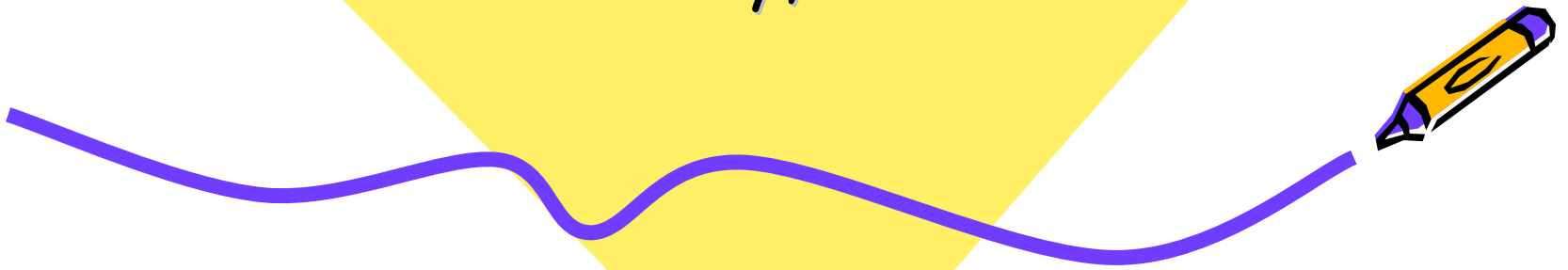




Pediatric Emergencies and Drug Calculations

February, 2014



Introduction

- Children's bodies respond to significant injury and shock differently than adults.
- These differences may be subtle and difficult to recognize

EMS providers must recognize these differences in order to provide the best possible care for an ill/injured child.



Key Terms



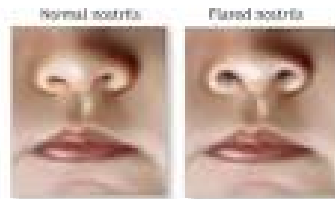
- Compensated shock - An early stage of shock in which the body is able to compensate for inadequate tissue perfusion. It is characterized by sustained tachycardia, decreased skin perfusion and subtle changes in mental status.
- Decompensated shock - A later stage of shock in which the body's compensatory mechanisms break down.
- Fontanelle - Areas where the cranial bones of an infant have yet to grow together creating soft spots on the head.



Terms (cont'd)



- Hypotension - BP that is lower than the normal range. A systolic blood pressure below 70+ (2x age in years) is considered hypotension in children.
- Nasal flaring - As a child breathes out, the nostrils widen. Seen in infants and toddlers; an indicator of increased work of breathing.



#AIDAM



Terms (cont'd)



- Shock - A condition that is caused by inadequate tissue perfusion. It usually develops when the circulatory system is not able to deliver sufficient blood and oxygen to the body organs.
- Postictal - An altered state of consciousness that occurs after experiencing a seizure. Postictal states usually last between 5 and 30 minutes and are characterized by confusion, drowsiness and nausea.



Terms (cont'd)



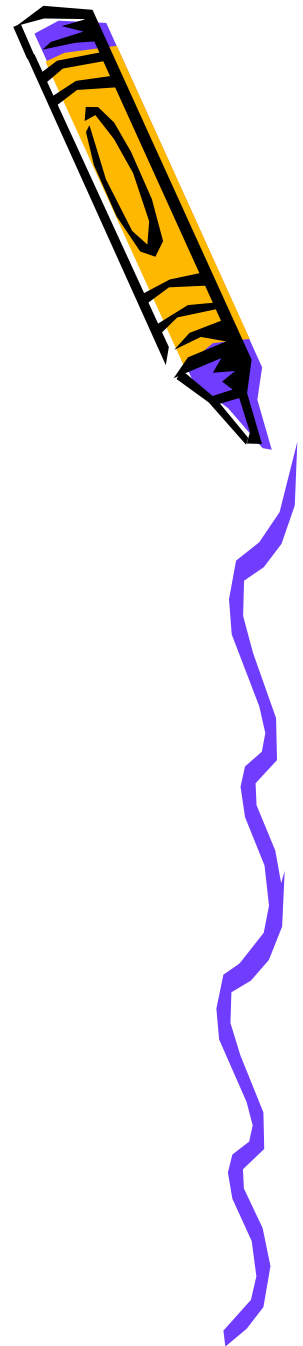
- Respiratory distress - Occurs when a child is able to maintain adequate oxygenation of the blood but only by increasing work of breathing.
- Retractions - A visible sinking-in of the soft tissues in the chest wall or neck muscles seen during respiratory distress



