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Causes Of Cardiopulmonary Arrest In Infants And Children

- Injuries
- Foreign body airway obstruction
- Smoke inhalation
- SIDS
- Poisoning
- Infections

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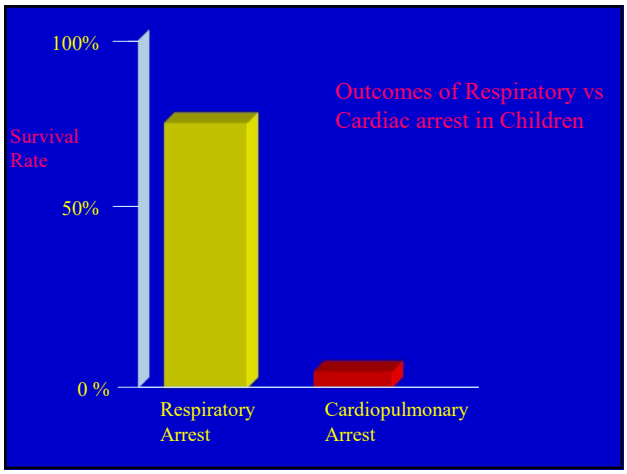

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Definition of Cardiopulmonary Failure

- Deficits in
  - Oxygenation
  - Ventilation
  - Perfusion
- Resulting In
  - Agonal Respirations
  - Bradycardia
  - Cardiopulmonary arrest

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Rapid Cardiopulmonary Assessment

Conditions requiring it

- Respiratory rate > 60
- Heart rate > 180 in kids under 5 y/o
  > 150 in kids greater 5 y/o
- Respiratory distress
- Trauma
- Cyanosis

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Rapid Cardiopulmonary Assessment

Conditions requiring it (con't)

- Altered level of Consciousness
  - failure to recognize parents
  - not consolable, not distractible
- Seizures
- High fever with a petechial rash

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Rapid Cardiopulmonary Assessment

Evaluate

- A irway patency
- B reathing
- C irculation
- End organ perfusion
  - skin perfusion
  - CNS perfusion

"phone fast"
vs
"phone first"

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The AIRWAY

- Clear?
- Maintainable without adjuncts?
- Unmaintainable?
  - BVM assist
  - endotracheal intubation

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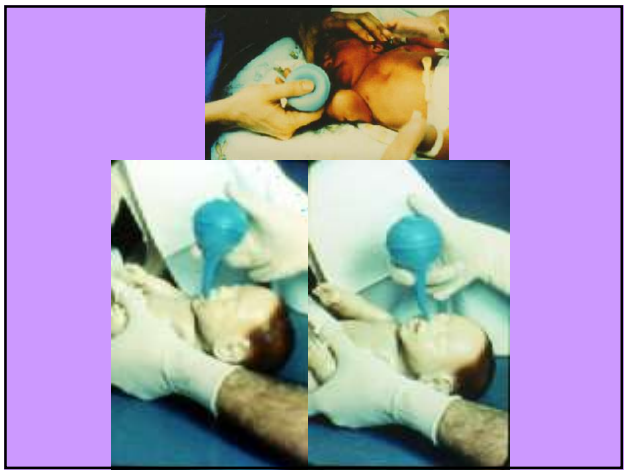

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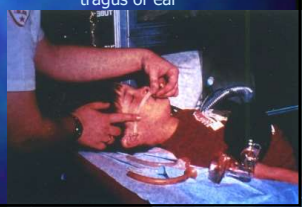
Airways

- Oral Airways
  - size from the central incisors to the angle of the jaw
- Nasopharyngeal Airways
  - Better tolerated in awake patients
    - size from tip of nose to tragus of ear



