Advanced Pediatric Assessment

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Financial Disclosures

No relevant financial relationships with any commercial interests

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Objectives

- Discuss how pediatric anatomy and physiology influences illness presentation and progression
- Review methods to assess pediatric patient status and accurately determine severity of illness/injury
- Discuss systemic approach to care for pediatric patients

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Those pesky kids . . .

Why does MY heart rate go up when a sick kid comes in?

- 20-25% of community ED admissions are for children < 18 years of age
- Of these, only 4.5% result in hospital admission

When their sick, they're really sick!!

US Dept of Health and Human Services, Agency for Healthcare Research and Quality

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Take the pressure off!!

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Pediatric Wisdom 101

- Take YOUR TIME and TESTS to diagnose
- **Basic treatments save lives**
- **Key to success = Prevent hypovolemia and hypoxemia**
  - **Full set of Vital Signs**
  - **Place 02**
  - **Place IV**
  - **Suction**

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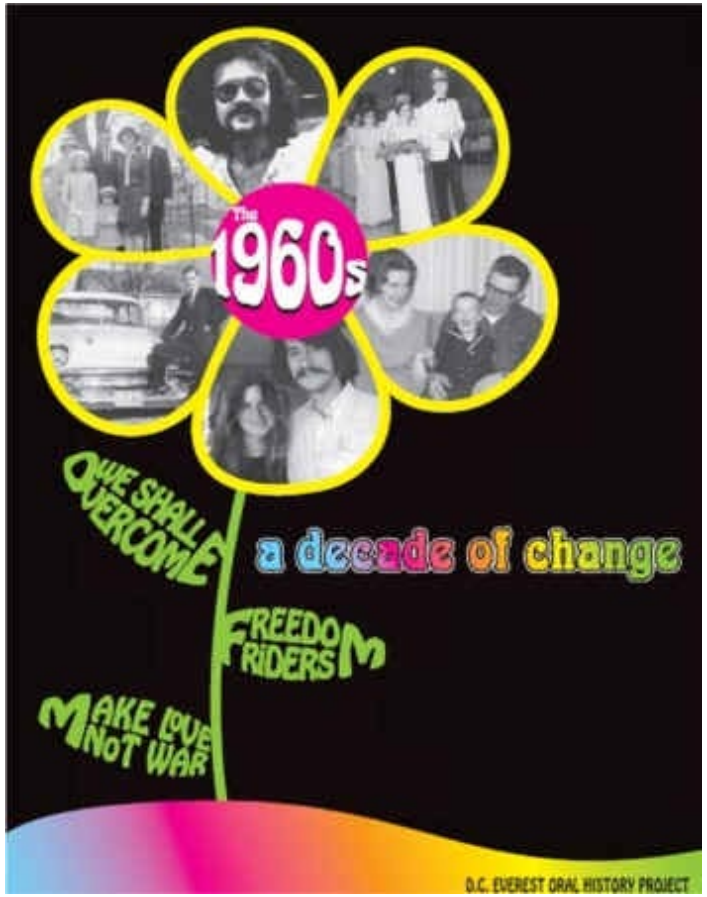
Pediatric Wisdom 101: Hate the 60's



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Pediatric Wisdom 101: Hate the 60's

- Heart Rate 60 = bradycardia
- Respiratory Rate 60 = tachypnea
- Systolic Blood Pressure 60 = hypotension/uncompensated shock
- BGL 60 = borderline
  - 40-60 hypoglycemic

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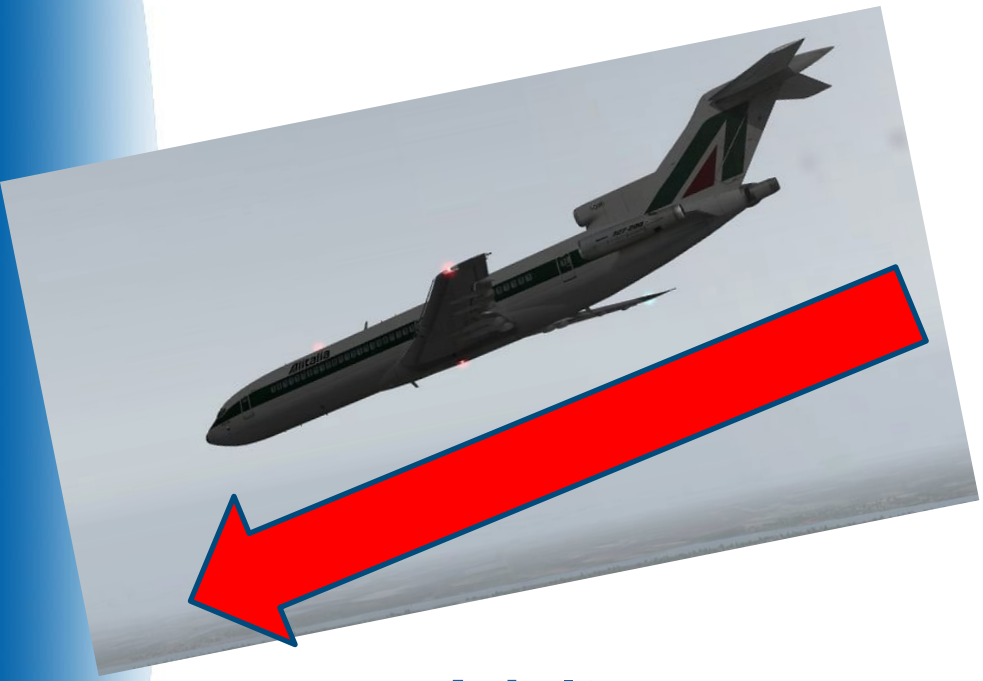
Adult vs. Pediatric Crash



Adults

Infants/Children

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Pediatric Wisdom 101

- **Children's Hospital RULE – The younger the patient, the more naked they need to be for your assessment**
- Infants, children = High RPMs
- When things slow down, trouble is imminent
- Impeding Death associated with sudden drop in RR, HR, BP
- Decrease in mentation can be ominous

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Pediatric Wisdom 101

- Minute-to-minute trends are important – including blood pressure!!

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Enhanced monitoring improves pediatric transport outcomes: a randomized controlled trial.

RESULTS:

Patients in the intervention group **received more intravenous fluid** (19.8 ± 22.2 vs 9.9 ± 9.9 mL/kg; P = .01), had a **shorter hospital stay** (6.8 ± 7.8 vs 10.9 ± 13.4 days; P = .04), and had **less organ dysfunction** (18 of 206 vs 32 of 202 PICU days; P = .03)

Stroud MH, Prodhan P, Moss M et al. Enhanced monitoring improves pediatric outcomes: a randomized controlled trial. Pediatrics 2011. 127(1):42-8.

Review Anatomical Differences: Kids are not little adults!