Anatomical Differences

A child's anatomy differs in four significant ways from an adult's. They are:

- Smaller airways
- Less blood volume
- Bigger heads
- Vulnerable internal organs



Anatomical Differences (cont'd)

Smaller Airway

- Large tongue in relation to a small oropharynx
- Diameter of the trachea is smaller
- Trachea is not rigid and will collapse easily
- Back of the head is rounder and requires careful positioning to keep airway open



Anatomical Differences (cont'd)

Less Blood Volume

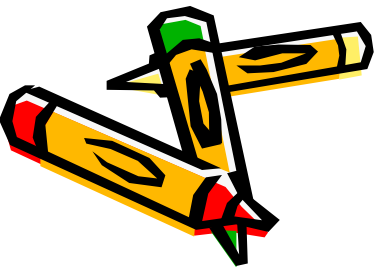
- Relatively smaller blood volume
- Approx 70ml of blood for every 1kg (2lbs) of body wt.
- A 20 lb child has about 700ml of blood



Anatomical Differences (cont'd)

Bigger heads

- Head size is proportionally larger
- Prominent occiput and a relatively straight cervical spine
- Neck and support structures aren't well developed
- Infants and small children are prone to falling because they are top heavy



Anatomical Differences (cont'd)

Internal organs

- Internal organs are not well protected
- Soft bones and cartilage and lack of fat in the rib cage make internal organs susceptible to internal injuries
- Injury can occur with very little mechanism or obvious signs





Development Considerations



Infant: 1 - 12 months

- Active extremity movement
- Tracks object with eyes
- Obstruction of the nose may cause resp. distress
- Separation anxiety later in this period
- Provide sensory comfort such as a warm stethoscope





Development Considerations (cont'd)



Toddler: 1-3 years

- Approach slowly & limit physical contact
- Most have stranger anxiety
- Sit down or squat next to and use a quiet voice
- Not good at describing or localizing pain
- Use play and distraction objects
- Have caregiver hold child
- Ask only yes/no questions





Development Considerations (cont'd)



Preschool age: 3 - 5 years

- Explain procedures in simple terms
- Use games or distractions
- Set limits on behaviors
- Praise good behavior
- Offer a stuffed animal or toy to hold





Development Considerations (cont'd)



School age: 6 - 12 years

- Speak directly to the child
- Be careful not to offer too much information
- Explain procedures immediately before carrying them out
- Don't negotiate unless the child really has a choice





Development Considerations (cont'd)



Adolescent: 12 - 15 years

- Explain what you are doing and why
- Show respect
- Get history from patient, if poss.
- Respect independence; address directly
- Allow parents to be involved in exam, if ok with patient
- Consider asking questions about sexual activity, drug/alcohol use privately.



Pediatric Assessment Triangle (PAT)



There are 3 elements that you need to assess in a pediatric patient in order to determine severity of illness:

- Appearance
- Work of breathing
- Circulation to the skin

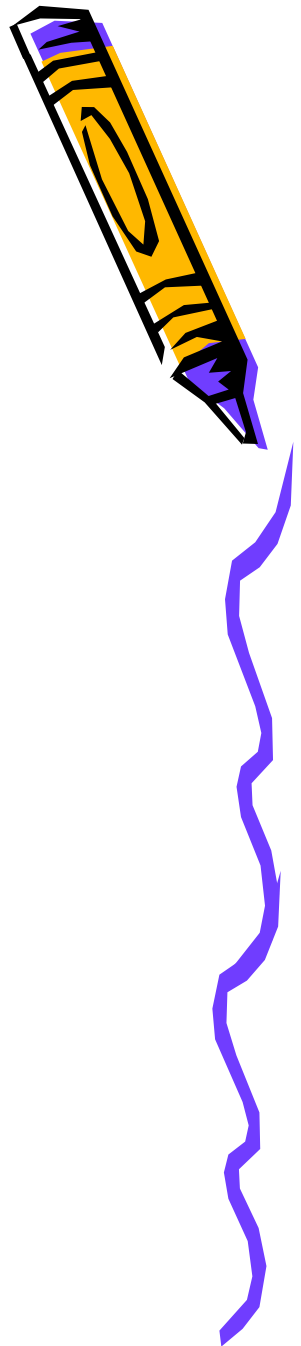
These 3 indicators reflect the overall status of a child's cardiovascular, respiratory, and neuro systems.