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Airways

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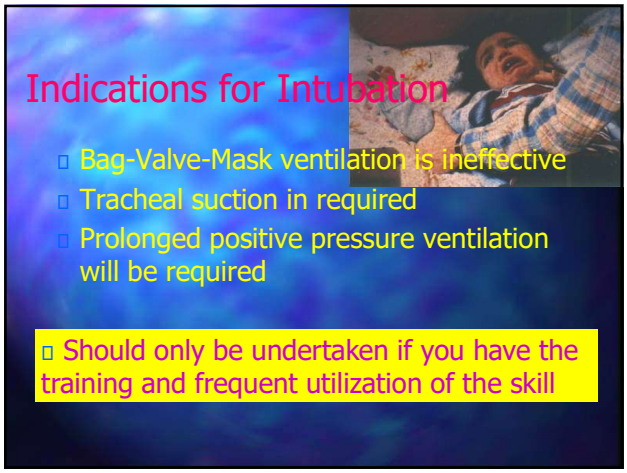
Indications for Intubation
Bag-Valve-Mask ventilation is ineffective
Tracheal suction in required
Prolonged positive pressure ventilation will be required
Should only be undertaken if you have the training and frequent utilization of the skill

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EndoTracheal Intubation
AIRWAY CAM

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KING LT
Insertion

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AIRWAY

- ETT size: 16 + age/ 4
- Proper depth of insertion in cm's: 3 x tube size

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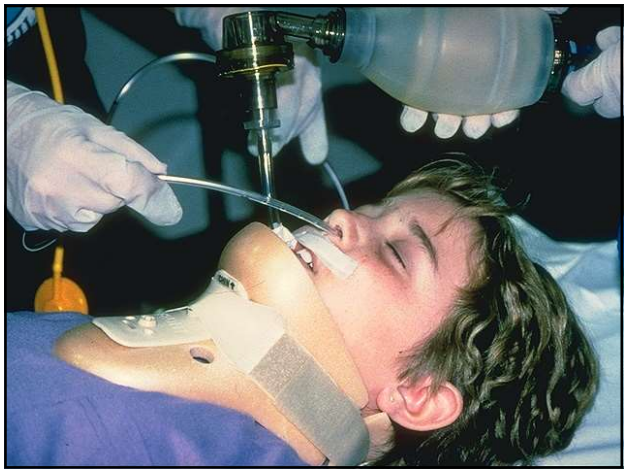

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Re-Assess

- DOPE for post Advanced Airway complications
  - D - Displaced tube
  - O - Obstructed tube
  - P - Pneumothorax
  - E - Equipment failure, inadequate ventilatory support, gastric distention

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BREATHING

- **Blue is bad!** Oxygen consumption is 6-8 ml/kg/min in infants versus 3-4 ml/kg/min in adults
- the smaller you are the faster you breath

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Respiratory Failure

- Compensated - adequate gas exchange
  - increased effort or work of breathing
    - tachycardia, tachypnea, retractions
- Decompensated - inadequate gas exchange

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Child Development: Applying the Pediatric Assessment Triangle

PAT: Respiratory Distress

Appearance
Normal

Work of Breathing
Increased

Circulation to Skin
Normal

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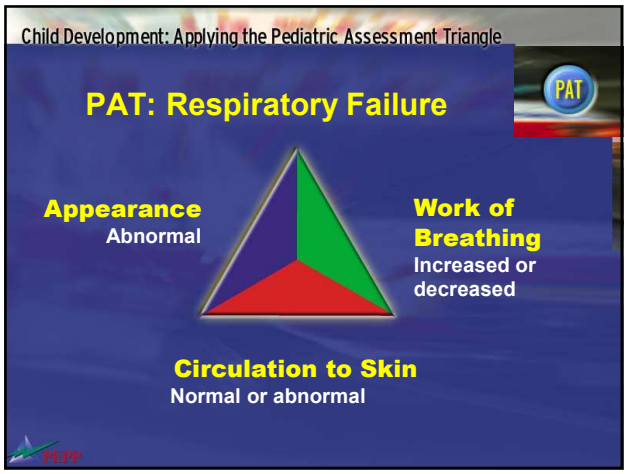

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Rapid Cardiopulmonary Assessment

Breathing

- Rate
  - Tachypnea
  - Bradypnea
- Air entry
  - chest rise
  - breath sounds
  - stridor
  - wheezing
- Mechanics of Breathing
  - retractions
  - Grunting
  - Head bobbing
  - Sea-saw respirations
- Color

