rural EMS

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Activity Disclosures

• No Commercial Support was received for this activity.

• No individuals involved in the creation of this medical educational activity had any relevant financial relationships or conflicts of interest to disclose.
Objectives

- Review the anatomy and sounds
- Review the medications and limitations
- Review the equipment we use
- Review some of the more common and life-threatening respiratory problems
Topics

- Respiratory anatomy
- Medications
- Equipment
- Respiratory problems
Patient #1: 2-year-old

- Respiratory distress for 1 day with noisy breathing and retractions
- History of wheezing
- On albuterol
- Not diagnosed with asthma
- Exposed to smoke recently
- Albuterol given without effect
- • Alert in moderate distress •

- P 145, RR 40, Pox 93%
  - Minimal retractions
  - Decreased BS with moderate wheezing
Patient #2: 6-month-old

- Nasal congestion for 3 days and now with worsening respiratory distress, poor fluid intake.
- Started attending day care 2 weeks ago
- 34 weeks preemie
- Low grade fever
- Decreased urine output

- Irritable
- Alert in moderate resp distress
- P 180, RR 64, Pox 92%
- Dry mucus membrane
- Severe nasal congestion and coughing
- Moderate retraction and rhonchi
- Moderate air entry
Patient #3: 2-year-old

- 2 days of URI now with fever, barky cough and respiratory distress
- • Woke up with stridor and barky cough
- • Fever for 2 days
  • Vomited with coughing
- Alert irritable and in moderate distress
- P 180, RR 60, Pox 96%
- Audible marked inspiratory
- Stridor
- Severe retraction
- Occasional barky cough
- Air entry adequate
Patient #4: 12-month-old

- Sudden onset of respiratory distress with stridor
- Healthy
- Mom heard gagging and choking from playroom
- Turned blue and having moderate respiratory distress

- Alert infant in distress
- Audible stridor
- P 192 RR 28 Pox 88%
- Severe retraction with minimal air entry
Patient #5: 2-year-old

- Ill appearing with 1 day of fever, stridor, drooling and respiratory distress
  - Fever started today to 39.5
  - No immunizations
  - Drooling and will not lie down
  - Noisy breathing

- Alert toxic appearing child drooling in severe distress
- P 196, RR 60, Pox 96%
- Audible marked inspiratory
- Stridor
- Severe retraction and stridor
- Unable to swallow secretions
- Minimal breath sounds
Pediatric Airway: The Basics

- Infant’s and young children’s heads are large relative to the rest of their bodies.
  - Take care when positioning airway.
  - Cover head to prevent heat loss.
General Assessment

**Pediatric Assessment Triangle**

- **Appearance**
  - Tone
  - Interactiveness
  - Consolability
  - Look/Gaze
  - Speech/Cry

- **Work of Breathing**
  - Abnormal Breath Sounds
  - Abnormal Positioning
  - Retractions
  - Nasal Flaring

- **Circulation to the Skin**
  - Pallor
  - Mottling
  - Cyanosis
Assessment

Appearance
A child with a grossly abnormal appearance requires immediate life-support interventions and transportation.

Table 5 Characteristics of Appearance: The TICLS Mnemonic

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Features to Look For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tone</td>
<td>Is the child moving or resisting examination vigorously? Does the child have good muscle tone? Or is the child limp, listless, or flaccid?</td>
</tr>
<tr>
<td>Interactivity</td>
<td>How alert is the child? How readily does a person, object, or sound distract the child or draw the child’s attention? Will the child reach for, grasp, and play with a toy or exam instrument, like a penlight or tongue blade? Or is the child uninterested in playing or interacting with the caregiver or prehospital professional?</td>
</tr>
<tr>
<td>Consolability</td>
<td>Can the child be consoled or comforted by the caregiver or by the prehospital professional? Or is the child’s crying or agitation unrelieved by gentle reassurance?</td>
</tr>
<tr>
<td>Look or gaze</td>
<td>Does the child fix his or her gaze on a face, or is there a “nobody home,” glassy-eyed stare?</td>
</tr>
<tr>
<td>Speech or cry</td>
<td>Is the child’s cry strong and spontaneous or weak or high-pitched? Is the content of speech age-appropriate or confused or garbled?</td>
</tr>
</tbody>
</table>
Assessment

Work of breathing
Reflects attempt to compensate for abnormalities in oxygenation, ventilation