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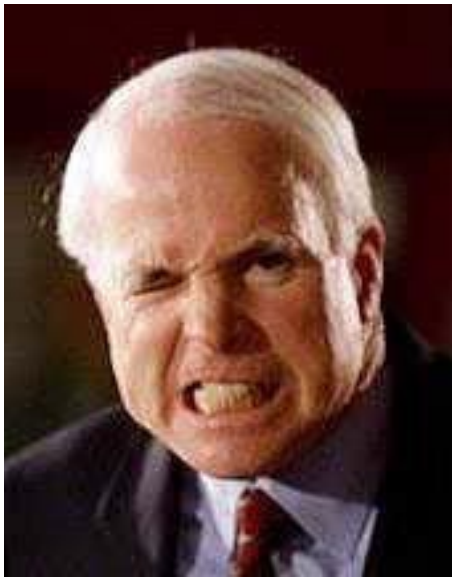

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Review: Anatomical Differences

Body Proportions

- Greater body surface area to total body weight

PEM Considerations:

- **Prone to hypothermia and dehydration**

=

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Review: Physiological Differences

Physiology	PEM Considerations
• Higher metabolic rate (need more energy and oxygen)	• Prone to hypoxia, hypoglycemia
• Higher fluid requirements (newborn = 70-80% water)	• Prone to dehydration (v/d)

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Review: Physiological Differences

Physiology	PEM Considerations
• Good vasculature and heart = great compensation ability	• **Hypotension late sign!**

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The Challenge: Rapid Assessment of a Child

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Pediatrics: Best Management

1. **Rapid Initial, then Ongoing, Assessment**

   Pediatric Assessment Triangle

2. **Systematic, Head-to-Toe Approach**

   Treatment/Management

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Pediatric Assessment Triangle: General Impression/Determine Urgency

Appearance

Work of Breathing

Circulation to Skin

Source: American Academy of Pediatrics, Pediatric Education for Prehospital Professionals

Source: American Academy of Pediatrics, Pediatric Advanced Life Support

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Pediatric Assessment Triangle

1. How sick/injured is this child?
2. What is the most likely physiologic abnormality?
3. What is the **urgency** for treatment?

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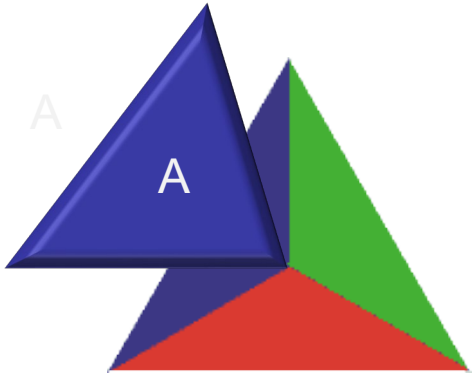
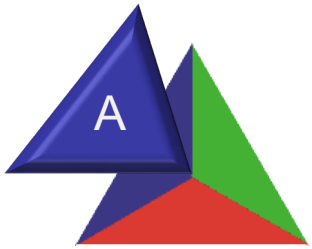
Pediatric Assessment Triangle

- **Appearance (Neuro Status)**
  - Decreased/Altered Mentation in peds = CRITICAL FINDING until proven otherwise
    - Bodies shut down systematically
  - Rapid Assessment: Awake, alert, eyes open, focus/track, verbalizing, crying/consolable?, reactive to assessment/interventions



Pediatric Assessment Triangle



TICLS Mnemonic

- TONE – Floppy/Flaccid/Limp = CRITICAL FINDING
- INTERACTIVENESS
- CONSOLABILITY
- LOOK/GAZE - Lights on? Anybody home?
- SPEECH/CRY – quality (high pitched?)

Floppy Baby

Good Flexion/Tone

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Hypotonic Baby

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Good Flexion/Tone

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Floppy Baby

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Good Flexion/Tone

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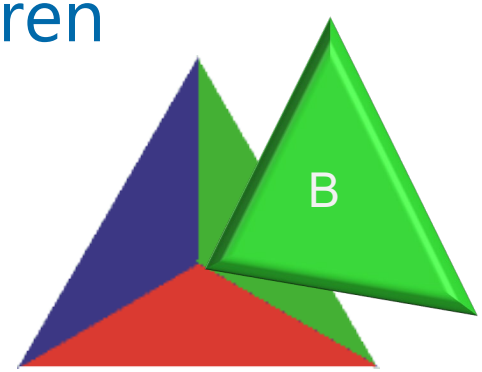
Pediatric Assessment Triangle

- Breathing
  - Rapid Assessment: Audible wheeze or stridor, tripod positioning, inability to manage secretions, grunting, nasal flaring, retractions
  - Respiratory arrest frequently precedes cardiac arrest in infants and children



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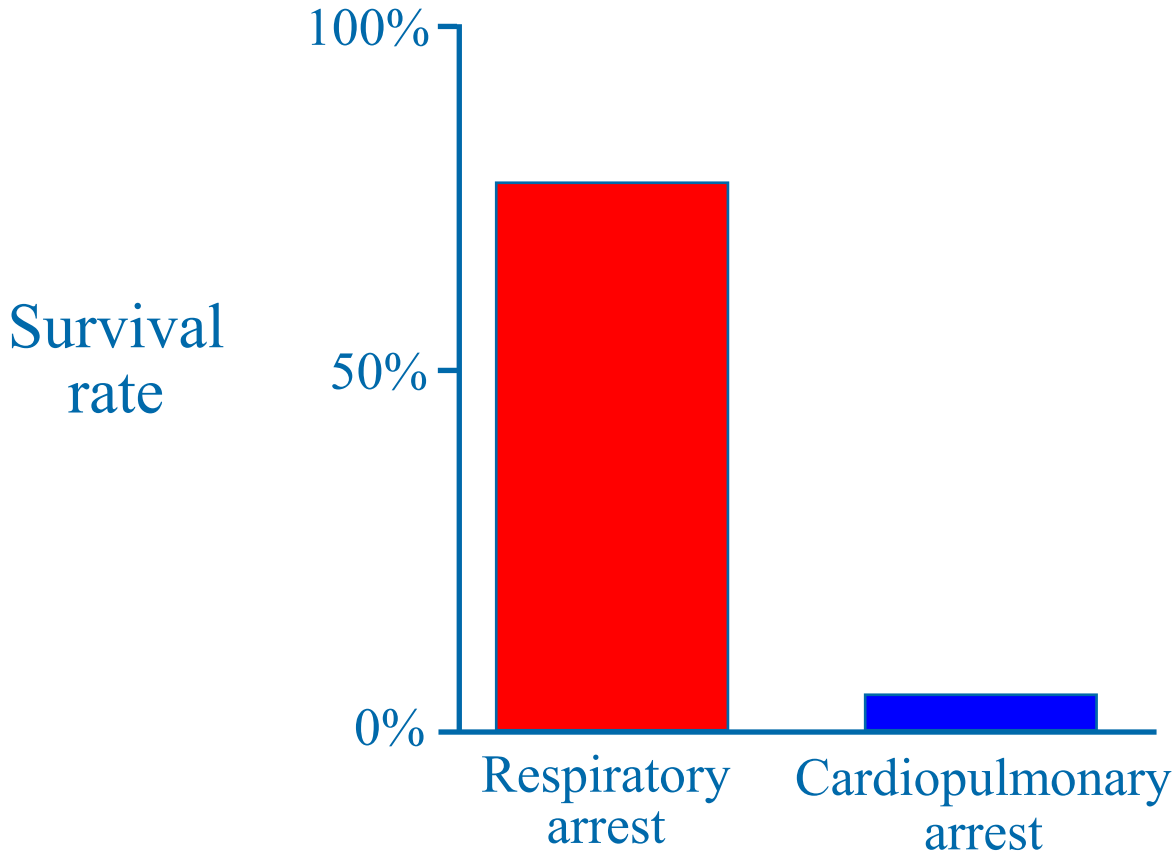
Survival Following Respiratory Arrest vs Cardiopulmonary Arrest in Children



