Pediatric Cardiac Arrest

Pea Ridge Fire Department

EMS Refresher

Introduction

- Children differ from adults in their anatomy, physiology, and emotions.
- Your approach to pediatric patients must:
  - Be based on age
  - Accommodate developmental and social issues

Neonate and Infant

- Neonatal period: First month
- Infancy: First 12 months

Table 43-1 Infant Development

	Birth to 2 Months	2 to 6 Months	6 to 12 Months
Physical Development	▪ Controls gaze ▪ Turns head	▪ Can recognize caregivers ▪ Makes eye contact ▪ Uses both hands ▪ Rolls over ▪ Most sleep through the night	▪ Sits without support ▪ Crawls ▪ Puts things in mouth ▪ Teething begins ▪ Eats soft foods
Cognitive Development	▪ Begins crying to communicate needs ▪ Crying peaks at 6 weeks	▪ Increased awareness ▪ Explores own body	▪ Babbles (learns first word by 12 months) ▪ Remembers objects ▪ Curious about what objects do
Emotional Development	▪ Trust develops in parents	▪ Uses expressions of joy, anger, fear, surprise ▪ Seeks attention	▪ Separation anxiety develops ▪ Start of tantrums ▪ Self-determination while eating

Neonate and Infant

- During assessment:
  - Keep child warm.
  - Support a young infant's head and neck.
  - Older infants will be calmest in a parent's arms.
  - If child is quiet, listen to heart and lungs first.

Toddler

- Ages 1 to 2

Table 43-2 Toddler Development

	12 to 18 Months	18 to 24 Months
Physical Development	▪ Crawls ▪ Walks ▪ Front teeth emerge ahead of molars ▪ Undergoes sensory development	▪ Has improved gait and balance ▪ Runs ▪ Climbs ▪ Head grows more slowly than body
Cognitive Development	▪ Imitates others ▪ Makes believe ▪ Understands more than expressed ▪ Knows major body parts ▪ Knows 4 to 6 words	▪ Begins to understand cause and effect ▪ Labels objects ▪ Speech picks up to approximately 100 words by 24 months
Emotional Development	▪ Demonstrates basic reasoning ▪ Understands object permanence ▪ Demonstrates separation anxiety	▪ Demonstrates attachment to certain objects, such as a pacifier, doll, or blanket

Toddler

- Use the Pediatric Assessment Triangle (PAT) to assess the child.
- Strategies for examination:
  - Examine on parent's lap.
  - Get down to the child's level.
  - Have a parent assist when possible.
  - Be flexible.

Preschool-Age Child

- Ages 3 to 5
- Becoming verbal and active
- Respect modesty.
- Let child participate.
- Set limits on behavior if the child acts out.

School-Age Child

- Ages 6 to 12
- Capable of abstract thought, understand cause and effect
- By age 8, anatomy and physiology is similar to adults.
- Explain steps in simple language.

Adolescence

- Ages 13 to 18
- Once secondary sexual characteristics have developed, treat as an adult.
- Address and reassure patient.
- Offer as much control as appropriate.

The Head

- Infants' and young children's heads are large relative to the rest of their bodies.
- During infancy, the anterior and posterior fontanelles are open.

The Neck and Airway

- Short neck, smaller airway
- Epiglottis is long and floppy.
- Keep nares clear with suctioning.
- Avoid hyperextension of neck.
- Keep the airway clear of all secretions.
- Use care when managing the airway.

The Respiratory System

- Smaller tidal volume, double metabolic oxygen demand
- Smaller functional residual capacity
- Faster breathing

Table 43-3 Pediatric Respiratory Rates

Age	Respirations (breaths/min)
Neonate (0 to 1 month)	30 to 60
Infant (1 month to 1 year)	30 to 53
Toddler (1 to 2 years)	22 to 37
Preschooler (3 to 5 years)	20 to 28
School-age child (6 to 12 years)	18 to 25
Adolescent (12 to 15 years)	12 to 20

Data from: American Heart Association (AHA). Vital signs in children. In: AHA. *Pediatric Advanced Life Support*. Dallas, TX: AHA; 2015.

The Respiratory System

- Infants use diaphragm during inspiration.
- Experience muscle fatigue quicker
- Highly susceptible to hypoxia
  - Can cause cardiovascular collapse and arrest

The Cardiovascular System

- Children rely on pulse rate to:
  - Compensate for decreased oxygenation
  - Maintain cardiac output

Table 43-4 Pediatric Pulse Rates

Age	Awake Rate (beats/min)	Asleep Rate (beats/min)
Neonate (0 to 1 month)	100 to 205	90 to 160
Infant (1 month to 1 year)	100 to 180	90 to 160
Toddler (1 to 2 years)	98 to 140	80 to 120
Preschooler (3 to 5 years)	80 to 120	65 to 100
School-age child (6 to 12 years)	75 to 118	58 to 90

Data from: American Heart Association (AHA). Vital signs in children. In: AHA. *Pediatric Advanced Life Support.* Dallas, TX: AHA; 2015.

The Cardiovascular System

- Limited but vigorous cardiac reserves
- Injured children can be in shock and maintain blood pressure for long periods.
- Hypotension is an ominous sign.

The Heart

- ECG: Large right-sided forces are normal in young infants.
- Cardiac output is rate dependent in infants and young children.
- Mediastinum is more mobile.

Pediatric Patient Assessment

- Differs from adult assessment
- Adapt your assessment skills.
- Have age-appropriate equipment.
- Review age-appropriate vital signs.

Scene Size-up

- On the way to the scene, prepare for pediatric:
  - Size-up
  - Equipment use
  - Assessment
- Collect information from dispatch.