Table 6 Characteristics of Work of Breathing

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Features to Look For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal airway sounds</td>
<td>Snoring, muffled or hoarse speech, stridor, grunting, or wheezing</td>
</tr>
<tr>
<td>Abnormal posturing</td>
<td>Sniffing position, tripod position, refusing to lie down</td>
</tr>
<tr>
<td>Retractions</td>
<td>Supravacular, intercostal, or substernal retractions of the chest wall; head bobbing in infants</td>
</tr>
<tr>
<td>Flaring</td>
<td>Flaring of the nares on inspiration</td>
</tr>
</tbody>
</table>
Assessment

Circulation to skin

Determine adequacy of cardiac output and core perfusion.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Features to Look For</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallor</td>
<td>White or pale skin or mucous membranes from inadequate blood flow</td>
</tr>
<tr>
<td>Mottling</td>
<td>Patchy skin discoloration due to vasoconstriction or vasodilation</td>
</tr>
<tr>
<td>Cyanosis</td>
<td>Bluish discoloration of skin and mucous membranes</td>
</tr>
</tbody>
</table>
Assessment

- Infants use diaphragm during inspiration.
- Experience muscle fatigue quicker
- Highly susceptible to hypoxia
  - Can spiral into cardiovascular collapse
Decision Time:

**ABCs or H & P**

**Stay or go**

- Use findings from Pediatric Assessment Triangle to determine whether the patient requires urgent care.
- Assess ABCs.
- Treat life threats.
- Transport.
- If condition is stable, finish assessment.
Decision Time:
- Sick or not sick?
- ABC
- Clinical assessment
- Diagnosis
- Interventions
- Reassessment
- Call a friend…

KEEP CALM
AND
CALL A FRIEND
Pediatric Airway: The Basics

- Short neck, smaller airway
- More prone to obstruction

In supine position, the relatively large size of an infant’s head results in natural neck flexion compressing the soft upper airway passages. Under conditions of low airway tone like during general anesthesia, the relatively large tongue falls back against the posterior pharyngeal wall and contributes to airway turbulence and upper airway obstruction.
Pediatric Airway: The Basics

- Epiglottis is long and floppy.
- Difficult to see vocal cords during intubation
Pediatric Airway: The Basics

- Keep nares clear with suctioning.
- Avoid hyperextension of neck.
- Keep the airway clear of all secretions.
- Use care when managing the airway.
Pediatric Airway: The Basics

- Smaller tidal volume, double metabolic oxygen demand
- Smaller functional residual capacity
- Faster breathing

### Table 3: Pediatric Respiratory Rates

<table>
<thead>
<tr>
<th>Age</th>
<th>Respirations (breaths/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate: 0 to 1 month</td>
<td>30 to 60</td>
</tr>
<tr>
<td>Infant: 1 month to 1 year</td>
<td>25 to 50</td>
</tr>
<tr>
<td>Toddler: 1 to 3 years</td>
<td>20 to 30</td>
</tr>
<tr>
<td>Preschool-age: 3 to 5 years</td>
<td>20 to 25</td>
</tr>
<tr>
<td>School-age: 6 to 12 years</td>
<td>15 to 20</td>
</tr>
<tr>
<td>Adolescent: 13 to 17 years</td>
<td>12 to 20</td>
</tr>
<tr>
<td>Adult: Older than 18 years</td>
<td>12 to 20</td>
</tr>
</tbody>
</table>
Pediatric Airway

**INFANT**

2 mm

Resistance ↑ by factor of 16

4 mm

**ADULT**

5

10 mm

Resistance ↑ by factor of 2.4

4

8 mm
Differentiating airway sounds

- Pediatric Airway Examples
  - Stridor
  - Wheezing
  - Rhonchi
  - Rales
Drugs

- Oxygen
- albuterol
- levalbuterol/Xopenex
- ipratropium/Atrovent
- Steroids
- epinephrine
Drugs

▶ Oxygen
  ▶ Drug
  ▶ May be dangerous sat >92%
  ▶ COPD
Drugs

- albuterol
- levalbuterol/Xopenex
  - β2 agonist
  - Bronchodilator
  - Stim lungs < cardiac stim
  - Inhaler
  - Nebulizer
    - Q20min
    - Q1hour
    - continuous
- Which is better?
- Use
Drugs

- ipratropium/Atrovent
  - Anticholinergic
  - Bronchodilator
  - Duoneb q20x 3
  - Use
Drugs

- Steroids prednisone
- Oral vs IV
- Dose
  - IV 125 solumedrol
  - Decadron 10mg IV or PO
  - Prednisone 50-60mg PO
- When to give
- Result
Drugs