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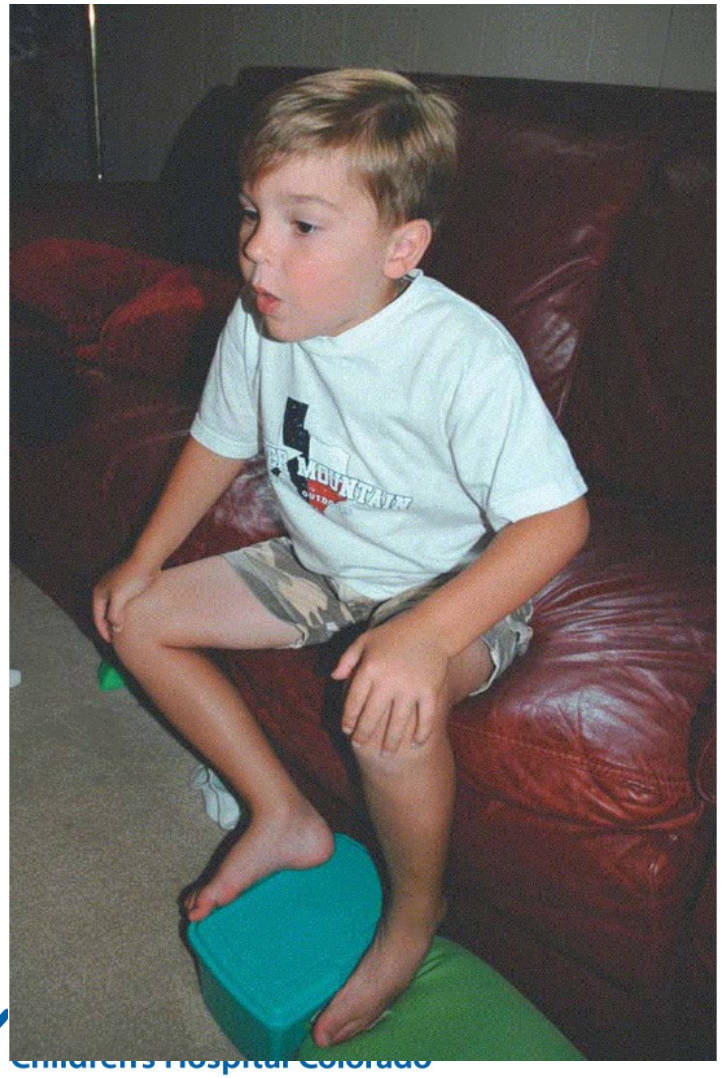
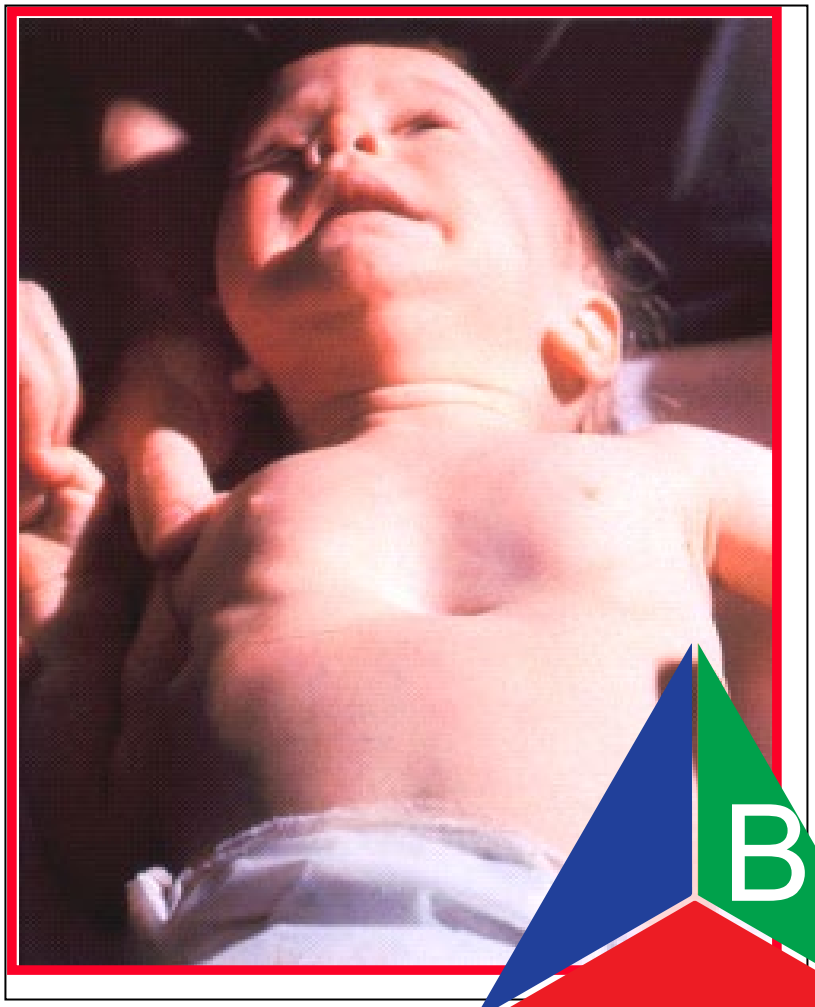
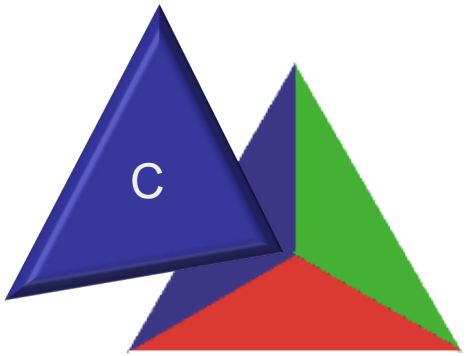
Respiratory distress will progress to failure!





Pediatric Assessment Triangle

- **Circulation**
  - Rapid Assessment: Skin Findings (capillary refill, temperature, color, mottling), mucous membranes, pulses, HR, mental status



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Best Practice – Pediatric Style

Systematic (Head to Toe) Approach

1. Airway (C-spine immobilization)
2. Breathing
3. Circulation
4. Disability (Da Brain) & Dextrose
5. Expose & Environmental Control

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Systematic Approach – Airway challenges