Scene Size-up

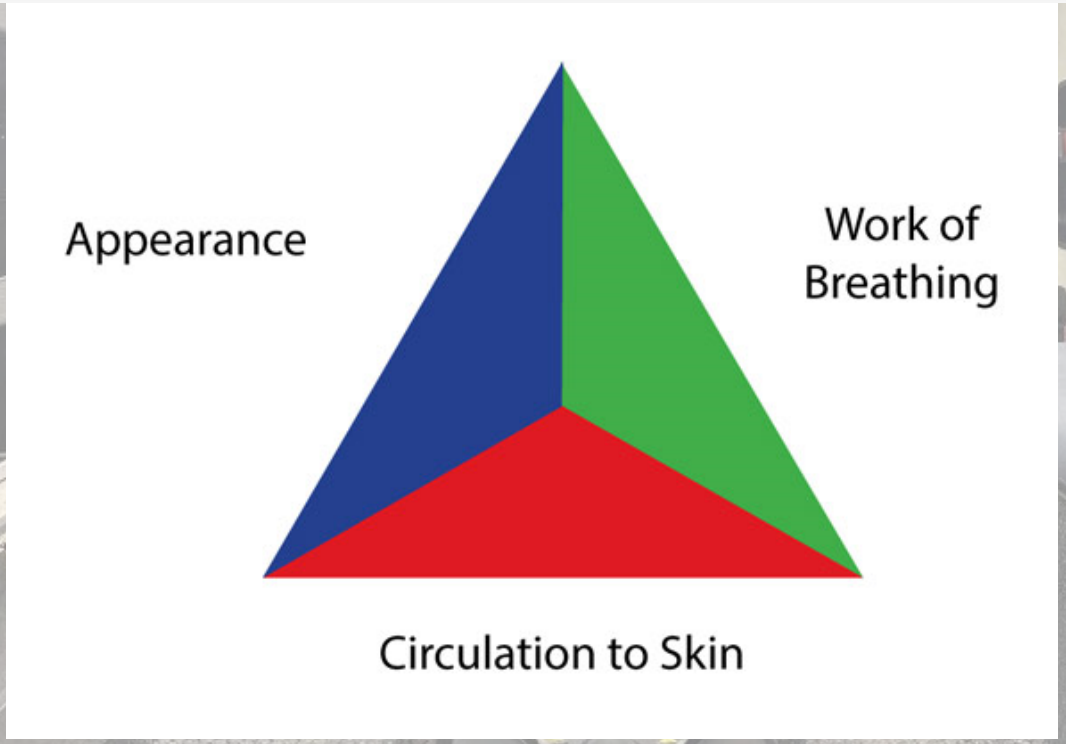
- Take appropriate standard precautions.
- Note child's position.
- Look for clues to MOI or NOI.
- Note pills, medicine bottles, alcohol, drug paraphernalia, or household chemicals.
- Observe the scene or vehicle for clues.

Scene Size-up

- Other important assessments:
  - Cleanliness of home
  - Appearance of other children in family
  - Presence of medical devices
  - Indications of substance abuse

Primary Survey

- Use the PAT to form a general impression.



Primary Survey

- Appearance
  - Often the most important factor in determining the severity of illness, need for treatment, and response to therapy

Table 43-5 Characteristics of Appearance: The TICLS Mnemonic

Characteristic	Features to Look For
Tone	Is the child moving or resisting examination vigorously? Does the child have good muscle tone? Or, is the child limp, listless, or flaccid?
Interactiveness	How alert is the child? How readily does a person, object, or sound distract the child or draw the child's attention? Will the child reach for, grasp, and play with a toy or exam instrument, like a penlight or tongue blade? Or, is the child uninterested in playing or interacting with the caregiver or prehospital professional?
Consolability	Can the child be consoled or comforted by the caregiver or by the prehospital professional? Or, is the child's crying or agitation unrelieved by gentle reassurance?
Look or gaze	Does the child fix his or her gaze on a face, or is there a "nobody home," glassy-eyed stare?
Speech or cry	Is the child's cry strong and spontaneous, or weak, muffled, or hoarse?

Modified from: American Academy of Pediatrics. Pediatric assessment. In: Fuchs S, Klein BL, eds. *Pediatric Education for Prehospital Professionals*. Rev 3rd ed. Burlington, MA: Jones & Bartlett Learning; 2016:6.

Primary Survey

- Appearance (cont'd)
  - A child with a grossly abnormal appearance requires immediate life-support interventions and transport.

Primary Survey

- Work of breathing
  - Reflects attempt to compensate for abnormalities in oxygenation, ventilation

Table 43-6 Characteristics of Work of Breathing

Characteristic	Features to Look For
Abnormal airway sounds	Snoring, muffled or hoarse speech, stridor, grunting, or wheezing
Abnormal posturing	Sniffing position, tripod position, refusal to lie down
Retractions	Supraclavicular, intercostal, or substernal retractions of the chest wall; head bobbing in infants
Flaring	Flaring of the nares on inspiration

Primary Survey

Courtesy of Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau (MCHB), Emergency Medical Services for Children (EMSC) Program.

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Courtesy of Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau (MCHB), Emergency Medical Services for Children (EMSC) Program.

Primary Survey

- Circulation to skin
  - Determines adequacy of cardiac output and core perfusion.
  - Pallor, mottling, cyanosis

Primary Survey

- Stay or go
  - Use findings from PAT to determine whether the patient requires urgent care.
    - Assess ABCDEs.
    - Treat life threats.
    - Transport.
  - If condition is stable, finish assessment.

Hands-on Primary Survey

- Manage threats to ABCs as you find them.
- Steps are the same as with adults.
- Estimate child's weight.

Hands-on Primary Survey

- Airway
  - Determine whether airway is open and patient has adequate chest rise with breathing.
  - If there is potential obstruction, position airway and suction as necessary.

Hands-on Primary Survey

- Breathing
  - Calculate the respiratory rate.
  - Auscultate breath sounds.
  - Check pulse oximetry.

