PALS Systematic Approach Algorithm

1. Initial impression (appearance, breathing, circulation)

2. Is child unresponsive or is immediate intervention needed?
   - Yes: Shout for help. Activate emergency response plan (as appropriate for setting).
   - No: Initial impression (appearance, breathing, circulation)

3. Is child breathing with a pulse?
   - Yes: Open and maintain airway.
     - No: Is pulse <60/min with poor perfusion despite oxygenation and ventilation?
     - No: Start CPR (C-A-B).
     - Yes: Support airway, ventilation, and perfusion.
       - Open and maintain airway.
       - Provide oxygen when available.
       - Attach monitor, pulse oximeter.

4. Is child breathing or only gasping, no pulse?
   - Yes: Support airway, ventilation, and perfusion.
     - Open and maintain airway.
     - Provide oxygen when available.
     - Attach monitor, pulse oximeter.
   - No: Is child breathing with a pulse?

5. Is pulse <60/min with poor perfusion despite oxygenation and ventilation?
   - Yes: Support airway, ventilation, and perfusion.
     - Open and maintain airway.
     - Provide oxygen when available.
     - Attach monitor, pulse oximeter.
   - No: Is child breathing with a pulse?

6. If at any time you identify cardiac arrest
   - Identify
   - Evaluate
     - Primary assessment
     - Secondary assessment
     - Diagnostic assessments
   - Intervene

Pediatric Cardiac Arrest Algorithm—2018 Update

1. Start CPR
   - Give oxygen
   - Attach monitor/defibrillator

2. Rhythm shockable?

3. VF/pVT

4. CPR 2 min
   - IO/IV access

5. Shock

6. CPR 2 min
   - Epinephrine every 3-5 min
   - Consider advanced airway

7. Rhythm shockable?

8. CPR 2 min
   - Amiodarone or lidocaine
   - Treat reversible causes

9. Asystole/PEA

10. CPR 2 min
    - IO/IV access
    - Epinephrine every 3-5 min
    - Consider advanced airway, capnography

11. CPR 2 min
    - Treat reversible causes

12. Rhythm shockable?

   - If no signs of return of spontaneous circulation (ROSC), go to 10 or 11
   - If ROSC, go to Post–Cardiac Arrest Care

CPR Quality
- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100–120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 15:2 compression-ventilation ratio.

Shock Energy for Defibrillation
First shock 2 J/kg, second shock 4 J/kg, subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

Drug Therapy
- Epinephrine IO/IV dose: 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration). Repeat every 3-5 minutes. If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration).
- Amiodarone IO/IV dose: 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.
- Lidocaine IO/IV dose: Initial: 1 mg/kg loading dose. Maintenance: 20-50 mcg/kg per minute infusion (repeat bolus dose if infusion initiated >15 minutes after initial bolus therapy).

Advanced Airway
- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypoglycemia
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

© 2018 American Heart Association
PALS Management of Shock After ROSC Algorithm

**Optimize Ventilation and Oxygenation**
- Titrate $\text{FiO}_2$ to maintain oxyhemoglobin saturation 94%-99% (or as appropriate to the patient's condition); if possible, wean $\text{FiO}_2$ if saturation is 100%.
- Consider advanced airway placement and waveform capnography.
- If possible, target a PCO$_2$ that is appropriate for the patient's condition and limit exposure to severe hypercapnia or hypocapnia.

**Assess for and Treat Persistent Shock**
- Identify and treat contributing factors.*
- Consider 20 mL/kg IV/IO boluses of isotonic crystalloid. Consider smaller boluses (e.g., 10 mL/kg) if poor cardiac function suspected.
- Consider the need for inotropic and/or vasopressor support for fluid-refractory shock.

**Possible Contributing Factors**
- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypoglycemia
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
- Trauma

**Estimation of Maintenance Fluid Requirements**
- **Infants <10 kg:**
  4 mL/kg per hour
  
  Example: For an 8-kg infant, estimated maintenance fluid rate 
  = 4 mL/kg per hour × 8 kg 
  = 32 mL per hour
- **Children 10-20 kg:**
  40 mL per hour + 2 mL/kg per hour for each kg above 10 kg
  
  Example: For a 15-kg child, estimated maintenance fluid rate 
  = 40 mL per hour 
  + (2 mL/kg per hour × 5 kg) 
  = 50 mL per hour
- **Children >20 kg:**
  60 mL per hour + 1 mL/kg per hour for each kg above 20 kg
  
  Example: For a 28-kg child, estimated maintenance fluid rate 
  = 60 mL per hour 
  + (1 mL/kg per hour × 8 kg) 
  = 88 mL per hour

After initial stabilization, adjust the rate and composition of intravenous fluids based on the patient's clinical condition and state of hydration. In general, provide a continuous infusion of a dextrose-containing solution for infants. Avoid hypotonic solutions in critically ill children; for most patients, use isotonic fluid such as normal saline (0.9% NaCl) or lactated Ringer's solution with or without dextrose, based on the child's clinical status.