Respiratory

- Significant soft tissue
- Large, friable tonsils

PEM Considerations

- CNS depression increases UAO
- "built-in" UAO

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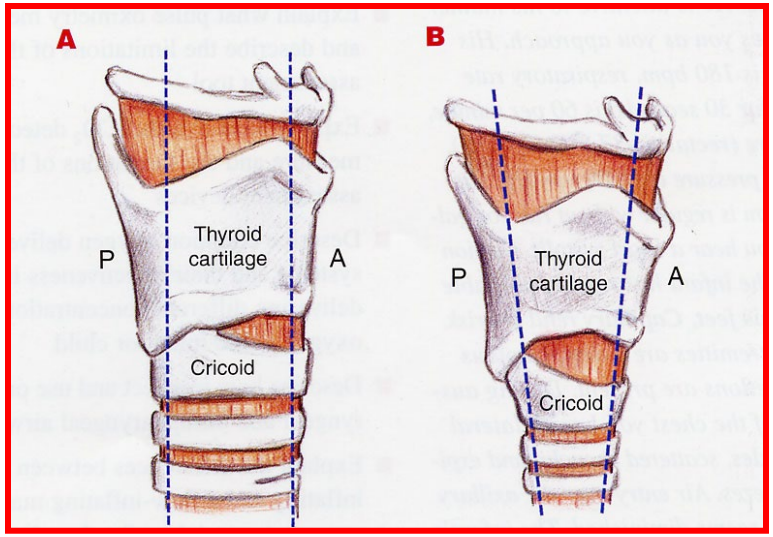
Systematic Approach – Airway Challenges

Anatomy

- Large tongue
- Short, narrow trachea



Considerations

- Obstruction risk, difficult to displace
- Extremes of flexion/extension or aggressive cricoid causes UAO

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Systematic Approach – Airway Challenges

Anatomy

- Small diameter of airways

Considerations

- Small swelling = BIG obstruction!

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Systematic Approach – Airway Challenges

Physiology

- Infants are obligate nose breathers

Consideration

- Distress comes quickly with congestion

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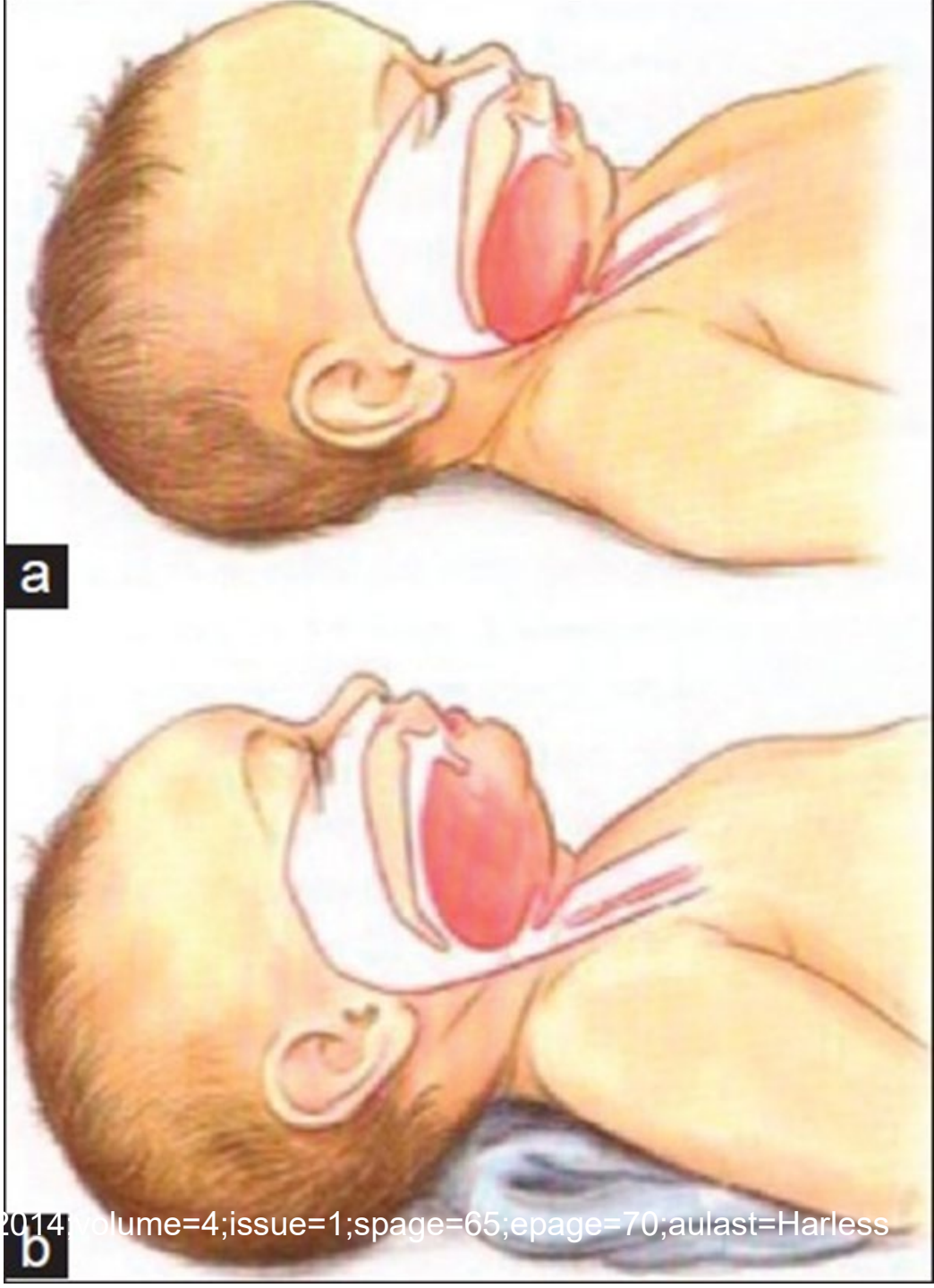
Kids have big heads!



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Systematic Approach

Airway Management

- Towel roll/neutral spine/good airway position

Big head, little body

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Systematic Approach

Airway Management

- Suction
  - Rigid tip/Yankauer
  - Deep Nasal Suction (flexible catheter)
  - Bulb Syringe

Deep Nasal Sxn Option

- "Mushroom Tip" suction
- Allows non-invasive suction of nasopharynx
- No measuring required
- No vagal nerve stim

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Nasal suction LIFESAVER

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Best Practice – Pediatric Style

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Systematic Approach – Breathing Physiology

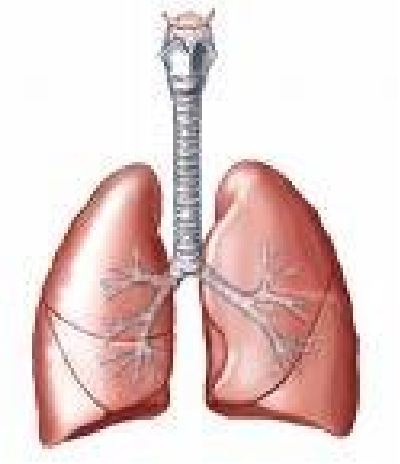
Physiology

- Children have smaller residual lung capacity, but HIGHER oxygen consumption

Considerations

- Become hypoxic more quickly
- ⬆ RR may be first sign of distress

vs



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Systematic Approach – Breathing Physiology

- Immature chest wall musculature
  - Fatigue easily
  - Greater reliance on diaphragm
- Slowing of RR, visible effort may be signs of respiratory failure, not improvement!