Hands-on Primary Survey

- Circulation
  - Integrate information from PAT.
  - Listen to the heart or feel pulse for 30 seconds.
    - Double the number to get pulse rate.
  - After checking the pulse rate, do a hands-on evaluation of skin CTC.

Hands-on Primary Survey

- Disability
  - Use the AVPU scale or Pediatric Glasgow Coma Scale to assess level of consciousness.
    - Assess pupillary response.
    - Evaluate motor activity.
  - Combine this information with PAT to determine neurologic status.

Hands-on Primary Survey

Table 43-8 AVPU Scale

Category	Stimulus	Response Type	Reaction
Alert	Normal environment	Appropriate	Normal interactiveness for age
Verbal	Simple command or sound stimulus	Appropriate Inappropriate	Responds to name Nonspecific or confused
Painful	Pain	Appropriate Inappropriate Pathologic	Withdraws from pain Makes sound or moves without purpose or localization of pain Posturing
Unresponsive			No perceptible response to any stimulus

Abbreviation: AVPU, Awake and alert, responsive to Verbal stimuli, responsive to Pain, Unresponsive

Hands-on Primary Survey

Table 43-9 Pediatric Glasgow Coma Scale (GCS)

Activity	Score	Infant	Score	Child
Eye opening	4	Open spontaneously	4	Open spontaneously
	3	Open to speech or sound	3	Open to speech
	2	Open to painful stimuli	2	Open to painful stimuli
	1	No response	1	No response
Verbal	5	Coos, babbles	5	Oriented conversation
	4	Irritable cry	4	Confused conversation
	3	Cries to pain	3	Cries; inappropriate words
	2	Moans to pain	2	Moans; incomprehensible words/sounds
	1	No response	1	No response
Motor	6	Normal spontaneous movement	6	Obeys verbal commands
	5	Localizes pain	5	Localizes pain
	4	Withdraws from pain	4	Withdraws from pain
	3	Abnormal flexion (decorticate)	3	Abnormal flexion (decorticate)
	2	Abnormal extension (decerebrate)	2	Abnormal extension (decerebrate)
	1	No response (flaccid)	1	No response (flaccid)

Modified from: Davis RJ et al. Head and spinal cord injury. In: Rogers MC, ed. *Textbook of Pediatric Intensive Care.* Baltimore, MD: Williams & Wilkins; 1987; James H, Anas N, Perkin RM. *Brain Insults in Infants and Children*. New York, NY: Grune & Stratton; 1985; and Morray JP et al. Coma scale for use in brain-injured children. *Critical Care Medicine*. 1984;12:1018.

Hands-on Primary Survey

- Exposure
  - Perform a rapid exam of the entire body.
  - Avoid heat loss, especially in infants.
  - Cover child as soon as possible.

Transport Decision

- Transport immediately for trauma with:
  - Serious MOI
  - Physiologic abnormality
  - Significant anatomic abnormality
  - Unsafe scene
- Attempt vascular access en route.

History Taking

- Conduct en route if condition is unstable.
- Goals:
  - Elaborate on chief complaint.
  - Obtain history.

Table 43-10 SAMPLE Components for Pediatric History Taking

Component	Features
Signs and symptoms	Onset and nature of symptoms of pain or fever Age-appropriate signs of distress
Allergies	Known medication reactions or other allergies
Medications	Exact names and doses of ongoing drugs (including over-the-counter, prescribed, herbal, and recreational drugs) Timing and amount of last dose Time and dose of analgesics or antipyretics
Past medical history	Previous illnesses or injuries Immunizations History of pregnancy, labor, delivery (infants and toddlers)
Last oral intake	Timing of the child's last food or drink, including bottle or breastfeeding
Events leading to illness or injury	Key events leading to the current incident Fever history

Secondary Assessment

- May include a full-body examination or a focused assessment
  - Head
  - Pupils
  - Nose
  - Ears
  - Mouth
  - Neck
  - Chest
  - Back
  - Abdomen
  - Extremities
  - Capillary refill
  - Level of hydration

Secondary Assessment

- Attempt to take the child's blood pressure on the upper arm or thigh.
  - Minimal systolic blood pressure = 70 + (2 × Age in years)

Table 43-11 Normal Blood Pressure for Age

Age	Systolic Blood Pressure (mm Hg)	Diastolic Blood Pressure (mm Hg)
Neonate (0 to 1 month)	67 to 84	35 to 53
Infant (1 month to 1 year)	72 to 104	37 to 56
Toddler (1 to 2 years)	86 to 106	42 to 63
Preschooler (3 to 5 years)	89 to 112	46 to 72
School-age child (6 to 12 years)	97 to 120	57 to 80
Adolescent (12 to 15 years)	110 to 131	64 to 83

Data from: American Heart Association (AHA). Vital signs in children. In: AHA. *Pediatric Advanced Life Support.* Dallas, TX: AHA; 2015.

Secondary Assessment

- Pediatric pain
  - When assessing pain:
    - Consider developmental age.
    - Discuss child's pain with caregivers.
    - Use pain scales with pictures.

Secondary Assessment

- Pediatric pain (cont'd)
  - Consider pharmacologic methods:
    - Acetaminophen
    - Opiates
    - Benzodiazepines
    - Nitrous oxide
  - Weigh benefits and risks of administration.

Reassessment

- Includes the following:
  - PAT
  - Patient priority
  - Vital signs
  - Assessment of interventions
  - Reassessment of focused exam areas

Respiratory Emergencies

- Frequently encountered
- Respiratory failure and arrest precede majority of cardiopulmonary arrests.
- Early identification and intervention are critical.

Respiratory Arrest, Distress, and Failure

- First determine severity.
  - Distress, failure, or arrest
- Keep anatomic and physiologic respiratory differences in mind.