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Normal Respiratory rates in Children

Age	Normal Values
Infant	30 - 60
Toddler	24 - 40
Preschooler	22 - 34
School age	18 - 30
Adolescent	12 - 18

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Respiratory Assessment

Respiratory Mechanics (con't)

Stridor

- Airway Obstruction
  - Congenital abnormalities - vocal cord paralysis, tumors, cysts
  - Infections - epiglottitis, croup
  - Foreign body aspiration

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Respiratory Assessment

Respiratory Mechanics (con't)

Prolonged expiration

- Bronchial or bronchiolar obstruction
  - manifested by wheezing
- Bronchiolitis
- Asthma

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Respiratory Assessment

Respiratory Mechanics (con't)

Grunting

Premature glottic closure with contractions of the chest wall during expiration

Pulmonary edema
Pneumonia
Atelectasis
ARDS

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Respiratory Failure Is a Process, Not an Event

- The goal is to ***prevent*** cardiac arrest, not to treat it!
  - Respiratory dysfunction proceed from covert compensated dysfunction and proceeds to overt uncompensated dysfunction (cardiopulmonary failure)
  - Interventions in compensated state are the safes and most successful
  - Distinctions between distress and failure are artificial

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Respiratory Assessment should be Rapid and Repeated

- Observation is most useful

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Major Errors in Initial Management are:

- Underestimation of distress
- Overzealous examination
- Lab studies that distress the child

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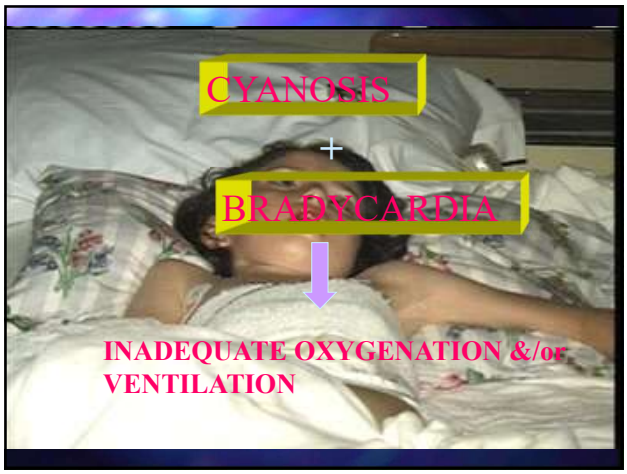

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Categorize Respiratory Problems by Severity		
	Respiratory Distress	Respiratory Failure
A	Open and Maintainable	Not Maintainable
B	Tachypnea	Bradypnea to apnea
	WOB increased effort	Decreased effort → Apnea
	Good air movement	Poor to absent air movement
C	Tachycardia	Bradycardia
	Pallor	Cyanosis
D	Anxiety, agitation	Lethargy to unresponsiveness
E	Variable Temperature	

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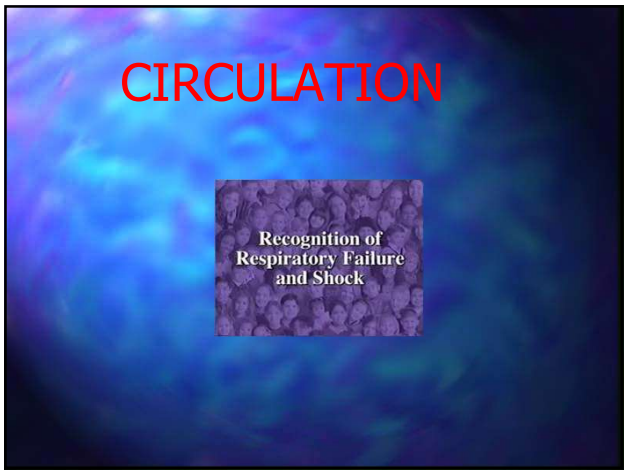

