Phase II Pediatric Block

The Division of Pediatric Emergency Medicine

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Introduce the Pediatric Assessment Triangle

- Distinguishing PAT and ABCDE

Understand the Anatomic and Physiologic differences between adults and children in regard to:

- Respiratory Distress
- Shock
- Trauma
Pediatric Assessment Triangle

- Appearance
- Breathing
- Circulation
Appearance

Tone
Interactiveness
Consolability
Look/Gaze
Speech/Cry
Work of Breathing

Abnormal airway sounds
Abnormal positioning
Retractions
Nasal flaring
Head bobbing
Circulation to Skin

Pallor
Mottling
Cyanosis
General Approach

Pediatric Assessment Triangle (PAT)

Hands-on assessment of ABCDEs
  • Pediatric differences
Airway

Airway opening maneuvers:
  Head tilt-chin lift, jaw thrust

Suction:
  Often dramatic improvement in infants

Age-specific obstructed airway support:
  • <1 year: Back blow/chest thrust
  • >1 year: Abdominal thrust

Advanced airway techniques
Breathing:
Respiratory Rate Varies with Age

<table>
<thead>
<tr>
<th>Age</th>
<th>Respiratory Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>30 to 60</td>
</tr>
<tr>
<td>Toddler</td>
<td>24 to 40</td>
</tr>
<tr>
<td>Preschooler</td>
<td>22 to 34</td>
</tr>
<tr>
<td>School-aged child</td>
<td>18 to 30</td>
</tr>
<tr>
<td>Adolescent</td>
<td>12 to 16</td>
</tr>
</tbody>
</table>

Slow or fast respirations are worrisome.
Breathing: Auscultation

Midaxillary line, above sternal notch

- **Stridor:** Upper airway obstruction
- **Wheezing:** Lower airway obstruction
- **Grunting:** Poor oxygenation; pneumonia, drowning, pulmonary contusion
- **Crackles:** Fluid, mucus, blood in airway
- **Decreased / absent breath sounds:** Obstruction
# Circulation: Heart Rate varies by Age

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<thead>
<tr>
<th>Age</th>
<th>Normal Heart Rate</th>
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<tbody>
<tr>
<td>Infant</td>
<td>100 to 160</td>
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Circulation

Pulse: Central, peripheral pulse quality

Skin temp: “Reverse thermometer” sign

Capillary refill: \( \leq 2 \text{ sec}, \) warm finger, 5 sec

B/P: \textit{Minimum} = 70 + (2 \times \text{age in years})
Disability (and Dextrose)

AVPU scale:
- Alert
- Verbal: Responds to verbal commands
- Painful: Responds to painful stimulus
- Unresponsive

(Pediatric) Glasgow Coma Scale

Check Dextrose (glucose) if impaired
Exposure / Environment

Full Exposure Necessary

• Evaluate physiologic function
• Identify anatomic abnormalities

Maintain warm ambient environment

Minimize heat loss

Monitor temperature

Warm IV fluids
Reassess

General impression (PAT)

ABCDE

Continually reassess ABCs for response to therapy
The Bottom Line

Begin with PAT, then ABCDEs.

Form a general impression to guide priorities.

Treat respiratory distress, failure, and shock \textit{as they are recognized}.

Focused history and detailed PE.

\textbf{Reassessment} throughout ED stay.
Airway / Breathing
Objectives

Compare anatomic, physiologic differences b/w adult & pediatric airway

Distinguish respiratory distress from failure

Describe clinical features of upper and lower airway obstruction and diseases of the lung
Respiratory arrest vs cardiac arrest intact survival rates in children
Why do children have more respiratory difficulties?

Anatomic

Physiologic
Anatomy

- Large occiput – need shoulder roll
- Large tongue – obstruction
- Cephalad larynx – difficult to visualize
- Soft epiglottis – use Miller blades
- Smallest diameter below cords
- Small airways – high resistance
Physiology: Pediatric vs Adult

Higher Basic Metabolic Rate = Shorter time to Desaturation
  • (6-8 mL/kg vs 3-4)

Smaller airways =
  Higher Airway Resistance ($1/R^4$)

Prolonged respiratory distress -> failure
Physiology: Time to Desaturation
Signs of Respiratory Distress and Failure