Respiratory Arrest, Distress, and Failure

- Respiratory distress
  - Increased work of breathing results in adequate gas exchange.
- Respiratory failure
  - Patient can no longer compensate; hypoxia and/or carbon dioxide retention occur.
- Respiratory arrest
  - Patient is not breathing spontaneously.

Respiratory Arrest, Distress, and Failure

- Determining severity of illness will indicate urgency of treatment and transport.
  - Obtain SAMPLE history on scene or during transport.

Table 43-12 Signs of Impending Respiratory Failure

Assess	Sign
Mental status	Agitation, restlessness, confusion, lethargy (VPU components of the AVPU scale)
Skin color	Central cyanosis despite oxygen administration, pallor
Respiratory rate	Tachypnea → bradypnea → apnea
Respiratory effort	Severe retractions and accessory muscle use, nasal flaring, grunting, paradoxical abdominal motion, tripod positioning
Auscultation	Stridor, wheezing, crackles, or diminished air movement
Blood oxygen saturation	Low despite supplemental oxygen administration
Pulse rate	Tachycardia → bradycardia

Abbreviation: AVPU, Awake and alert, responsive to Verbal stimuli, responsive to Pain, Unresponsive

Respiratory Arrest, Distress, and Failure

- Respiratory distress is most common.
  - Requires only supportive care
- With fatigue, distress may progress to failure.
- Reassess frequently.

Respiratory Arrest, Distress, and Failure

- Respiratory emergency treatment
  - Give supplemental oxygen.
  - Perform ECG monitoring.
  - Establish IV access.
  - Manage the airway.
  - Use supraglottic airway devices and intubation only if bag-mask ventilation fails.

Nasopharyngeal (Nasal) Airway

- Several problems are possible:
  - Diameter that is too small
  - Airway that is too long
  - Inserting the airway in responsive patients
- Do not use with facial trauma or moderate to severe head trauma.

Oxygenation

- All patients with respiratory emergencies should receive supplemental oxygen.
- Common methods for pediatric patients
  - Blow-by technique
  - Nonrebreathing mask

Oxygenation

- Blow-by technique
  - Best used when:
    - Small amount of oxygen is needed.
    - Patient cannot tolerate the mask.

Oxygenation

- Nonrebreathing mask preferred for:
  - Respiratory distress or failure
  - Older children
- Can deliver up to 95% oxygen

Bag-Mask Ventilation

- Use if airway positioning or adjunct does not improve respiratory effort.
- May need to try a variety of mask sizes
- Deliver breaths at a rate of 12 to 20 breaths/min for infants and children.

Bag-Mask Ventilation

- Ensure that equipment is the right size.
- Maintain a good seal with the face.
- Ventilate at the appropriate rate and volume.

Bag-Mask Ventilation

- Errors in technique can result in gastric distention or decreased venous return to the heart (preload).
- Two-person bag-mask ventilation is usually more effective.

Supraglottic Airways

- Devices used to provide:
  - Positive pressure ventilation to apneic patients
  - Maintain a patent airway in unresponsive patients who are breathing but need advanced airway management

Endotracheal Intubation

- Consider only if:
  - Bag-mask technique is not effective.
  - Transport times are long.

Endotracheal Intubation

- Advantages
  - Definitive airway
  - Decreased risk of aspiration
- High complication rate, which includes:
  - Bradycardia
  - Increased ICP
  - Incorrect placement

Endotracheal Intubation

- Indications include:
  - Cardiopulmonary arrest
  - Traumatic brain injury
  - Inability to maintain a patent airway
  - Need for prolonged ventilation
- Remember the differences between the adult and pediatric airways.

Endotracheal Intubation

- Pediatric equipment is mandatory.
  - Laryngoscope blades sizes 0 to 3
  - ET tubes sizes 2.5 to 6.0
- Any size laryngoscope handle can be used.

Endotracheal Intubation

- Appropriately sized blade extends from the patient's mouth to the tragus of the ear.
  - Length-based resuscitation tape measure
  - General guidelines:
    - Premature newborn: Size 0 straight blade
    - Full-term newborn to 1 year: Size 1 straight blade
    - 2 years to adolescent: Size 2 straight blade
    - Adolescent +: Size 3 straight or curved blade

Endotracheal Intubation

- Uncuffed ET tube
  - Use a 3.5-mm tube for infants up to 1 year.
  - Use a 4-mm tube for children between 1 and 2 years.
  - Use formula for children older than 2 years:
    - 4 + (Age in years ÷ 4) = Uncuffed tube size (in mm)

Endotracheal Intubation

- Cuffed ET tube
  - Use a 3-mm tube for infants and a 3.5-mm tube for children between 1 and 2 years.
  - Use formula for children older than 2 years:
    - 3.5 + (Age in years ÷ 4) = Cuffed tube size (in mm)

Endotracheal Intubation

- Appropriate depth for insertion is 2 to 3 cm beyond vocal cords.
  - Record as the mark at the corner of the child's mouth.
- With stylet in place, bend ET tube into a gentle upward curve.

Endotracheal Intubation

- Preoxygenate before intubation.
- Ensure head is in the proper position.
- Insert an airway adjunct if needed.
- Apply a cardiac monitor if one is available.
- Use a pulse oximeter before, during, and after the intubation.

Endotracheal Intubation

- Have suction handy.
- If an intubated child deteriorates, use the DOPE mnemonic to identify the problem.
  - Displacement
  - Obstruction
  - Pneumothorax
  - Equipment failure

Endotracheal Intubation

- Complications:
  - Unrecognized esophageal intubation
  - Induction of emesis, possible aspiration
  - Hypoxia from prolonged intubation attempts
  - Damage to teeth, soft tissues, and intraoral structures

Shock

- Inadequate delivery of oxygen and nutrients to tissues to meet metabolic demand
- Three types:
  - Hypovolemic
  - Distributive
  - Cardiogenic

Shock

- Compensated shock
  - Critical abnormalities of perfusion
  - Body is able to maintain adequate perfusion to vital organs.
  - Intervention is needed to prevent child from decompensating.