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Airway/Breathing Red Flags

Respiratory Distress & Failure:

- Audible wheeze
- Stridor
- Tripoding
- Nasal Flaring
- Hypoxia
- Decreased respiratory rate (impending death)

More Pronounced in Pediatrics:

- Retractions
- Head-bobbing
- Anxious/difficult to console
- Dehydration

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Systematic Approach

Breathing Management

- **Kids are pink until they are dead!!!**
  - High flow oxygen via NRHFM
- Apnea? Inadequate effort? Assist ventilations with BMV
  - Airway Adjuncts: OPA/NPA

Know, and LOVE, your pediatric equipment

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Best Practice – Pediatric Style

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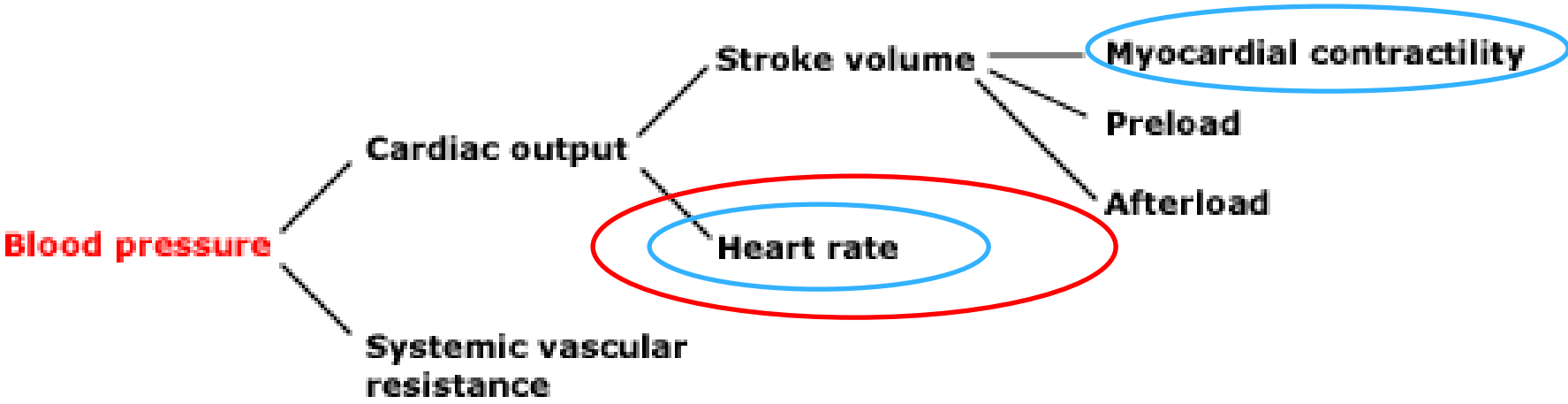
Systematic Approach – Circulatory Physiology



Adult

Child

Systematic Approach – Circulatory Assessment

Direct Assessment:

- Capillary refill
  - Room-temperature dependent
- Pulses
- Blood pressure

Indirect Assessment:

- Mental Status
  - Parents may be first to notice!
- Skin Exam
- Evaluate other end organs later (ie UOP)

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Systematic Approach – Circulatory Assessment

- Know (or have access to!) pediatric norms

Age (yr)	Respiratory Rate (breaths/min)	Heart Rate (beats/ min)
<1	30-60	100-160
1-2	24-40	90-150
2-5	22-34	80-140
6-12	18-30	70-120
>12	12-16	60-100

Systematic Approach – Circulatory Assessment

Definition of Hypotension by Systolic BP

Age	Systolic BP
Term Neonate (0-28 days)	<60
Infants (1-12 months)	**<70**
Children (1-10 years)	<70 + (age in years x 2)
Children > 10 years	<90

American Academy of Pediatrics, Pediatric Advanced Life Support 2006

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Systematic Approach

Circulation Management

- EKG monitor (minute to minute trends)
- IV access
  - Consider NS bolus (10-20cc/kg)
- Compensated vs uncompensated shock . . . Still a clinical diagnosis, even in pediatrics!

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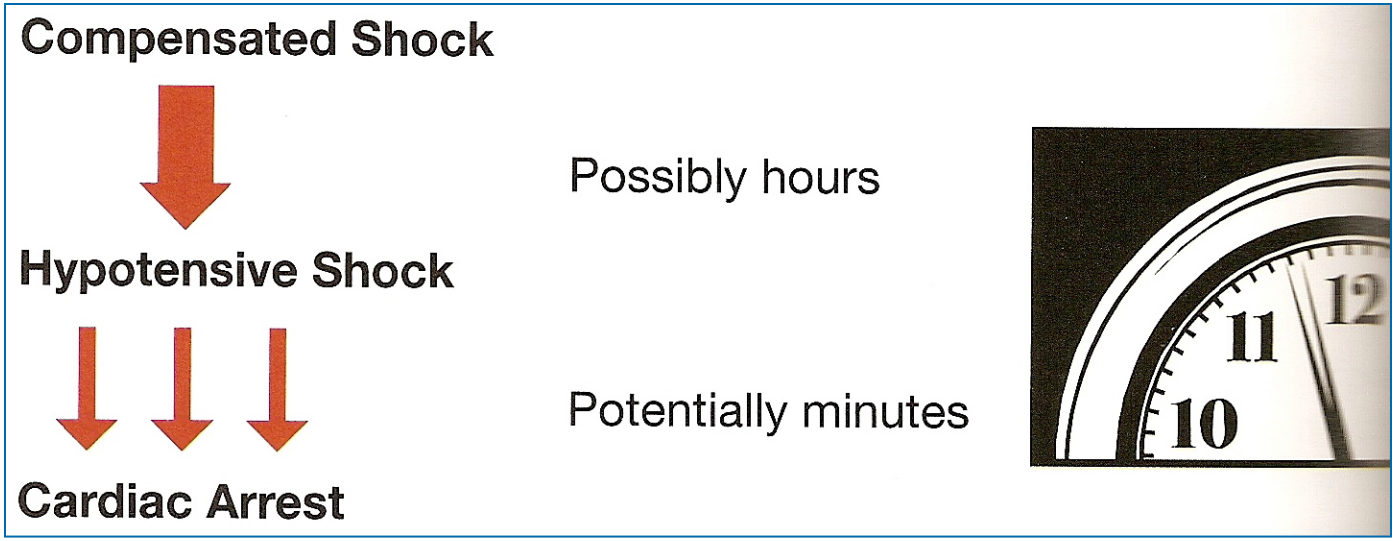
Pediatric Compensated Shock

- Increased heart rate and SVR
- Poor systemic perfusion with delayed capillary refill and faint/nonpalpable distal pulses
- Normotensive

Pediatric Uncompensated Shock

- Weak central pulses
- Altered mental status
- Hypotension (means ≥ 25% volume loss!)

TIME MATTERS!!



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Pediatric Shock: What Does it Mean to You?

Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine.

Brierley J, Carcillo JA, Choong K, et al. 2009 Feb;37(2):666-88.

- Compared to adults, children in septic shock require:
  1. Proportionally more fluid
  2. Early inotrope and vasodilator therapy (EVEN if that means through a PIV rather than a central line!)
  3. Hydrocortisone for absolute adrenal insufficiency
  4. ECMO for refractory shock

Pediatric Shock: What Does it Mean to You?

- "Recommend age-specific therapies to attain time-sensitive goals
  1. First-hour fluid resuscitation and inotrope therapy directed to goals of threshhold heart rates, normal blood pressure, and cap refill ≤ 2 seconds
  2. Subsequent intensive care unit hemodynamic support directed to goals of central venous oxygen saturation >70% and cardiac index 3.3-6.0 L/min/m."

Pediatric Shock: What Does it Mean to You?