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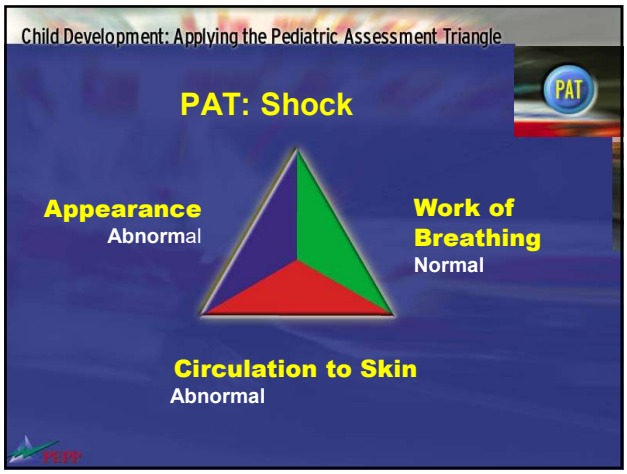

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Cardiovascular Assessment

Circulation (con't)

Skin

- Capillary fill time (CFT)
- Temperature
- Color
- Mottling

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Cardiovascular Assessment

Circulation

- Heart rate
- Blood pressure
  - End-organ perfusion
    - peripheral circulation
      - quality of pulses - central vs peripheral

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Cardiovascular Assessment

Circulation (con't)

CNS

- Recognition of parents
  - distractibility, consolable
- Reaction to pain
- Muscle tone
- Pupil size

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Cardiovascular Assessment

Circulation (con't)

Abnormalities of Heart Rate

- Tachycardia
  - Anxiety
  - Fever
  - Hypoxia
  - Hypercapnea
  - Hypovolemia
- Bradycardia
  - Ominous
  - Pre-arrest state

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Normal Heart Rates

Age	Normal Values
Infant	120 - 160
Toddler	90 - 140
Preschooler	80 - 110
School age	75 - 100
Adolescent	60 - 90

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Cardiovascular Assessment

Circulation (con't)

Peripheral Circulation

- Quality of Pulses
  - fast, slow or not at all
  - Thready - low volume, hypothermia
  - Bounding - Septic shock

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Cardiovascular Assessment

Circulation (con't)

Failure to perfuse

- Skin cold, CFT > 2 sec.
- Loss of consciousness, poor muscle tone, coma, lethargy, weak cry, fretful look, wrinkled brow
- Urine: UOP < 1cc/kg/hr (normal 1-2 cc/kg/hr)

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CIRCULATION

- Blood Pressure:
  - > 95% of kids > 1 year of age have a systolic B/P > 80 mmHg
  - Approximated median systolic B/P for kids > 1 y/o (up to age 10):
    - (2 X age) + 70 for lower limit
    - (2 x age) + 80 is the mean SBP
    - (2 X age) + 90 for upper limit
  - > 10 y/o < 90 mmHg is hypotension

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Normal Pediatric Blood Pressure Ranges

Age	Systolic (mmHg)	Diastolic (mmHg)
Infants	74-100	50-70
Toddlers	80-112	50-80
Preschoolers	82-110	50-78
School age	84-120	54-80
Adolescents	94-140	62-88

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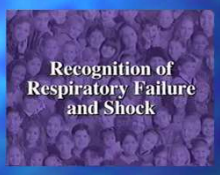
CIRCULATION



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BLOOD PRESSURE

- Equipment

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Shock

- Hypovolemic
- Distributive
- Obstructive
- Cardiogenic

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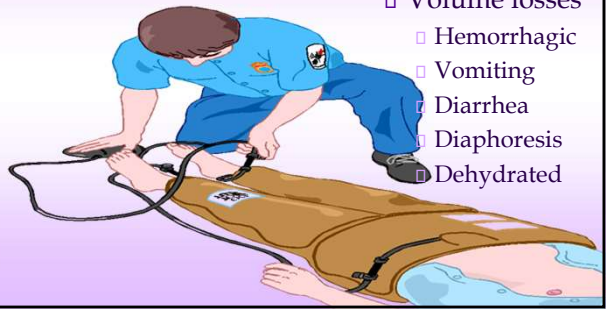
Hypovolemic