Shock

- Decompensated shock
  - State of inadequate perfusion
- Child will be profoundly tachycardic and show signs of poor peripheral perfusion.
  - Hypotension is a late and ominous sign.
- Start resuscitation on scene.

Hypovolemic Shock

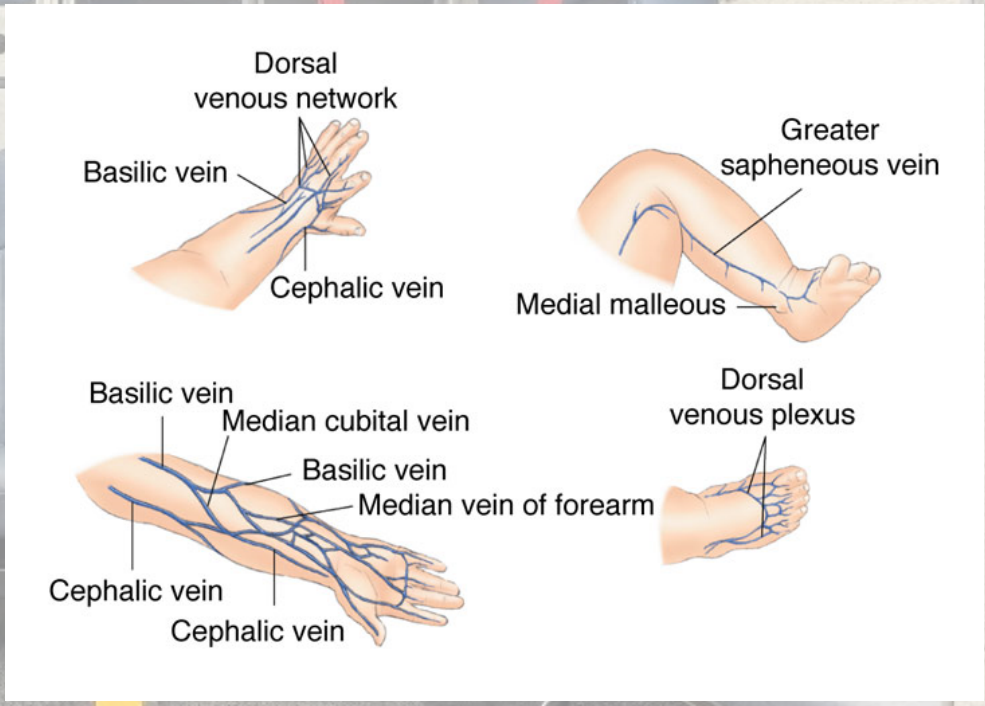
- Most common cause of shock in infants and young children
  - Loss of volume due to illness or trauma
  - Early signs may include:
    - Tachycardia
    - Pale or mottled skin
    - Cool extremities

Hypovolemic Shock

- Management
  - Position of comfort
  - Supplemental oxygen
  - Keep the child warm.
  - Direct pressure to stop external bleeding
  - Volume replacement

Hypovolemic Shock

- With compensated shock, you can attempt IV or intraosseous (IO) access en route.



Hypovolemic Shock

- Establish IV access.
- Begin fluid resuscitation with isotonic fluids only.
- In decompensated shock with hypotension, begin initial fluid resuscitation on scene.
  - Evaluate sites for IV access.
    - If this is unsuccessful, begin IO infusion.

Hypovolemic Shock

- IO needles usually consist of a solid-bore needle inside a sharpened hollow needle.

Courtesy of VidaCare Corporation (www.vidacare.com).

Distributive Shock

- Decreased vascular tone develops.
  - Vasodilation and third spacing of fluids occurs.
  - Caused by sepsis in most pediatric cases
- Treatment is volume resuscitation.
  - With apparent sepsis and persistent hypotension, consider vasopressor support.
  - Treat anaphylactic shock with IM epinephrine.

Cardiogenic Shock

- Result of pump failure
- May be present in children with:
  - Underlying congenital heart disease
  - Myocarditis
  - Cardiomyopathy
  - Rhythm disturbances

Cardiogenic Shock

- Signs and symptoms may include:
  - Listless or lethargic
  - Increased work of breathing
  - Impaired circulation
  - Skin pale, mottled, or cyanotic
  - Enlarged liver
  - Sweating with feeding
  - History of congenital heart disease

Cardiogenic Shock

- Initial management includes:
  - Position of comfort
  - Supplemental oxygen
  - Transport
    - Facility must offer pediatric critical care.
  - Supplemental oxygen

Cardiogenic Shock

- Err on the side of fluid resuscitation unless you are sure of diagnosis.
- The following confirms cardiogenic shock:
  - Increased work of breathing
  - Drop in oxygen saturation
  - Worsening perfusion after a fluid bolus

Cardiovascular Emergencies

- Relatively rare in children
- Often related to respiratory insufficiency, arrest, or infection
- Identify through primary survey.

Dysrhythmias

- Classified based on pulse rate
  - Too slow (bradydysrhythmias)
  - Too fast (tachydysrhythmias)
  - Absent (pulseless)
- Signs and symptoms are often nonspecific.

Bradydysrhythmias

- Often secondary to hypoxia in children
- Initial treatment:
  - Airway management
  - Supplemental oxygen
  - Assisted ventilation as needed.