PAT (cont'd)

Airway

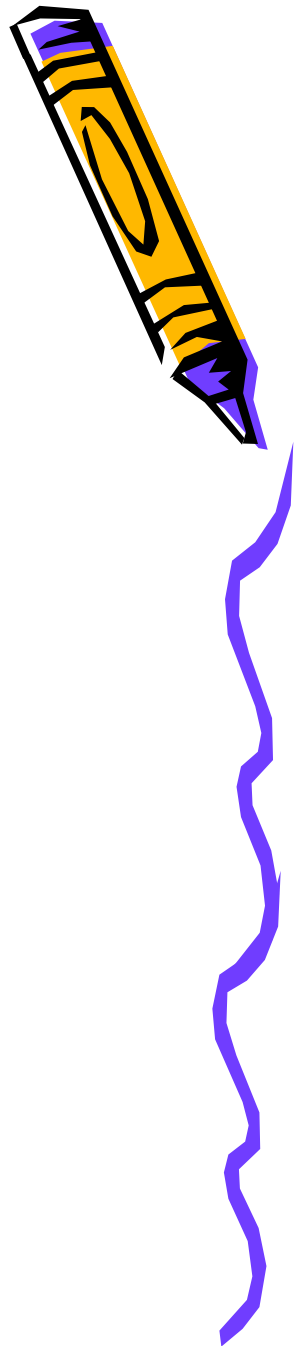
- Alertness
- Distractibility
- Consolability
- Eye contact
- Speech/cry
- Spontaneous motor activity
- Color



PAT (cont'd)

Work of breathing

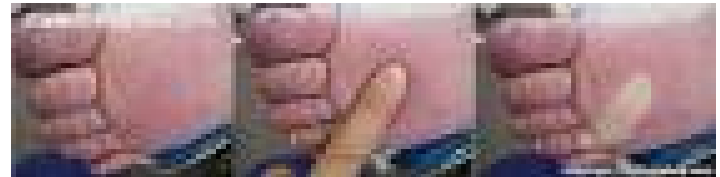
- Abnormal position
- Abnormal breath sounds
- Retractions
- Nasal flaring

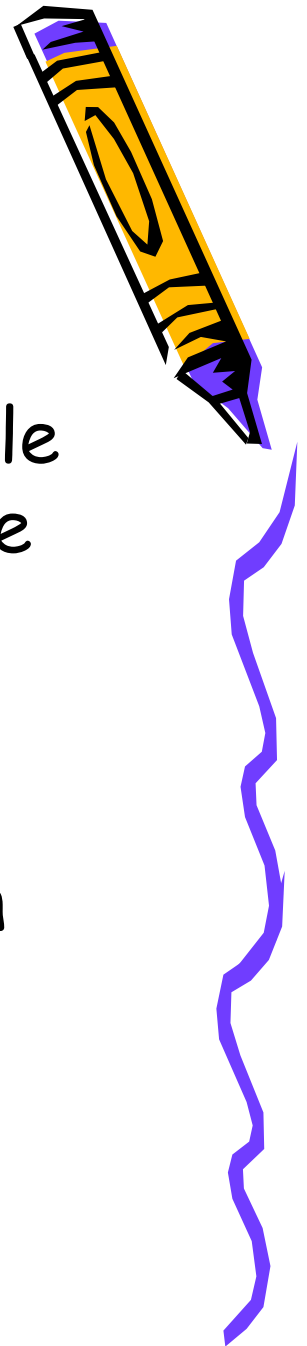


PAT (cont'd)