- Volume losses
  - Hemorrhagic
  - Vomiting
  - Diarrhea
  - Diaphoresis
  - Dehydrated



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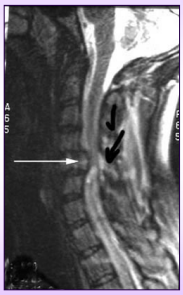
Distributive/Septic

- Sepsis
- Barbiturates
- ganglionic block
- Spinal cord dissection
- Anaphalaxis



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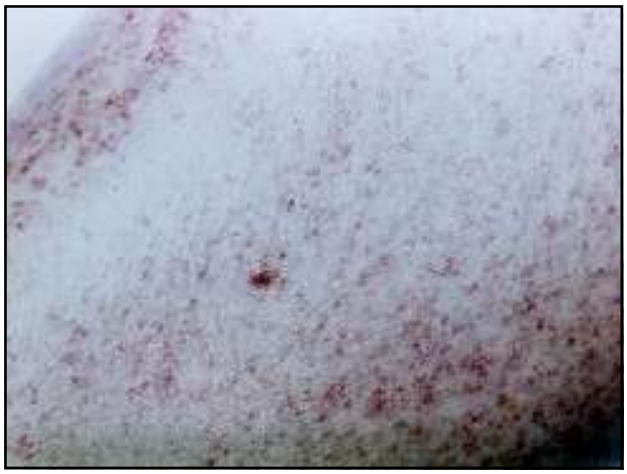

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Obstructive

- Vena cava compression
- Pericardial tamponade
- Embolism
- Tension pneumothorax
- Dissecting aneurysm

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Cardiogenic

- MI
- Acute mitral insufficiency
- Ruptured ventricular septum
- Cardiac failure
- Arrhythmias
- Cardiac contusion

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D for Disability

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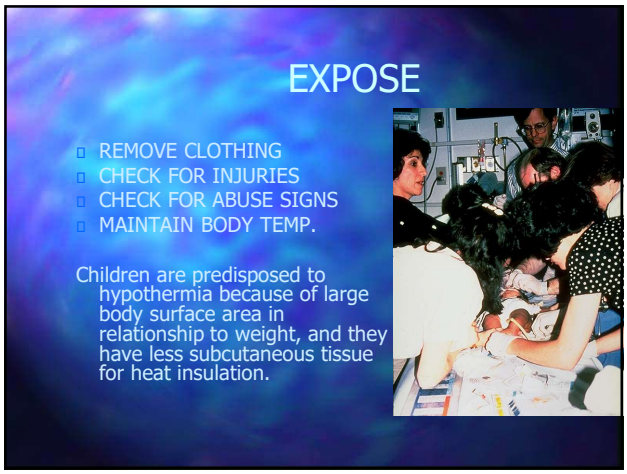
Modified Glasgow Coma Scale for Children			
Activity	Score	> 1 y/o	< 1 y/o
Eye opening	4 3 2 1	Spontaneously To verbal command To pain No response	Spontaneously To shout To pain No response
Verbal response	5 4 3 2 1	Appropriate words and phrases Inappropriate words, disoriented Persistent cries and/or screams Grunts, incomprehensible sounds No response	Smiles, coos appropriately Cries, but consolable Nonconsolable screaming Grunts, agitated, restless No response
Motor response	6 5 4 3 2 1	Follows commands Localizes pain Withdraws to pain Decorticate posturing Decerebrate posturing No response	Spontaneous Localizes to pain Withdraws to pain Decorticate posturing Decerebrate posturing No response
Total:			

76

78



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Pharmacological Support

- Intravenous preferred
  - I.O. equivalent to I.V.
- Endotracheal
  - dilute drug to a total distillate of 1-5 cc, inject distally and provide positive pressure ventilation
- Rectally

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Pharmacological Support

- Medications Deliverable via the ETT
  - O - Oxygen
  - L - Lidocaine
  - E - Epinephrine
  - A - Atropine
  - N - Narcan