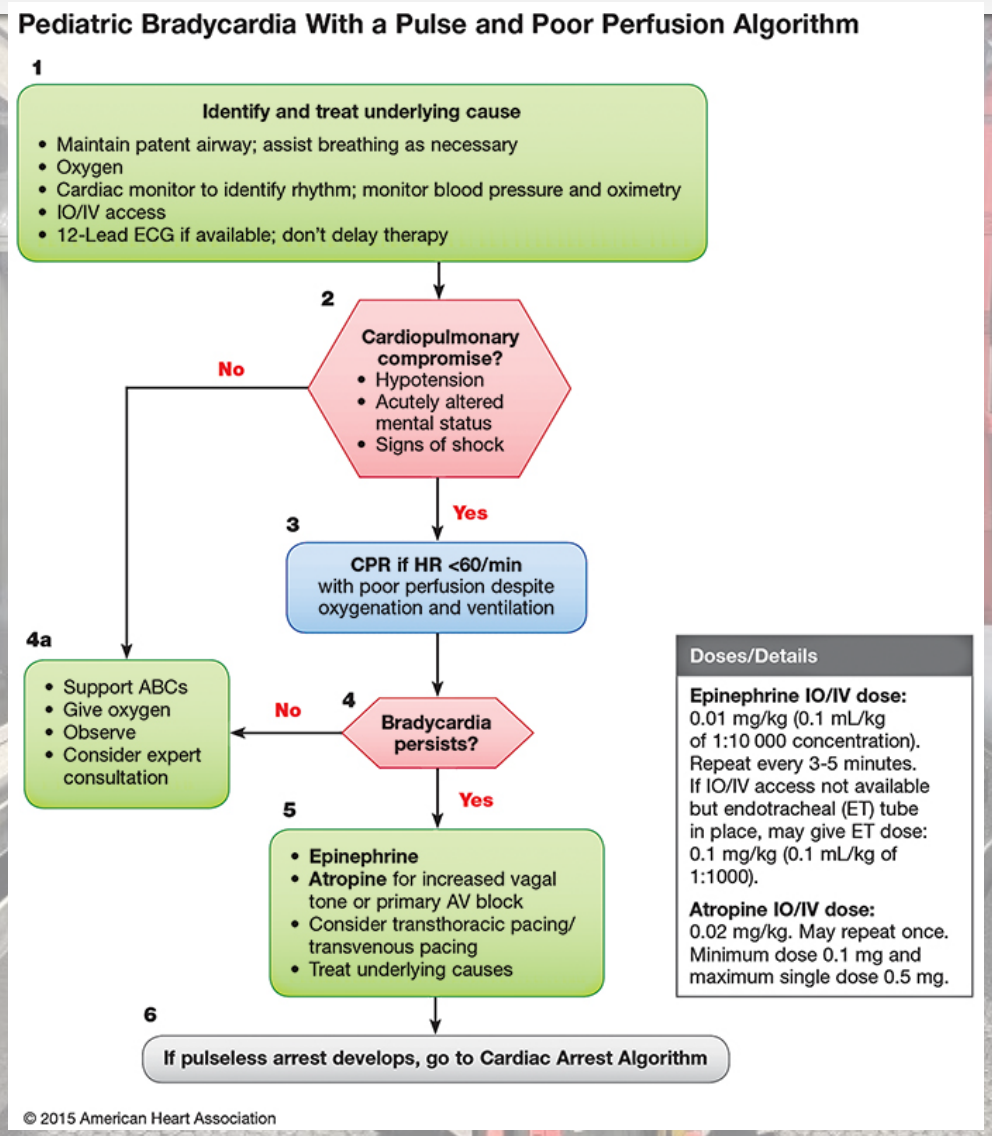
Bradydysrhythmias

- Try to identify and treat the underlying cause of the bradycardia.
- Initiate electronic cardiac monitoring.
  - With a sinus bradycardia, the heart rate is slower than the lower range of normal for the patient's age.
  - Incidental finding in adolescents

Bradydysrhythmias

- Atrioventricular (AV) block
  - First-degree block
    - Asymptomatic, often incidental finding
    - No intervention is needed.
    - Treatment only with signs of cardiovascular compromise
  - Second-degree block
    - Progressive prolongation of the PR interval; drop of the QRS complex
    - May progress to third-degree block

Bradydysrhythmias



Tachydysrhythmias

- Pulse rate is higher than normal for age.
- Subdivided into two types:
  - Narrow complex tachycardia: QRS complex is 0.09 second or less
  - Wide complex tachycardia: QRS complex is greater than 0.09 second

Tachydysrhythmias

- Treatment is directed at underlying cause.
  - Treat with antipyretics if child appears well, has a fever, and monitor shows sinus tachycardia.
  - Use fluid resuscitation for a child with sinus tachycardia and a history of vomiting or diarrhea.

Tachydysrhythmias

- Narrow complex tachycardia
  - SVT: The most frequent tachydysrhythmia requiring treatment
  - Identified by:
    - Narrow QRS complex
    - Absence of P waves
    - Unvarying heart rate of more than 220 beats/min (infant) or more than 180 beats/min (child)

Tachydysrhythmias

- Narrow complex tachycardia (cont'd)
  - Treatment depends on perfusion and stability.
    - If stable, consider vagal maneuvers while obtaining IV access.
    - If poor perfusion, synchronized cardioversion is recommended.

Tachydysrhythmias

- Wide complex tachycardia
  - Wide QRS complex tachycardia and palpable pulse is likely ventricular tachycardia (VT).
  - If stable, consider antidysrhythmic medication.
  - If unstable, use synchronized cardioversion.
  - If pulseless, begin CPR.

Tachydysrhythmias

- Pulseless arrest
  - Provide high-quality CPR.
  - Attach a monitor or defibrillator if indicated.