Does it work?

- Centers reporting use of 2002 guidelines reported best practice outcomes
- Early implementation of 2002 guidelines improved outcomes in community hospital EDs (NNT 3.3)
- Every hour that went by without adherence to guidelines was associated with a 1.4 fold increased risk of mortality

Pediatric Shock: What Does it Mean to You?

What about traumatic pediatric shock?

- Hemorrhage control
- Early IV access and crystalloid infusion
  - After 40ml/kg, consider 10ml/kg PRBC
  - If presenting in decompensated shock, simultaneously infuse crystalloid and PRBCs

Remember:

1. Traumatic force is widely distributed in a child = more organs affected
2. Will maintain normal BP despite up to 30% of acute blood loss!

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Peds Trauma = Under-Resuscitated

First responder performance in pediatric trauma: A comparison with an adult cohort

"Intravenous access was successfully established in **85.9% of adults compared to 65.7%** in children at the scene (p = .001). Consequently, on arrival at the trauma center, more children required intravenous access, 80.4% compared with 63.6% for adults (p = .011). **As a result, more children (25.5%) required initial or additional fluid bolus** at the trauma center compared with adults (9.1%, p = .003)."

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Bankole S, Asuncion A, Ross S et al. Pediatr Crit Care Med 2011. 12(4):e166-e170

Pediatric Shock: What Does it Mean to You?

Bottom Line:

- RECOGNIZE signs of pediatric shock
- Initiate fluid resuscitation quickly
- Think about inotrope therapy early in septic shock, regardless of access
- Think about PRBCs in traumatic shock refractive to 40ml/kg crystalloid
- Consider early transport decisions based upon resources

Best Practice – Pediatric Style

Systematic (Head to Toe) Approach

1. Airway (C-spine immobilization)
2. Breathing
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4. Disability (Da Brain) & Dextrose
5. Expose & Environmental Control

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Systematic Approach – Disability and Dextrose

- Head trauma accounts for up to 80% of pediatric trauma deaths each year!
- Eyes are the window to the soul…and the brain!

- AVPU Response (awake/alert, verbal, pain, unresponsive) – universally accepted
- Glasgow Coma Score

Systematic Approach – Disability and Dextrose

- GCS validated for trauma only
- More accurate predictor of outcome for children than adults!

Modified GCS for infants

Eye opening response

4. Spontaneous
3. To verbal stimuli
2. To painful stimuli
1. None

Verbal response

5. Coos and/or babbles
4. Irritable and continuous crying
3. Cries to painful stimuli
2. Moans to painful stimuli
1. None

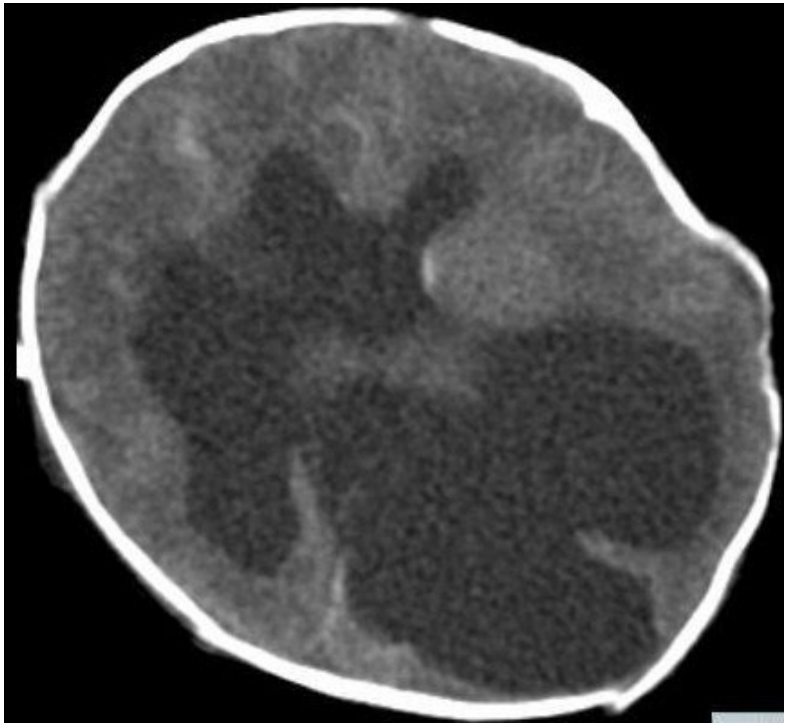
Motor response

6. Spontaneous purposeful movements
5. Withdraws to touch
4. Withdraws to painful stimuli
3. Abnormal flexion (decorticate rigidity)
2. Abnormal extension (decerebrate rigidity)
1. None

Systematic Approach – Disability and Dextrose

Signs of Infant ↑ ICP

- Full fontanel
- Split sutures
- Paradoxical irritability
- Sun-setting eyes
- Persistent emesis
- AMS



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Systematic Approach – Disability and Dextrose

- Check blood sugar…susceptible to hypoglycemia with illness, fatigue
- The younger the child, the more easily glycogen stores are depleted

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Systematic Approach

Disability Management

- Immediate measures for signs of increased ICP
  - Head midline and elevated 30°
  - Maintain normotension
  - Do not excessively hyperventilate (EtCO2 35mmHg goal)
  - Consider Mannitol 0.25gm/kg – 1gm/kg
- Treat hypoglycemia

  For kids, remember the **Rule of 50**

  50 = D50 x 1ml/kg

  50 = D25 x 2ml/kg

  50 = D10 x 5ml/kg

  50 = D5 x 10ml/kg

Systematic Approach: Management Bottom Line

- Hypotension and Hypoxemia increase morbidity and mortality in traumatic brain injury*
  - **Oxygenate/ventilate and Perfuse!**

*Pediatric Traumatic Brain Injury: Epidemiology, Pathophysiology, Diagnosis, and Treatment. *Pediatric Emergency Medicine Reports.* **Sept 1, 2010**

*Early Resuscitation of Children with Moderate to Severe Traumatic Brain Injury. Pediatrics **2009**:124:56-64. American Academy of Pediatrics.

***2007** Guidelines for Management of Severe Traumatic Brain Injury; Joint Project of Brain Trauma Foundation and American College of Neurological Surgeons, Congress of Neurological Surgeons, AANS/CNS Joint Section on Neurotrauma and Critical Care.

Best Practice – Pediatric Style

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Systematic Approach: Expose

- Rule of thumb…the younger the patient, the more naked they should be for your assessment (then cover ‘em up!)
- Surgical scars, rash, s/s abuse
- Check posterior, unusual places…in mouth, under diapers
- PROLONGED cold stress has physiological consequences (worsens acidosis, increases metabolic demand)

Some add “F” to the ABCDEs – always consider the **Family**

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In Summary

- Pediatric Assessment Triangle, and Systematic Approach – **It's all about the basics!**
  - Get 'em naked!
- Early Recognition of impending decompensation is the key
- Understanding pediatric anatomy/physiology and intervening will improve outcomes
- **Avoid Hypotension and Hypoxia at all times**
- **Don't be afraid to ask us!!!**

720-777-3999 (One Call)

720-777-8838 (Transfer Center)

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- Questions?

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Thank you!