**Respiratory Distress**
- Tachypnea
- Stridor
- Retractions
- Head bobbing
- Nasal Flaring

**Respiratory Failure**
- Altered mental status
- Poor resp effort
- Bradypnea
- Bradycardia
- Apnea

*Resp failure = inadequate oxygenation or ventilation*
Mild Respiratory Distress: Accessory Muscle Usage
Severe Respiratory Distress: Accessory Muscle Usage
Airway Obstruction: Upper Vs. Lower

- Stridor
- Sturtor

Upper

- Cough
- Retractions
- Apnea
- Resp effort w/o air entry

Lower

- Wheeze
  ↓ breath sounds

↓ breath sounds
Airway Obstruction Causes: Upper Vs. Lower

**Upper**
- Croup
- Foreign Bodies
- Epiglottitis (rare)

**Lower**
- Bronchiolitis
- Asthma
- Foreign Bodies
Upper Airway Obstruction: Croup
Upper Airway Obstruction: Treatment

Reposition Airway
Suction (infants, in particular)
Partial obstruction – position of comfort
Complete obstruction
  • Back blows/ chest thrusts < 1 yo
  • Abdominal thrusts > 1 year
N-P airway – sturtor; O-P airway (no gag)
Advanced techniques
Lower Airway Obstruction: Treatment

Oxygen / Supportive (bronchiolitis)
Beta$_2$ agonist (albuterol in asthma)
Bronchoscopy (foreign body)
Case 1 – Airway/Breathing

cc: “Funny breathing”

HPI: 14 month male with acute resp dist. No prior symptoms. Mom in other room, noted “funny breathing” while he was playing on the floor.

ROS: No fevers, Otherwise well

PE: AF, VSWNL except RR 50

Gen: Awake, alert, stridor at rest, mod resp dist

Pulm: Retractions x3, transmitted airway sounds

CV: RRR, no m/r/g, nl pulses, cap refill
Case 1 – Airway/Breathing

Would you:

a) Use a BVM, prepare to Intubate
b) Give abdominal thrusts
c) Give back blows/chest thrusts
d) Place in position of comfort
e) Start CPR
f) Discharge home
Case 1 – Airway/Breathing

Would you:

a) Use a BVM, prepare to Intubate
b) Give abdominal thrusts
c) Give back blows/chest thrusts
d) **Place in position of comfort**
e) Start CPR
f) Discharge home
Case 2 – Airway/Breathing

cc: “Choked”
HPI: 9 month male with difficulty breathing. Mom was feeding him grapes and peanuts. Had a choking episode, was making “funny sounds”, then during your exam stopped breathing and turned blue.

ROS: No fevers, Otherwise well
PE: AF, resp effort at 60, HR 190, SpO2 65%
Gen: Limp, cyanotic.
Pulm: Supraclavicular retractions, no air entry
CV: Tachycardic, no m/r/g, 2+ pulses, ↓ CR
Case 2 – Airway/Breathing

Would you:

a) Use a BVM, prepare to Intubate
b) Give abdominal thrusts
c) Give back blows/ chest thrusts
d) Place in position of comfort
e) Perform cricothyroidotomy
f) Discharge home
Case 2 – Airway/Breathing

Would you:

a) Use a BVM, prepare to Intubate
b) Give abdominal thrusts
c) Give back blows/chest thrusts
d) Place in position of comfort
e) Perform cricothyroidotomy
f) Discharge home
# Respiratory Rate Varies by Age

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<th>RR</th>
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<td>35-50</td>
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<td>Older infants/ toddlers</td>
<td>30-40</td>
</tr>
<tr>
<td>Elementary school age</td>
<td>20-30</td>
</tr>
<tr>
<td>Older child/ adolescent</td>
<td>12-20</td>
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Case 3 – Airway/Breathing

cc: “Trouble breathing”

HPI: 9 month male with difficulty breathing. Cough, difficulty breathing x 4 days. Not taking fluids well, now “lethargic”.

ROS: Fever to 102 F, decreased wet diapers.

PE: AF, RR 12, HR 190, SpO2 78%

Gen: Limp, shallow resp effort.