- Epinephrine
  - α and β agonist
  - When
  - Dose
    - Epi pen
    - Epi SQ
    - Epi nebulized
    - Racemic epi
  - Treatment
Devices

- Cannula
- Masks
- High flow nasal cannula HFNC
- BiPAP
- Intubation
- Inhaler
- Nebulizer
- Capnography
Devices

- Cannula
  - Low flow
    - Up to 5 LPM
    - 28-44% oxygen
Devices

- Mask
  - Simple mask
    - Min 5 LPM
    - Less will not compensate exhaled CO2
  - Max 10 LPM
  - 40-60 % O2
Devices

- High flow nasal cannula HFNC
  - New on the scene
  - May cause some positive pressure
  - May be help prevent:
    - CPAP/BiPAP
    - Intubation
Devices

- Positive Airway Pressure
  - Bi-level
  - Continuous
    - applies mild air pressure on a continuous basis to keep the airways continuously open in people who are not able to breathe spontaneously on their own.
Devices

- **Inhaler**
  - Both MDI and nebulizer have been shown to be equally efficacious.
    - Some studies show may be superior
  - Inhaler with spacer most efficacious
  - Can give up to 10 puffs
Devices

- Nebulizer
  - Various drugs
  - Slower delivery
  - Mainstay of asthma treatment
### Table 1: Overview of extraglottic devices with pediatric sizes available

<table>
<thead>
<tr>
<th>Device</th>
<th>Laryngeal mask airways</th>
<th>King Laryngeal Tube (King LT)</th>
<th>CombiTube</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td>Supraglottic</td>
<td>Retroglottic</td>
<td>Retroglottic</td>
</tr>
<tr>
<td><strong>Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Most require air to inflate the cuff.</td>
<td>Single inflation port inflates both upper and lower balloons.</td>
<td>Two separate ports for inflation of the balloons and separate attachments for the BVM.</td>
</tr>
<tr>
<td></td>
<td>Usually have a port for a gastric tube, allowing for less gastric distension, which facilitates more effective BVM ventilation.</td>
<td>Recent models have a port for a gastric tube, allowing for less gastric distension, which facilitates more effective BVM ventilation.</td>
<td>Providers must assess if the distal end is in the stomach or trachea prior to using the BVM. (This is difficult and increases the chance of error.)</td>
</tr>
<tr>
<td></td>
<td>Some are designed for an ET tube to be passed into the trachea.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sizes</strong></td>
<td>Usually come in pediatric and neonate sizes.</td>
<td>Comes in pediatric and neonate sizes.</td>
<td>Smaller-size 37F is available to use in patients ≥ 4 feet. (No sizes available for patients &lt; 4 feet.)</td>
</tr>
</tbody>
</table>
Devices

- Intubation
  - Control patient’s airway
  - RSI
  - 100% O2

- Types
  - Direct
  - video
Extra-glottic v Endotracheal airways in cardiac arrest

**Take Home Points**

- A randomized controlled trial found improved survival in out-of-hospital cardiac arrest with placement of an extra-glottic device compared to endotracheal intubation.

- There was almost 3% higher survival with laryngeal tube insertion compared to intubation.

- The study found an intubation success rate of 53%.

- Another study found no difference in survival between intubation or the i-gel, another supraglottic airway device.


Airway Diseases

- Bronchiolitis
  - Virus
    - RSV 40-80% of cases
  - Symptoms
    - Coughing
    - Wheezing, grunting
    - Flaring, retractions
    - Temp <102
Airway Diseases

- Bronchiolitis
  - Treatment
    - Supportive care
    - NO O2 unless sat <92%
      - Severe cases HFNC
    - Nasal suctioning bulb syringe
    - Hydration
    - No
      - Racemic epi
      - Steroids
      - Antibiotics
Airway Diseases

- Asthma
  - Inflammation
  - PASS
  - Symptoms
    - Wheezing
    - Coughing
    - Shortness of breath
    - Retractions
    - Accessory muscle use
  - Treatment

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<th>2</th>
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<tr>
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Airway Diseases

- Asthma
  - Inflammation
  - PASS
  - Symptoms
  - Treatment
    - Beta agonist
    - Ipratropium
    - Steroids
    - Epi
    - Magnesium

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Airway Diseases

- **Croup**
  - **Diagnosis-RSV**
  - **Symptoms**
    - URI
    - Barky cough
    - SOB
  - **Treatments**
Airway Diseases