Questions?
Kelley.roswell@childrenscolorado.org

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Case Review

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911 Activation

- ALS unit arrives to ED after called to home for a 6 year old with respiratory distress
- EMS reports that child has h/o asthma, recent URI with cough and multiple hospitalizations for asthma
- Given albuterol x 2, 2mg/kg solumedrol and 20ml/kg NS bolus en route
- Of note, home was filled with cigarette smoke and in disarray per transporting team

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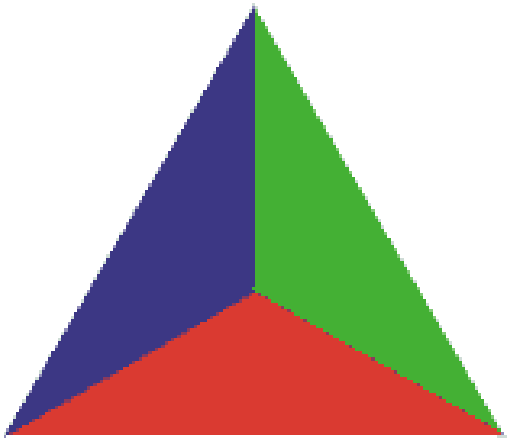
Pediatric Assessment Triangle

- **Appearance** = Alert, speaking in 2-3 word sentences
- **Breathing** = +IC/SC retractions, tugging at notch, significant abdominal breathing and audible wheeze
- **Circulation** = Face pink, cap refill 2-3 seconds
- **Disability** = Dstick 70, AVPU alert
- **Exposure** = No rashes to trunk, extremities



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ED Immediate Interventions

- Airway – clear
- Breathing – Albuterol/atrovent nebulizer with oxygen, pulse oximetry placed
- Circulation – second bolus started
- Disability – dextrose to be added with maintenance fluids
- Exposure – Warm blankets

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ED Primary Survey

T 101.5 P 130 BP 90/45 R 40 pO2 92% on 1L

Gen: Mild respiratory distress with tachypnea, + subcostal retractions, speaking in 5-6 word sentences and complaining that his chest and feet hurt

HEENT: TMs mildly erythematous, no purulence. MMM

Chest: Decreased BS in all lung fields with scattered wheezes and crackles, + retractions, prolonged I:E ratio. Reproduction of chest pain with compression

Cardiac: Tachy and regular, 2/6 vibratory SEM along LSB.

Abd: Soft, ND and NT

Ext: Cap refill 2-3 seconds

ED Secondary Survey

- SAMPLE history significant for:
  - 4-5 day history of URI symptoms and worsening cough
  - Tactile fevers
  - Family ran out of albuterol, gave Robitussin
  - No allergies, no other medications
  - History of asthma with multiple hospitalizations and no ICU stays. Last course of steroids was 3 months ago
  - Poor PO over last several days, mother unsure when he ate
  - No other events leading to episode, no exposures (mom denies cigarette smoke exposure)

ED Tertiary Survey

- Sent to radiology for r/o PNA CXR
- Child continued to complain of pain to his feet
- Radiology tech removed shoes due to child's persistent complaining:

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Child Abuse and Neglect

- Over 1 million cases of child abuse/neglect **annually**
- Estimated prevalence of physical abuse at anytime during childhood is 5-35%
  - As few as 5% are reported to child protective agencies
- Victims characteristics:
  - 67% are < 1 year of age; 80% < 3 years
  - Past h/o abuse
  - Learning disabilities, MR, DD
  - Congenital anomalies
  - Hyperactive children
  - Adopted or step-children
  - Prematurity, LBW (conflicting)

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Top 10 History "Red Flags"

1. Injury unexplained by history
2. Absent, changing or evolving history
3. Delay in seeking medical care
4. Inappropriate affect of caregiver
5. Triggering event causing loss of control in caregiver
6. Unrealistic expectations for the child
7. Crisis or stress if child's environment
8. Social/physical isolation of child or family
9. Pattern of increasing severity of escalation of event over time
10. Prior history of abuse of caregiver as a child

Physical Exam – Concerns

- Unusual distribution of injuries
- Multiple bruises or bruises in more than 1 plane
- Soft tissue surfaces
- Patterned bruises or bruises of different ages

Accidental	Abuse
Shins	Upper anterior thighs
Elbows	Trunk (torso/chest/BACK)
Lower arms	Upper arms
Forehead	Face & ears
Beneath chin	Neck and cheeks
Ankles	Hands and feet
Hips	Buttock, anus, genitalia

Accident vs Abuse?

Abuse Locations

- ✓ Upper anterior thigh
- ✓ Trunk
- ✓ Upper arms
- ✓ Face/cheeks/neck

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Document, Document!

2 year old male with multiple body bruises with several patterned bruises, skin and soft tissue injuries, penis trauma and small left subdural hemorrhage.

This constellation of findings is not explained by the reported history of a minor fall and is consistent with non-accidental trauma / child physical abuse.

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Documentation: Photography

Key Elements:

- Quality 35mm or digital camera
- Zoom and wide angle
- Ensure proper lighting
- In-photo patient identifiers and labels
- Ask law enforcement to take photos

***Never use a cell phone* camera**

- ➢ Not a secure chain of evidence
- ➢ Serious violation of privacy if data shared

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911 Activation

- High-speed MVA
- Flown to your facility

- Known 2 on-scene fatalities
- Collision-to-door 59 minutes

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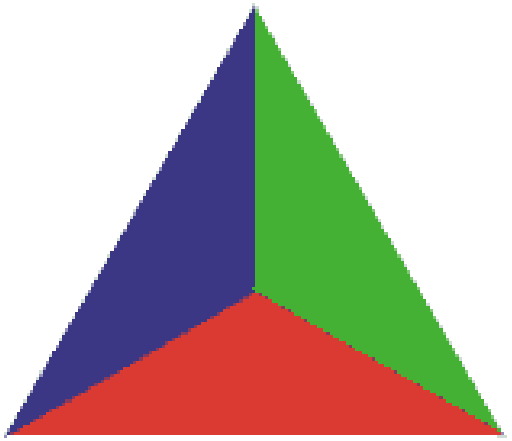
Pediatric Assessment Triangle

- **Appearance** = Mumbling and moaning on long board with C-spine precautions
- **Breathing** = Unlabored, no audible noises, no visible increased WOB
- **Circulation** = Pink and warm, cap refill 2-3 seconds
- **Disability** = Dstick 121, GCS 13, not moving lower extremities
- **Exposure** = Open femur fracture, multiple facial and corporal bruises



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ED Immediate Interventions

- Airway – clear
- Breathing – 10L O2 via NRBM
- Circulation – 2nd NS bolus started based on estimated weight of 25 kg
- Disability –
- Exposure – Warm blankets

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ED Primary Survey

T 96 P 60 BP 76/40 R 22 pO2 97% on 10L

Gen: Episodically awake, continuing to moan and mumble

HEENT: AT/NC, PERRL, facial bruising and swelling

Neck: C-collar in place, no crepitus or bruising

Chest: CTAB, no bruising or lacerations to chest wall

Cardiac: Brady and regular, no R/M/G

Abd: Soft, ND with 2 small bruises noted to right upper quadrant, linear petechiae along seatbelt distribution

Ext: Open left femur fracture, scattered other abrasions

Neuro: GCS 13, not moving lower extremities

Case Review

Highlights:

- abnormal vital signs
- TBI (GCS/AMS, facial trauma, mechanism)
- spinal cord injury (mechanism, physical exam)
- address femur fracture
- intraabdominal injury

Thoughts?