Pulm: Coarse bs, poor air entry

CV: Tachycardic, no m/r/g, central pulses only, ↓ CR 5-6 seconds
Case 3 – Airway/Breathing

Would you:

a) Use a BVM, prepare to Intubate
b) Give abdominal thrusts
c) Give back blows/chest thrusts
d) Place in position of comfort
e) Perform cricothyroidotomoty
f) Discharge home
Case 3 – Airway/Breathing

Would you:

a) Use a BVM, prepare to Intubate
b) Give abdominal thrusts
c) Give back blows/chest thrusts
d) Place in position of comfort
e) Perform cricothyroidotomy
f) Discharge home
Circulation
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Cardiac Output

\[ CO = HR \times \text{Stroke Volume} \]

Infants/children $\uparrow$ CO by $\uparrow$ HR $\gg$ SV
Shock: Definition and Types

Inadequate tissue perfusion (delivery of oxygen and nutrients) to meet the metabolic demands of the body.

- Hypovolemic
- Cardiogenic
- Distributive
- Septic
Shock: Definitions

**Compensated:**

- Vital organs perfused by compensatory mechanisms
- *B/P is normal*

**Decompensated:**

- Compensatory mechanisms overwhelmed, inadequate
- *Hypotension*, high mortality risk

**Aggressive treatment of early shock:**

- *Halts progression to decompensated shock*
Shock Clinical Features: Your First Clues

Abnormal mental status

Apnea

**Tachycardia** (hypotension **NOT** necessary)

Grunting, respiratory distress

Pale, cool skin; delayed capillary refill

- Warm shock CR will appear normal to brisk
Clinical Features of Specific Shock Types

Neurologic deficits (spinal cord injury)

Urticaria, allergen trigger, wheezing (anaphylactic)

Petechiae, erythroderma (septic)
Hypovolemic Shock

Fluid loss:

- Diarrhea, vomiting, anorexia, diuresis
- Hemorrhage

Resuscitation:

- Fluid replacement
- NS or LR 20 mL/kg bolus, reassess, repeat as needed
- Blood transfusion for excessive hemorrhage
Septic Shock

Has elements of distributive shock and cardiogenic shock:

- Inappropriate vasodilation with a maldistribution of blood flow
- Myocardial depression

Resuscitation:

- **Fluid boluses: 20cc/kg x3 in the first 15 minutes**
- Dopamine, Epinephrine or Norepinephrine
- Antibiotics
Trauma
Trauma: Epidemiology

Trauma is leading cause of death and disability in children worldwide.

Most common injuries:

- Infants: Physical abuse
- Preschoolers: Falls
- School aged: Motor vehicle collision – pedestrian or bicyclist

Differences in anatomy, physiology, mechanism drive differences in injury pattern, response.
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<th>Injury Response</th>
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<tr>
<td>Proportionately larger head</td>
<td>Higher frequency of head trauma, higher c-spine trauma</td>
</tr>
<tr>
<td>Large occiput and tongue</td>
<td>More airway obstruction</td>
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## How Trauma Differs in Pediatrics (2 of 3)

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<th><strong>Anatomy/Physiology</strong></th>
<th><strong>Injury Response</strong></th>
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<tr>
<td>Thinner chest wall, more flexible ribs</td>
<td>Higher frequency of pulmonary injury</td>
</tr>
<tr>
<td>Horizontal ribs, weaker intercostals, more mobile mediastinum</td>
<td>Tension pneumothorax poorly tolerated</td>
</tr>
<tr>
<td>Abdominal organs more anterior and less subcutaneous fat</td>
<td>Higher risk of intra-abdominal injury and bleeding</td>
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### How Trauma Differs in Pediatrics (3 of 3)

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<td>Softer bones, thicker periosteum</td>
<td>Higher frequency of incomplete fractures</td>
</tr>
<tr>
<td>Active, unfused bony growth plates</td>
<td>Disrupted growth after growth plate fractures</td>
</tr>
<tr>
<td>Compensatory vasoconstriction</td>
<td>Normal blood pressure with early shock</td>
</tr>
<tr>
<td>Larger body surface area/mass ratio</td>
<td>Greater heat loss from exposed body surfaces (head)</td>
</tr>
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</table>
Trauma Assessment

Primary survey

• Pediatric Assessment Triangle (PAT)
• ABCDEs (F-family)
• *Treat ABCDE in the order you find them*

Secondary survey

• Head to toe exam

Reassess
Summary

PAT = General impression (Appearance, B, C)

ABCDE = Airway, Breathing, Circulation, Disability / Dextrose, Extremities/Environment, F=Family

Reassess response to treatment

Respiratory Distress – Anat / Phys / Environmental

Shock – Compensated /Decompensated, Tachycardia

Trauma – Anatomic differences, logical approach
Thank you!