Circulation

- Color
- Temperature
- Capillary refill time
- Pulse quality





Respiratory Emergencies

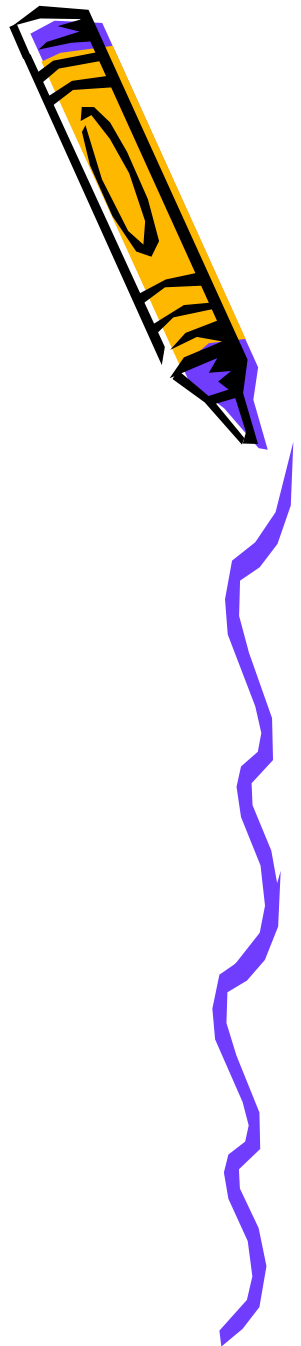
- Distress - is a state where a child is able to maintain adequate oxygenation of the blood, but only by increasing his or her work of breathing
- Failure - occurs when a child cannot compensate for inadequate oxygenation and the circulatory and resp. systems begin to collapse.



Seizures

Seizures may be caused by:

- Infection
- Head trauma
- Epilepsy
- Electrolyte imbalance
- Hypoglycemia
- Toxic ingestion or exposure
- Birth injury



Meningitis

Signs and symptoms can include:

- Altered LOC
- Fever
- Seizures
- Stiff neck
- Pain on moving of the head
- Small, red spots or purplish rash
- Irritability in infants
- Bulging fontanelle



Trauma

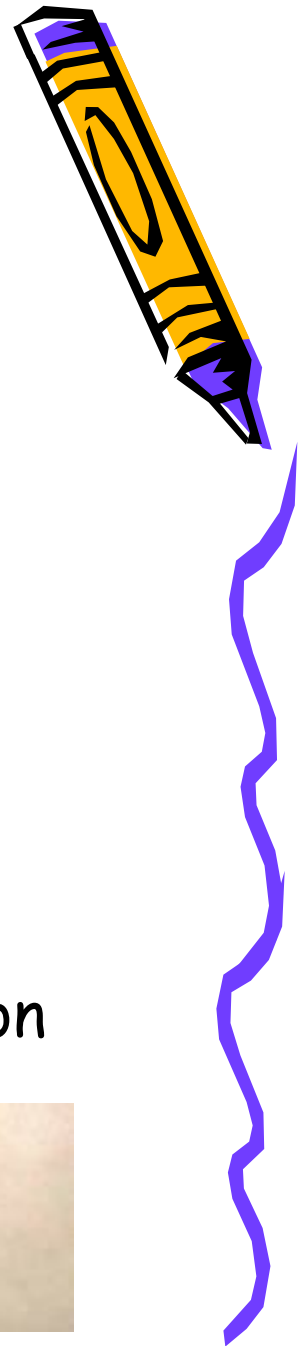
- Use appearance, work of breathing and circulation to the skin in your assessment
- Mechanism of injury may also play a factor when deciding whether the child is stable or critical



Abuse and neglect

General indicators of abuse include:

- Passive and withdrawn behavior
- Bruises on soft parts of body
- Burns in patterns or unusual locations
- Facial or head injuries
- Multiple injuries at various states of healing
- Poor hygiene (physical, dental) or poor nutrition
- Drug/alcohol abuse



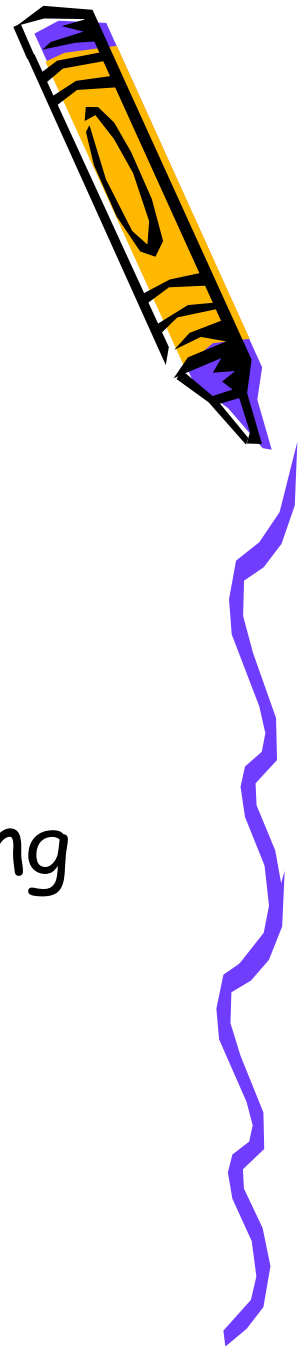
Injury patterns - Accidental



- Injury usually on bony prominence
- One injury or set of injuries usually occurs with resolution rather than repeatedly the same injury
- Lacerations more common
- One body plane usually affected