- Transport urgency?
- Decompensation risk?
- Interim therapy?

Pediatric TBI

- Affects 435,000 children per year and accounts for >1/3 of deaths in children
- Primary injury – done deal

  Secondary injury – caused by injury cascade (swollen organ too big for cage) and preventable insults including:

Hypoxia

Hypotension

What Can We Do?

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Brain Resuscitation - Pitfalls

1st Tier Therapy (in the field)

- Hypotension and hypoxia early after TBI associated with increased mortality and worse functional outcomes
  - Study of 299 children with TBI (82% severe)

	Normal BP or undocumented (181)	Hypotension with treatment (57)	Hypotension without treatment (61)
Median GCS	4	3	3
Death	7% (14)	30% (17)	56% (34)
Poor GOS (1-3)	13% (23)	39% (22)	65% (40)

Zebrack M, Dandoy C, Hansen K, Scaife E, Mann NC, Bratton S. *Early resuscitation of children with moderate-to-severe traumatic brain injury.* Pediatrics (2009) 124(1), 56-64

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Early Resuscitation of Children with Moderate-to-Severe Traumatic Brain Injury

	Normal **O2 or undocumented (168)**	Hypoxia with treatment (121)	Hypoxia without treatment (10)
Median GCS	5	3	3
Death	11% (7)	48% (58)	60% (6)
Poor GOS (1-3)	16% (10)	62% (75)	70% (7)

Zebrack M, Dandoy C, Hansen K, Scaife E, Mann NC, Bratton S. *Early resuscitation of children with moderate-to-severe traumatic brain injury.* Pediatrics (2009) 124(1), 56-64

Brain Resuscitation – 1st Tier Pitfalls

Bottom Line:

- >1/3 of children present without a field blood pressure or pulse oximetry
- >1/2 with documented hypotension are not being treated
- Failure to correct hypotension = 3.4 fold increase in odds of death compared to children who receive even an attempt at correction!
- The younger or the sicker the child, the LESS likely that child will be completely monitored or treated

Make sure your arriving EMS team has fully monitored vital signs and corrected hypotension/hypoxia!

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Brain Resuscitation - Goals

2nd Tier (ED)

Goal-directed therapy directed toward:

1. Minimize/avoid secondary injury
2. Identify mass lesions requiring emergent surgical intervention

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Brain Resuscitation - Goals

Pediatric-specific guidelines:

1. Avoid hypoxia/hypercarbia
   - paO2 >60mmHg
   - SaO2>90%
   - paCO2 35-40mmHg
2. Avoid hypotension (SBP <5th percentile)
   - Isotonic fluid administration to maintain euvolemia
   - Suggestion of added benefit to higher BP goal of 50-75th percentile until invasive monitoring devices placed (ICP/CPP directed therapy attained)
3. Avoid hyperthermia

Adelson PD, Bratton SL, Carney NA, et al. Guidelines for the acute medical management of severe traumatic brain injury in infants, children, and adolescents. Chapter 4. Resuscitation of blood pressure and oxygenation and prehospital brain-specific therapies for the severe pediatric traumatic brain injury patient. Pediatr Crit Care Med 2003; 4:S12–S18

Brain Resuscitation

Impending herniation?

- paCO2 30-35mmHg
- Mannitol vs hypertonic saline
  - 1.4g/kg mannitol shown to decreased ICP more rapidly than lower doses
  - Hypertonic saline (5ml/kg) may be a better option with tenuous hemodynamics

Case Review

- Circle Back…

	0943	0950	0955	1005
HR	**60**	**62**	**66**	**64**
B/P	**75/P**	**86/43**	**98/81**	**92/42**
RR	22	24	22	24

- Age/Weight = estimated 9y/25kg
- Hypotension = Systolic = 70 + (2 x 9) = **88**
- Warm, dry skin

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Case Review

- Arrive 1014 to Trauma Room 1
- Trauma Team activated prior to arrival
- 500mL infused
- Respiratory effort waning, pale
- HR 40's no distal pulses
- Cardiovascular collapse → CPR, intubation, IV
- Dopamine, Epi, Mannitol,
- Massive Transfusion Protocol started:
  - 40mL/kg NS and 2 units blood via rapid infuser
- FAST Ultrasound = + fluid in abdomen

The Problem?

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Case Review

- **11- year old, 35KG**
  - **30% under-resuscitated at 60 minutes post injury**
- Mid-cervical spinal cord injury with evidence of disruption at C7-T2 and epidural hemorrhage, rib fractures, femur fracture
  - posterior fusion from C5-T6

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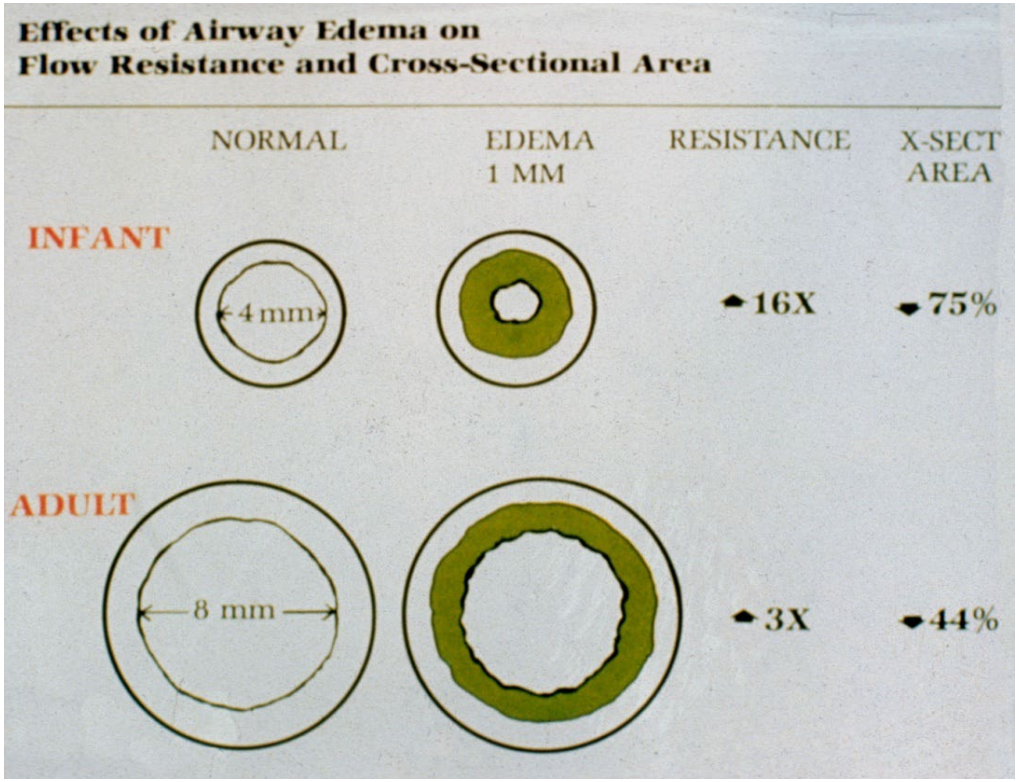

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