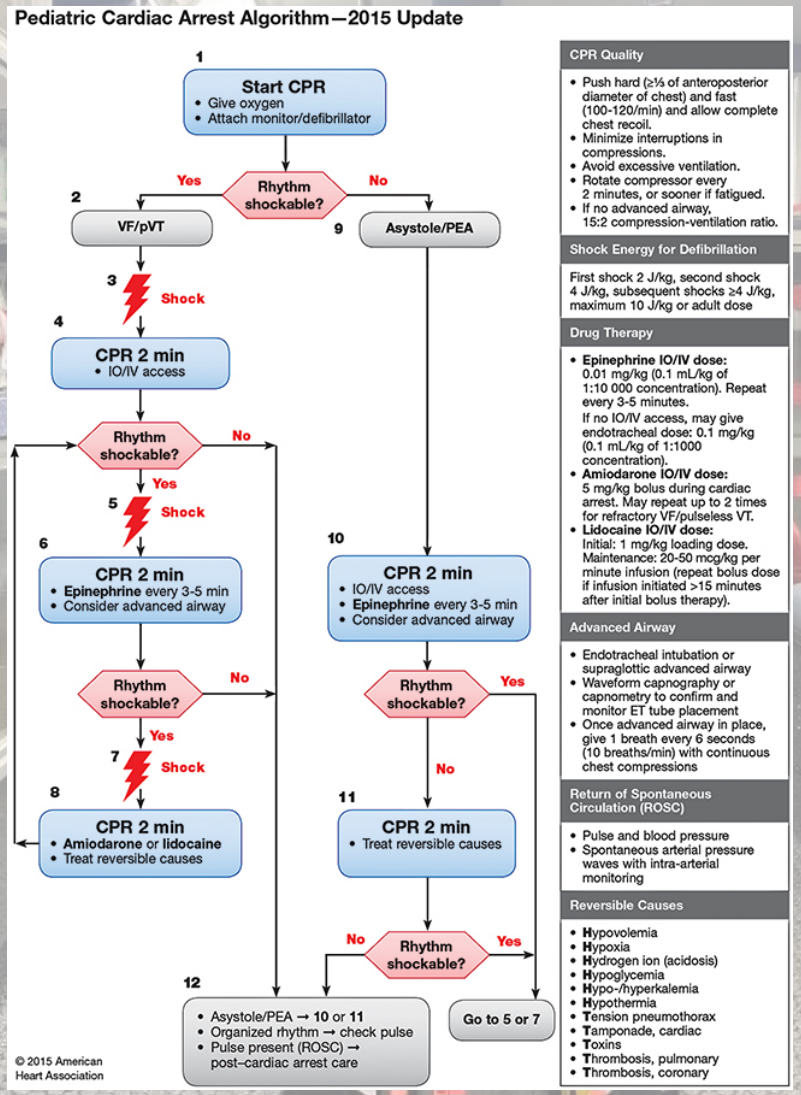
Tachydysrhythmias

- Pulseless arrest (cont'd)
  - Pulseless VT or VF: Defibrillation is indicated.
  - Additional treatment includes:
    - Establishing vascular access
    - Administration of epinephrine
    - Administration of antidysrhythmic

Tachydysrhythmias

- Pulseless arrest (cont'd)
  - Asystole or PEA: Defibrillation is not indicated.
  - Additional treatment includes:
    - Vascular access
    - Administration of epinephrine

Pediatric Cardiac Arrest Algorithm



Heart Failure

- Heart cannot meet metabolic demands at normal physiologic venous pressures.
- Signs and symptoms
  - Infants: Tachypnea, retractions, grunting
  - Children: Profuse sweating, increased work of breathing during feedings
  - Older children: Tachycardia, crackles

Heart Failure

- Treatment may include:
  - Oxygen
  - Diuretics
  - Inotropic medications (may be ordered by medical direction)
  - IV fluids (use judiciously)

Myocarditis

- Inflammation of the heart
  - Results in myocardial dysfunction
  - Can lead to heart failure
- Viral infections are common cause.

Myocarditis

- Transport with cardiac monitors.
- Obtain vascular access but use judiciously.
- Patients will often need inotropic support.
- Apply oxygen during transport.

Cardiomyopathy

- Dilated cardiomyopathy
  - Progressive dilation of the ventricles and poor contraction of myocardial muscle fibers
  - Typically due to viral infection or toxicity
  - Patients can present with fatigue, weakness, and signs of heart failure

Cardiomyopathy

- Hypertrophic cardiomyopathy
  - Heart muscle is unusually thick.
  - Heart has to pump harder to get blood to leave.
  - Patients can present with chest pain, dysrhythmias, dyspnea, syncope, and sudden death.

Cardiomyopathy

- Restrictive cardiomyopathy
  - Ventricle walls are stiff.
  - Ventricle filling is impaired.
  - Signs and symptoms similar to heart failure.

Assessment and Management of Cardiovascular Emergencies

- Begin with PAT, primary survey, and secondary assessment.
  - An abnormal appearance may indicate the need for rapid intervention.
    - Tachypnea is common with a primary cardiac problem.
    - Increased work of breathing and a fast respiratory rate are common with heart failure.

Assessment and Management of Cardiovascular Emergencies

- Determine:
  - Likely underlying cause
  - Patient's priority
  - Need for treatment or transport
- Repeat PAT and ABCs after intervention.

Neurologic Emergencies

- Can be benign or life threatening
- Medical history is important, including:
  - Previous seizures
  - Shunts
  - Cerebral palsy
  - Recent trauma or ingestions

Altered Mental Status

- Conditions that can interfere with mental status include:
  - Metabolic problems
  - Infectious diseases
  - Intracranial structural abnormalities
  - Trauma
  - Hypoxia
  - Poisonings

Altered Mental Status

- Use mnemonic AEIOUTIPS to remember common causes.
- Run through PAT and ABCDEs quickly.
  - Pay attention to disability and dextrose issues.
  - Check glucose.