Injury patterns - Intentional



- Injury usually on soft parts of the body
- Pattern injury (finger, bite marks, cord and strap marks)
- Injuries at various stages of healing
- Lacerations uncommon
- Injuries on multiple body planes



Pediatric shock

- Never wait for a drop in BP to begin treating for shock
- Children maintain BP by increasing their heart rate and vasoconstriction - even with a significant loss of blood vol. This means that BP does not drop until much later in the progression of shock
- A child can lose up to 1/3 of blood vol before a significant drop in BP
- Use appearance and circulation to the skin to help assess for shock



Signs of shock - Early

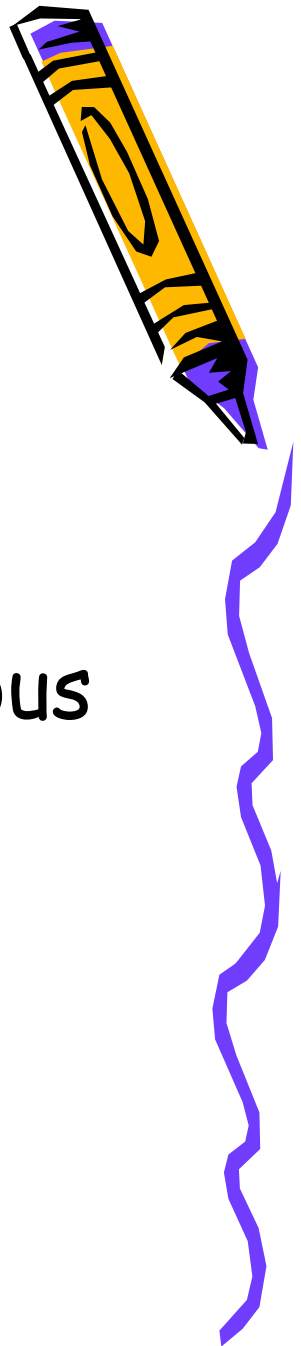
- Sustained tachycardia **
- Delayed capillary refill > 2 seconds
- Tachypnea
- Anxiousness, combativeness, agitation
- Peripheral constriction, cold clammy extremities

** May be the only suggestive finding



Signs of shock - Late

- Weak or absent peripheral pulses
- Decreased LOC - unconsciousness
- Hypotension (a very late and ominous sign)



Airway management

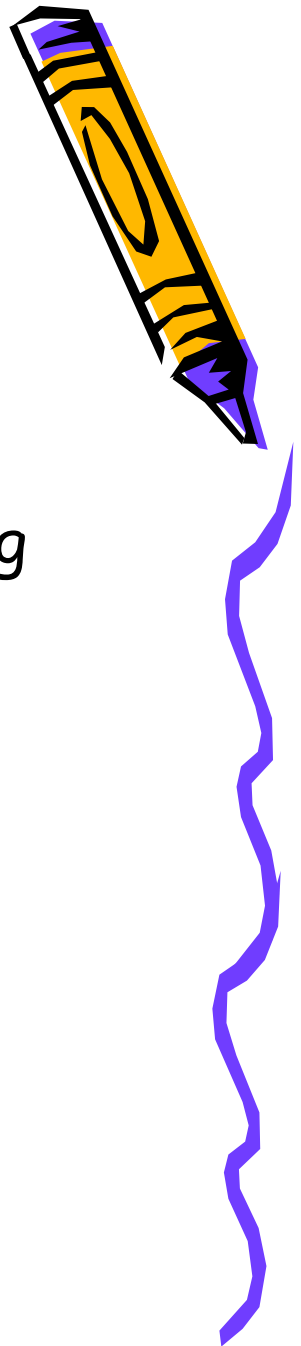


- You may need to position the head in a neutral position with a towel under the shoulders. Take care to not flex or extend the head, which can easily collapse the trachea.
- Use the head tilt-chin lift maneuver when there is no trauma involved.
- Use the jaw-thrust maneuver in cases where trauma was involved.
- Be prepared to suction the airway to remove foreign objects or fluids.
- While maintaining an open airway, take no more than 10 seconds to look, listen and feel for breathing



