ASPECTS OF PEDIATRIC TRAUMA - WHAT'S DIFFERENT ABOUT CHILDREN
OBJECTIVES

Define the Pediatric Assessment Triangle

Apply the Triangle to determine urgency of treatment

Identify initial management priorities based on physiologic assessment and developmental level
HIGH STRESS SITUATION

Child

- In pain
- Frightened
HIGH STRESS SITUATION

Parent

- Frightened
- Guilty
- Exhausted
HIGH STRESS SITUATION

Healthcare Providers

- Frightened
- May find themselves out of “comfort zone”
- May have difficulty with “non-verbal” assessment
CASE: 3-YEAR-OLD GIRL

The child is involved in a boating accident where she is found in the water face down. She revived quickly and is awake and alert. She seems fine initially but over the next 4 hours developed increasing coughing and trouble breathing. She brought to the emergency room for further evaluation.
CASE PROGRESSION

As you enter the room, you find a pale sleepy toddler with grunting respirations and marked intercostal retractions.

How sick is this child?
How do you know?
CASE DISCUSSION

This child is in respiratory failure.

You see the child’s appearance, work of breathing, and circulation to the skin and form an initial impression of overall illness or injury severity.
PEDIATRIC ASSESSMENT TRIANGLE

Appearance

Work of Breathing

Circulation
What aspects of this child’s appearance reflect her physiologic status?
THE PEDIATRIC ASSESSMENT TRIANGLE

**Appearance**
- Alertness
- Distractibility/consolability
- Eye contact
- Speech or cry
- Motor activity
- Color
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How do we recognize respiratory distress or respiratory failure by just looking at a child?
PEDDIATRIC ASSESSMENT TRIANGLE

Appearance

Work of Breathing
Abnormal breath sounds
Retractions
Nasal flaring

Circulation
RESPIRATORY DISTRESS

Normal Appearance

Normal Circulation

Work of Breathing Retractions
RESPIRATORY FAILURE

Abnormal Appearance

Circulation Normal or Poor

Work of Breathing
Without the use of instruments, how can we rapidly assess the adequacy of circulation?
SKIN CIRCULATION

Skin temperature
Pulse strength
Capillary refill time
Color
SHOCK

Abnormal Appearance

Normal Work of Breathing

Poor Circulation
PEDIATRIC ASSESSMENT TRIANGLE

Assessment Triangle provides a conceptual framework for making the sick–or not sick decision.

Recognition of the patient’s acuity determines the urgency of intervention.

Aggressiveness of your response is driven by the degree of physiologic compromise.
CASE: 18-MONTH-OLD BOY

You are called to see an 18-month-old was involved in a motor vehicle accident. He was restrained in a car seat, but this was found outside the car. The child initially was crying but is now quiet. He has a bruise on his right shoulder.
CASE PROGRESSION

The child lies still on the examination table and has no response to mother’s voice.

Extremities are cool with capillary refill time (CRT) is 5 seconds.

What is your impression of the physiologic state of this child?
SHOCK

Abnormal Appearance

Normal Work of Breathing

Poor Circulation

Cool extremities; CRT, 5 seconds; thready pulses
CASE PROGRESSION

You do a rapid primary survey:

- **Airway**: patent
- **Breathing**: clear shallow breath sounds, effortless tachypnea
- **Circulation**: tachycardic, no murmur
- **Disability**: pupils equal, AVPU - extensor posture to pain
- **Vital signs**: HR, 190; RR, 50; BP, 75/45; T, 40°C; Weight, 11 kg
Case Discussion

How would you characterize this child’s respiratory status?