Altered Mental Status

- Assess and support airway and breathing.
- If hypoglycemic, give glucose.
- If signs or symptoms suggest an opiate toxidrome, consider naloxone.

Altered Mental Status

- Transport all patients expeditiously.
- Assess for increased ICP.
  - Adding lidocaine prior to intubation may blunt the increase in ICP associated with intubation.
  - Signs include Cushing triad.

Sudden Infant Death Syndrome (SIDS)

- Sudden unexpected infant death (SUID)
  - Death of an infant younger than 1 year that occurs unexpectedly, the cause of which is not immediately obvious before investigation

Sudden Infant Death Syndrome (SIDS)

- Most SUIDs are one of three types:
  - Sudden infant death syndrome (SIDS)
  - Unknown cause
  - Accidental suffocation and strangulation in bed

Assessment and Management of SIDS

- Be alert to other potential causes of death.
- Decision to start or stop resuscitative efforts can be difficult.
- Thorough scene size-up and history are important.

Brief Resolved Unexplained Event (BRUE)

- Provide life support with signs of cardiorespiratory compromise or altered mental status.
- Transport all infants with a history of BRUE.

Fluid Management

- Airway management and ventilatory support take priority over circulation management.
  - Tachycardia is usually the first sign of circulatory compromise in a child.
  - Hypotension is a late finding.

Fluid Management

- Establishing vascular access
  - Large-bore IV catheters should be inserted into a large peripheral vein.
  - 20- or 22-gauge needles may be considered “large bore.”
  - Definitive care can only be provided at the ED.
  - To maintain perfusion, administer a bolus of 20 mL/kg of isotonic crystalloid solution.

Pain Management

- Pain is often undertreated in children.
  - Use tools to elicit child's self-report of pain level.
  - Use a calm, reassuring voice, distraction techniques, and medications when appropriate.
  - Children who are in shock and hemodynamically unstable are not good candidates for narcotics or sedatives.

Tracheostomy Tubes and Artificial Ventilators

- Tracheostomy:
  - Surgical creation of a stoma through which a tracheostomy tube can be placed for long-term ventilatory needs

Courtesy of Cindy Bissell.

Tracheostomy Tubes and Artificial Ventilators

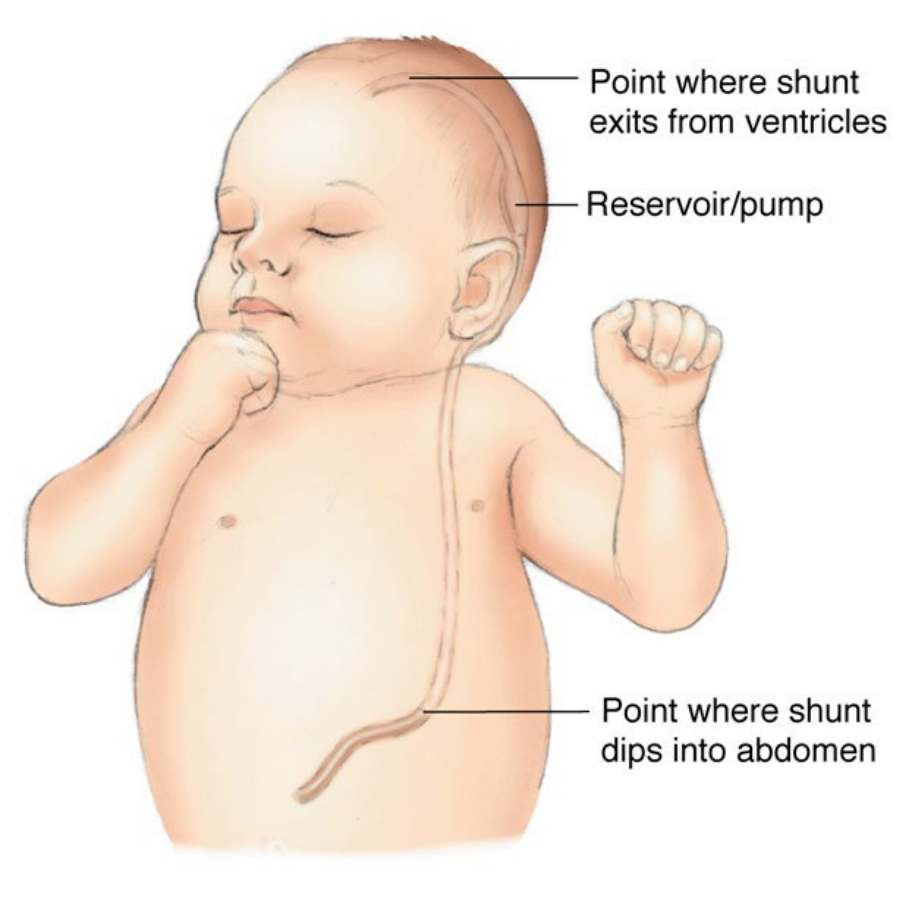
- Caregivers are a source of valuable information.
- Child may depend on a home ventilator and supplemental oxygen.
- Most common problem is obstruction of tube with secretions.
- With respiratory distress, assess tube position and suction tube.

Central Venous Catheters

- May be inserted for long-term IV access for medications or nutrition
- Complications include infections, obstruction, and dislodged or broken catheters.

Ventricular Shunts

- Inserted to drain excessive fluid from the brain
  - Without adequate drainage, CSF fluid accumulates, resulting in hydrocephalus.



Ventricular Shunts

- Shunt obstructions and infections are medical emergencies.
  - Transport for neurosurgical evaluation.
  - Maintain continuous cardiopulmonary monitoring during transport.

An Ounce of Prevention

- Emergency care for children involves a team approach by health professionals.
- To be an effective child safety advocate, you must be knowledgeable about local and national prevention programs.