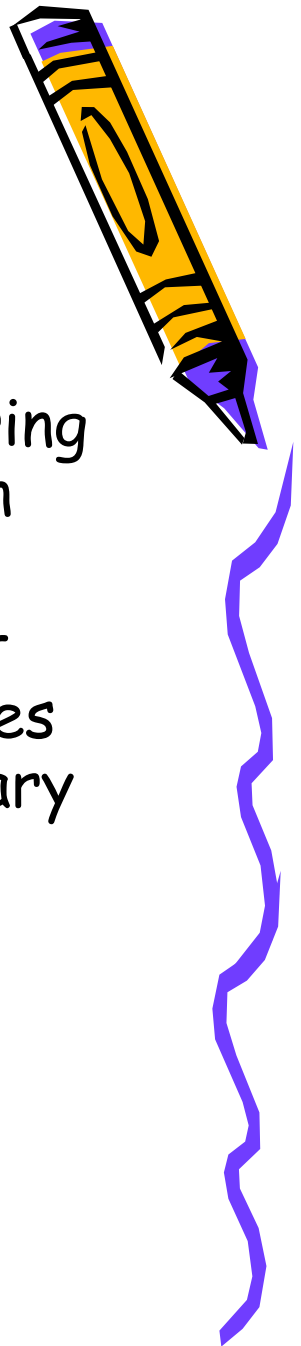
Oxygen Therapy

- Every child with a respiratory emergency or significant trauma should receive high flow oxygen. Use the appearance, work of breathing and circulation to the skin as a guide for determining a child's oxygen needs and which delivery device to use. You may need to assist respirations.
- Delivery device options are:
 - Blow-by oxygen
 - Pediatric non-rebreathing mask (NRM)
 - Bag-valve mask (BVM)



Oxygen Therapy (cont'd)

- Medics often deliver excessive ventilation during CPR, particularly when an advanced airway is in place.
- Excessive ventilation is detrimental because it impedes venous return and therefore decreases cardiac output, cerebral blood flow and coronary perfusion. It also increases the risk of regurgitation and aspiration.
- Do not over-ventilate.



Treatment - Seizures



- Assess for adequate respirations/pulse ox
- Maintain an open airway
- Prepare to suction and ensure proper positioning
- Other care may include: Protecting the actively seizing patient from trauma, administering oxygen therapy, assisting ventilations, monitoring vital signs, cooling measures (if indicated), ALS response with IV and Versed (0.1mg/kg IV or IO) - *watch for signs of respiratory depression.*
- Check blood sugar and treat as indicated (dextrose 25% or 12.4% for *infants under 2 months*)



Summary



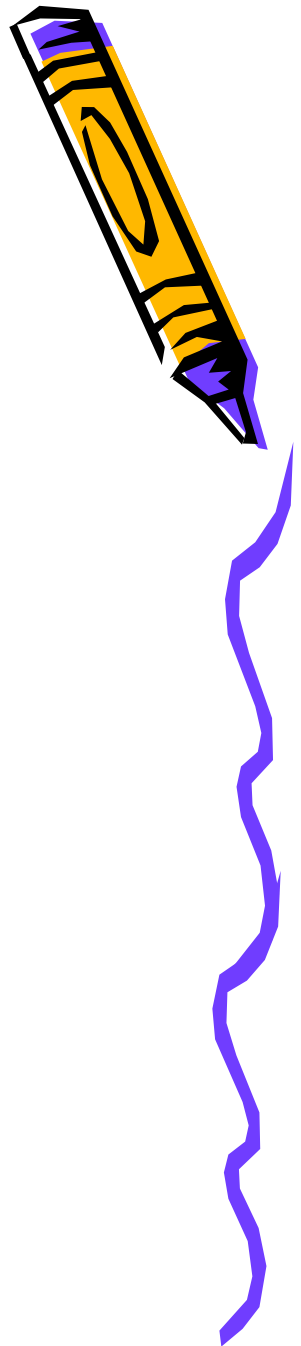
- The anatomic differences between adult and children are **smaller airways, less blood volume, bigger heads and vulnerable internal organs.**
- The 3 elements of the Pediatric Assessment Triangle are **appearance, work of breathing and circulation to the skin.**