What are your priorities in managing this patient?
CASE DISCUSSION: RESPIRATORY STATUS

Effortless tachypnea = compensatory mechanism for a child in shock

Hypoperfusion and increased metabolic demand leads to cellular hypoxia

Protective airway reflexes may be compromised
MANAGEMENT PRIORITIES

Urgency of intervention determined by Assessment Triangle
Graded intervention driven by degree of compromise
Stabilization of “ABCs”
Hemodynamic monitoring
CASE DISCUSSION

Management of airway and breathing: consider elective endotracheal intubation

Advantages of endotracheal intubation

- Decreases metabolic demand
- Intracranial pressure control
- Airway protection
- Anticipates deterioration
CASE DISCUSSION

Management Priorities: Circulatory support in hypovolemic shock

- Vascular access and volume resuscitation
  - 20 mL/kg normal saline, repeat as needed
- Stabilization and Identification of cause
CASE PROGRESSION

Patient electively intubated

Two intravenous lines placed and patient received 40 mL/kg normal saline

CT scan shows Grade III Liver Laceration and Grade II Spleen Laceration

Patient transported to the pediatric intensive care unit.
PATIENT ASSESSMENT

Priorities are similar to adult
Greater emphasis on airway, breathing
PATIENT ASSESSMENT

Limit to essentials
Look before you touch
INITIAL ASSESSMENT

Categorize as:
- Stable
- Potential Respiratory Failure or Shock
- Definite Respiratory Failure or Shock
- Cardiopulmonary Failure
Why is weight a pediatric vital sign?

\((\text{Age[hrs]} \times 2) + 8\)
HEART RATE

Apical auscultation
Peripheral palpation
Tachycardia may result from:
- Fear
- Pain
- Fever
HEART RATE

Tachycardia + Quiet, non-febrile patient = Decrease in cardiac output
- Heart rate rises long before BP falls!

Bradycardia + Sick child = Premorbid state
- Child < 60
- Infant < 80
BLOOD PRESSURE

Children >1 year old

- Systolic BP = (Age x 2) + 65

- <60 mm Hg in term neonates (0 to 28 days)
- <70 mm Hg in infants (1 month to 12 months)
  - <70 mm Hg + (2 × age in years) in children 1 to 10 years
  - <90 mm Hg in children ≥10 years of age
BLOOD PRESSURE

Hypotension = Late sign of shock

Evaluate perfusion using:
- Level of consciousness
- Pulse rate
- Skin color, temperature
- Capillary refill

Do not delay care to get BP
RESPIRATIONS

Before touching
For one full minute (if possible)
Approximate upper limit of normal = (40 - Age[yrs])
RESPIRATIONS

> 60/min = Danger!!

Slow = Danger, impending arrest

Rapid, unlabored

- Metabolic acidosis
- Shock
CAPILLARY REFILL

Check base of thumb, heel
Normal \( \leq 2 \) seconds
Increase suggests poor perfusion
Increases long before BP begins to fall
Cold exposure may falsely elevate
TEMPERATURE

Cold = Pediatric Patient’s Enemy!!!

- Large surface:volume ratio
- Rapid heat loss

Normal = 37°C (98.6°F)

Do not delay care to obtain
CONCLUSIONS

Physiologic status and urgency of treatment can be quickly established.

Knowledge of normal development allows recognition of abnormal behavior.
CONCLUSIONS

Graded intervention is driven by degree of physiologic compromise

Frequent reassessment is key to successful resuscitation
SPECIFIC ORGAN SYSTEMS

Head injury/neurologic

Most common fatal injury in pediatric trauma
usually closed head injury
Intracranial monitoring less important in young children
Cervical spine injury can be without bony injury
  Plain films do not clear C-spine

Thoracic

Pulmonary contusion is common and peaks at 24-48 hours after injury
Cardiac contusion is uncommon. Troponin levels are diagnostic
SPECIFIC ORGAN SYSTEMS

Abdomen

Liver and spleen injuries are common but generally can be managed nonoperatively.

Small bowel injuries can be difficult to diagnose.

- Abdominal pain and fever should be worrisome.
- Injury to the kidney requires high velocity force.
- Seatbelt injuries are more common when the belt is in properly placed.

Genitourinary

Straddle injuries.
THE END

Are there any questions?