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Acidosis in Cardiopulmonary Arrest is best treated with Normalized ventilation and Oxygenation

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Pharmacological Support

Glucose

- Always check a finger stick glucose during a pediatric arrest
  - Hypoglycemia can be the cause of an arrest
- If Hypoglycemic: 0.5 - 1 gm/kg (2-4 cc/kg of D_{25}), IVP

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Other Resuscitation Drugs

Drug	Indications for use
Atropine	Symptomatic bradycardia
Sodium Bicarb	Documented acidosis
Naloxone	Narcotic induced respiratory depression
Calcium Chloride	Ca channel blocker OD, Hypocalcemia, Hyperkalemia, Hypermagnesemia

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In Summary

The ABC's of Kids

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HISTORY

- AMPLE
  - A - Allergies
  - M - Medications
  - P - Past Medical History (PMH)
  - L - Last meal
  - E - Events leading to or preceding injury/illness

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HISTORY

- CIAMPEDS
  - C - Chief complaint
  - I - Immunizations
  - A - Allergies
  - M - Medications
  - P - PMH, parents
  - E - Events leading to or preceding illness/injury
  - D - Diet, diapers
  - S - Symptoms

90

HISTORY

- Estimation of child's weight in Kg:
  - (2 X child's age) + 8

I.e. a 4 y/o child would weight about 16 kg

91

AIRWAY

- ABC's
  - Neutral position
- BVM ventilation works!
- Don't hyperventilate

- 5-7 P's of Intubation:
  - Preoxygenate
  - Prepare
  - Premedicate
  - Paralyze
  - Pass tube
  - Placement
  - Position

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TUBE SELECTION

- Premature infant
  - 2.5 mm ETT
- Newborn & small infants
  - 3.0 or 3.5 mm ETT

Rule of Gestation:

Put a decimal point in the gestational age = Tube size

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Tubes in Kids

- Simple as A B C, 1 2 3
- Do your ABCs and then predict your ET size with a Broselow tape
  - 1 x the predicted tube size = the tube size
  - 2 x the ETT size = all of your other tube sizes
    - NG, foley, suction catheter, feeding tube, UVCs
  - 3 x the ETT size = the depth of insertion for your ETT

94

Breathing

- Don't Hyperventilate
- ?Appropriate masks?
  - Turn it upside down

95

CIRCULATION

- IO cannulation in any kid (no age limit)
- Defibrillation: 2 joules/kg initially, then double the dose to 4 joules/kg for remainder
- Cardioversion: 0.5 j/kg, 1 j/kg, 2 j/kg synchronized

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- Maintenance Fluids:
  - 4cc/kg/hour for first 10 kg
  - Additional 2cc/kg/hr for second 10 kg
  - Additional 1cc/kg/hr for third 10 kg and up to adult maintenance of 80-120 cc/hr

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IVs

- All Peds IVs should either be
  - Locked off
  - Placed on a pump
  - And/or used with a volutrol or Burette

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CIRCULATION

- Burn Fluids:
  - 3- 4 cc X weight in kg X BSA burned = Total

  half of total to be given in first 8 hours
- Volume Expansion:
  - 20cc/kg of NS or LR for kids > 1month old
  - 10cc/kg of NS or LR for neonates
  - 10cc/kg of Blood products (PRBCs)

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CIRCULATION

- Circulating Blood Volume
  - Infant: 90 cc/kg
  - Child: 80 cc/kg
  - Adult: 70 cc/kg
- Blood Pressures
  - Cuff size
  - (2 x age) + 80 = mean SBP

100

DISABILITY

- AVPU
  - A - Alert
  - V - Verbal or voice response
  - P - Pain response
  - U - Unresponsive
- Hypoglycemia is treated with 2-4 cc/kg of D_{25}

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EXPOSE/EXTREMITY/ENVIROMENT

- Keep 'em Warm, but expose them for trauma and fevers
- 5 or 6 P's of a Neurovascular Assessment in Musculoskeletal injuries
  - Pain
  - Pallor
  - Paresthesia
  - Pulselessness
  - Paralysis
  - Polar

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