► Croup
  ► Diagnosis-clinical
  ► Symptoms
  ► Treatments
    ► Humidified air
    ► O2
    ► Racemic epi
    ► Steroids
Airway Diseases

- Epiglottitis
Airway Diseases

- Epiglottitis
  - Cause/prevention
  - Diagnosis
  - Treatment
    - Do not agitate
    - Nothing in the mouth
    - Calm
    - Blow by O2
    - Careful transport
Airway Diseases

- Foreign Body
- Suspect
Patient #1: 2-year-old

- Respiratory distress for 1 day with noisy breathing and retractions
- History of wheezing
- On albuterol
- Not diagnosed with asthma

- Exposed to smoke recently
- Albuterol given without effect
- • Alert in moderate distress •
- P 145, RR 40, Pox 93%
  • Minimal retractions
  • Decreased BS with moderate wheezing
Patient #1: 2-year-old

- Sick or not sick?
- ABC
- Clinical assessment
- Diagnosis
- Interventions
- Reassessment
Patient #1: 2-year-old

- Asthma
  - Treatment
    - Position of comfort
    - Albuterol
    - Oxygen
    - Steroids
    - Magnesium Sulfate
    - Epinephrine
Patient #1: 2-year-old

- Red Flags
  - Multiple hospitalizations & ICU
  - Admission
  - Intubation
  - Multiple medications
  - No air movement
  - Tripod seating
  - Altered mental status
  - Elevated pCO2
Patient #2: 6-month-old

- Nasal congestion for 3 days and now with worsening respiratory distress, poor fluid intake.
- Started attending day care 2 weeks ago
- 34 weeks preemie
- Low grade fever
- Decreased urine output
- Irritable
- Alert in moderate resp distress
- P 180, RR 64, Pox 92%
- Dry mucus membrane
- Severe nasal congestion and coughing
- Moderate retraction and rhonchi
- Moderate air entry
Patient #2: 6-month-old

- Sick or not sick?
- ABC
- Clinical assessment
- Diagnosis
- Interventions
- Reassessment
Patient #2: 6-month-old

- Bronchiolitis
  - Nasal suction
  - Albuterol (?)
  - Oxygen
  - Hydration
- High risk: preemie & neonates
Patient #3: 2-year-old

- 2 days of URI now with fever, barky cough and respiratory distress
- Woke up with stridor and barky cough
- Fever for 2 days
- Vomited with coughing
- Alert irritable and in moderate distress

- P 180, RR 60, Pox 96%
- Audible marked inspiratory
- Stridor
- Severe retraction
- Occasional barky cough
- Air entry adequate
Patient #3: 2-year-old

- Sick or not sick?
- ABC
- Clinical assessment
- Diagnosis
- Interventions
- Reassessment
Patient #3: 2-year-old

- Croup
  - Cool humidified air
  - Racemic or Epi nebulized, if retraction or stridor at rest
  - Steroid
  - Oxygen if needed
Patient #4: 12-month-old

- Sudden onset of respiratory distress with stridor
- Healthy
- Mom heard gagging and choking from playroom
- Turned blue and having moderate respiratory distress

- Alert infant in distress
- Audible stridor
- P 192 RR 28 Pox 88%
- Severe retraction with minimal air entry
Patient #4: 12-month-old

- Sick or not sick?
- ABC
- Clinical assessment
- Diagnosis
- Interventions
- Reassessment
Patient #4: 12-month-old

- Aspirated Foreign body
  - Supportive care
  - If not moving any air:
    - back blows
    - chest or abdominal thrusts
  - Remove FB if visible
  - Transport ASAP
Patient #5: 2-year-old

- Ill appearing with 1 day of fever, stridor, drooling and respiratory distress
  - Fever started today to 39.5
  - No immunizations
  - Drooling and will not lie down
    - Noisy breathing

- Alert toxic appearing child drooling in severe distress
- P 196, RR 60, Pox 96%
- Audible marked inspiratory
- Stridor
- Severe retraction and stridor
- Unable to swallow secretions
- Minimal breath sounds
Patient #5: 2-year-old

- Sick or not sick?
- ABC
- Clinical assessment
- Diagnosis
- Interventions
- Reassessment
Patient #5: 2-year-old

- Epiglottis
  - O2 if can tolerate
  - Keep child calm
- **Do not:**
  - Lay flat
  - Try and visualize airway
  - Start IV or IO
- Warn receiving site
- Intubate only if respiratory arrest
Pearls

- Sick or not sick?
- Likely causes?
- Interventions?
Thanks
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