Summary (cont'd)

The 7 aspects of the **appearance** element of the **Pediatric Assessment Triangle** are:

- Alertness
- Distractibility
- Consolability
- Eye contact
- Speech/cry
- Spontaneous motor activity
- Color



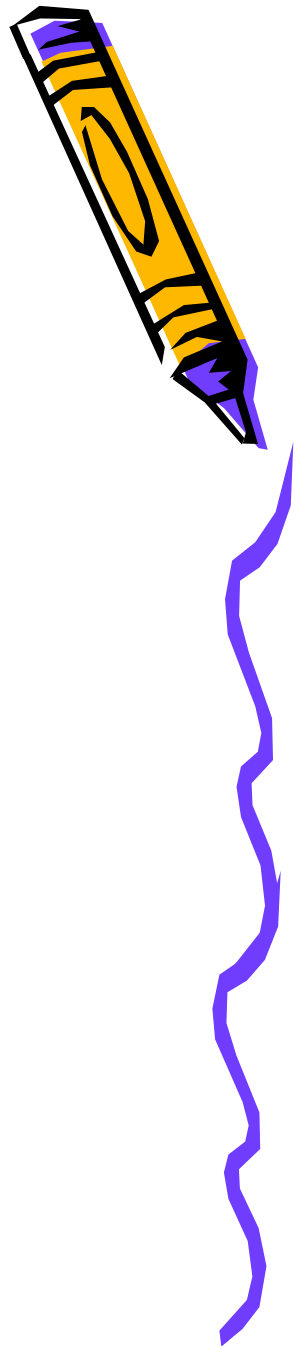
Summary (cont'd)

- The **Critical** child is one who you believe is **physiologically unstable** based on observable clinical indicators.
- Physiologic instability means that you see a significant abnormality in either appearance, work of breathing or circulation to the skin.



Summary (cont'd)

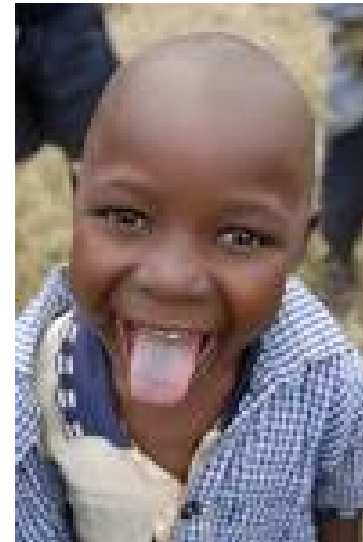
- The appearance of a **Critical** child can include:
- Motionless
- Mottled, dusky
- Cyanotic
- Fixed gaze
- Limp and listless
- Weak cry
- Hoarse, stridor



Summary (cont'd)

The appearance of a **Stable** child can include:

- Screaming
- Consolable by caregiver
- Maintains good eye contact
- Good muscle tone, pink skin color
- Alert
- Interactive
- Attentive
- Playful, active



Drug Calculations

Important formulas to remember

$$\frac{\text{Volume} \times \text{dose}}{\text{Concentration}}$$

$$\frac{\text{Volume} \times \text{dose} \times \text{drop}}{\text{Concentration}}$$

$$\frac{\text{Volume} \times \text{dose}}{\text{Time (minutes)}}$$

IV drip:

$$\frac{\text{Volume} \times \text{drop factor}}{\text{Time (minutes)}}$$

Think of **volume** as anything, liter, milliliter, microliter, etc.

Dose is what or how the doctor orders a drug to be given

Concentration is how the drug comes packaged (what you have on hand)

The Underline is "divided by"



Drug Calculations

You have 100mg/5ml. Medical control orders 75 mg. How many ml would you give?

$$\frac{\text{Volume} \times \text{dose}}{\text{Concentration}}$$

$$\frac{5\text{ml (vol)} \times 75\text{ mg (dose)}}{100\text{ mg (concentration, what you have on hand)}}$$

$$\frac{5 \times 75}{100} = 3.75\text{ml}$$



References

Mosby, 4th ed *Paramedic Textbook*

Pediatric Education for Prehospital
Personnel - PEPP