**Hypotensive Shock**
- Epinephrine
- Dopamine
- Norepinephrine

**Normotensive Shock**
- Dobutamine
- Dopamine
- Epinephrine
- Milrinone

- Monitor for and treat agitation and seizures.
- Monitor for and treat hypoglycemia.
- Assess blood gas, serum electrolytes, and calcium.
- If patient remains comatose after resuscitation from cardiac arrest, maintain targeted temperature management, including aggressive treatment of fever.
- Consider consultation and patient transport to tertiary care center.
Pediatric Tachycardia With a Pulse and Poor Perfusion Algorithm

1. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
   - IO/IV access
   - 12-Lead ECG if available; don’t delay therapy

2. Evaluate QRS duration
   - Narrow (≤0.09 sec)
   - Wide (>0.09 sec)

3. Evaluate rhythm with 12-lead ECG or monitor

4. Probable sinus tachycardia
   - Compatible history consistent with known cause
   - P waves present/normal
   - Variable R-R; constant PR
   - Infants: rate usually <220/min
   - Children: rate usually <180/min

5. Probable supraventricular tachycardia
   - Compatible history (vague, nonspecific); history of abrupt rate changes
   - P waves absent/abnormal
   - HR not variable
   - Infants: rate usually ≥220/min
   - Children: rate usually ≥180/min

6. Search for and treat cause

7. Consider vagal maneuvers (No delays)

8. Synchronized cardioversion
   - If IO/IV access present, give adenosine
   - If IO/IV access not available, or if adenosine ineffective, synchronized cardioversion

9. Possible ventricular tachycardia

10. Cardiopulmonary compromise?
    - Hypotension
    - Acutely altered mental status
    - Signs of shock

11. Consider adenosine if rhythm regular and QRS monomorphic

12. Yes or No

13. Expert consultation advised
    - Amiodarone
    - Procainamide

© 2015 American Heart Association

Doses/Details

Synchronized Cardioversion
- Begin with 0.5-1 J/kg; if not effective, increase to 2 J/kg.
- Sedate if needed, but don’t delay cardioversion.

Drug Therapy

Adenosine IO/IV dose:
- First dose: 0.1 mg/kg rapid bolus (maximum: 6 mg).
- Second dose: 0.2 mg/kg rapid bolus (maximum second dose: 12 mg).

Amiodarone IO/IV dose:
- 5 mg/kg over 20-60 minutes
- or

Procainamide IO/IV dose:
- 15 mg/kg over 30-60 minutes
- Do not routinely administer amiodarone and procainamide together.
Pediatric Bradycardia With a Pulse and Poor Perfusion Algorithm

1. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
   - IO/IV access
   - 12-Lead ECG if available; don’t delay therapy

2. Cardiopulmonary compromise?
   - Hypotension
   - Acutely altered mental status
   - Signs of shock

   3. No

   4a. CPR if HR <60/min with poor perfusion despite oxygenation and ventilation
      - Support ABCs
      - Give oxygen
      - Observe
      - Consider expert consultation

   4. Yes
      - Bradycardia persists?

      5. No
      - Epinephrine
      - Atropine for increased vagal tone or primary AV block
      - Consider transthoracic pacing/transvenous pacing
      - Treat underlying causes

      6. Yes
      - If pulseless arrest develops, go to Cardiac Arrest Algorithm

Doses/Details

**Epinephrine IO/IV dose:**
0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes. If IO/IV access not available but endotracheal (ET) tube in place, may give ET dose: 0.1 mg/kg (0.1 mL/kg of 1:1000).

**Atropine IO/IV dose:**
0.02 mg/kg. May repeat once. Minimum dose 0.1 mg and maximum single dose 0.5 mg.

© 2015 American Heart Association