# PEDIATRIC ADVANCED LIFE SUPPORT (PALS) RECERTIFICATION

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I. Cyclic Approach

This is the cyclic approach used to assess and manage an ill or injured child. It is repeated frequently during evaluation and management.

**Assess:** Evaluation starts with the general assessment and continues with the primary assessment, the secondary assessment, and the tertiary assessment. If you recognize a life-threatening condition at any time in any assessment, begin interventions.

**Categorize:** Attempt to categorize the child’s condition by type and severity.

<table>
<thead>
<tr>
<th>Type</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respiratory</strong></td>
<td>• Upper airway obstruction</td>
</tr>
<tr>
<td></td>
<td>• Lower airway obstruction</td>
</tr>
<tr>
<td></td>
<td>• Lung tissue disease</td>
</tr>
<tr>
<td></td>
<td>• Disordered control of breathing</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Circulatory</strong></td>
<td>• Hypovolemic Shock</td>
</tr>
<tr>
<td></td>
<td>• Obstructive Shock</td>
</tr>
<tr>
<td></td>
<td>• Distributive/Septic Shock</td>
</tr>
<tr>
<td></td>
<td>• Cardiogenic Shock</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The child’s condition may also be a combination of the two. As their condition deteriorates, one category may lead to others.
Decide: Now you need to decide on appropriate management based on your assessment and categorization of the child’s condition. This is done based on your scope of practice.

Act: Start treatment appropriate for the clinical condition.

II. Pediatric Assessment Flowchart

| General Assessment: | A – appearance  
|                    | B – work of breathing  
|                    | C – circulation  
| Primary Assessment: | A – airway  
|                    | B – breathing  
|                    | C – circulation  
|                    | D – disability  
|                    | E - exposure  
| Secondary Assessment: | S – signs and symptoms  
|                    | A – allergies  
|                    | M – medications  
|                    | P – past medical history  
|                    | L – last meal / liquids consumed  
|                    | E – events leading up to incident  

Also: Focused physical examination

| Tertiary Assessment: | Labs  
|                     | X-Rays  
|                     | Other tests as needed

Categorize Illness by Type and Severity

<table>
<thead>
<tr>
<th>Type</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory</td>
<td></td>
</tr>
</tbody>
</table>
| • Upper airway obstruction | • Respiratory distress  
| • Lower airway obstruction | • Respiratory failure  
| • Lung tissue disease |  
| • Disordered control of breathing |  
| Circulatory           |                                   |
| • Hypovolemic Shock   | • Compensated Shock  
| • Obstructive Shock   | • Hypotensive Shock  
| • Distributive/Septic Shock |  
| • Cardiogenic Shock   |  

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III. **Management of Respiratory Emergencies Flowchart**

- Airway positioning
- Oxygen Pulse oximetry
- ECG monitoring as needed
- BLS as needed

### Upper Airway Obstruction

**Specific Management for Selected Conditions**

<table>
<thead>
<tr>
<th>Croup</th>
<th>Anaphylaxis</th>
<th>Aspiration Foreign Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Racemic epinephrine</td>
<td>• IM epinephrine</td>
<td>• Allow position of comfort</td>
</tr>
<tr>
<td>• Corticosteroids</td>
<td>• Albuterol</td>
<td>• Specialty consultation</td>
</tr>
<tr>
<td>• Antihistamines</td>
<td>• Corticosteroids</td>
<td></td>
</tr>
<tr>
<td>• Corticosteroids</td>
<td>• Albuterol</td>
<td></td>
</tr>
</tbody>
</table>

### Lower Airway Obstruction

**Specific Management for Selected Conditions**

<table>
<thead>
<tr>
<th>Bronchiolitis</th>
<th>Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Nasal suctioning</td>
<td>• Albuterol and/or ipratropium</td>
</tr>
<tr>
<td>• Bronchodilator trial</td>
<td>• Corticosteroids</td>
</tr>
<tr>
<td>• SQ epinephrine</td>
<td>• SQ epinephrine</td>
</tr>
<tr>
<td>• Magnesium sulfate</td>
<td>• Magnesium sulfate</td>
</tr>
<tr>
<td>• Terbutaline</td>
<td>• Terbutaline</td>
</tr>
</tbody>
</table>

### Lung Tissue (Parenchymal) Disease

**Specific Management for Selected Conditions**

<table>
<thead>
<tr>
<th>Pneumonia / Pneumonitis</th>
<th>Pulmonary Edema</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infectious Chemical Aspiration</strong></td>
<td>Cardiogenic or ARDS</td>
</tr>
<tr>
<td>• Albuterol</td>
<td>• Consider noninvasive or invasive</td>
</tr>
<tr>
<td>• Antibiotics as needed</td>
<td>ventilator support with PEEP</td>
</tr>
<tr>
<td></td>
<td>• Consider vasoactive support</td>
</tr>
<tr>
<td></td>
<td>• Consider diuretic</td>
</tr>
</tbody>
</table>
Disordered Control of Breathing
Specific Management for Selected Conditions

<table>
<thead>
<tr>
<th>Increased ICP</th>
<th>Poisoning / Overdose</th>
<th>Neuromuscular Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Avoid hypoxemia</td>
<td>• Antidote (if available)</td>
<td>• Consider noninvasive or invasive ventilator support</td>
</tr>
<tr>
<td>• Avoid hypercarbia</td>
<td>• Contact Poison Control</td>
<td></td>
</tr>
<tr>
<td>• Avoid hyperthermia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This chart does not include all respiratory emergencies.

IV. Management of Shock Emergencies Flowchart

- Oxygen
- Pulse oximetry
- ECG monitor
- IV/IO access
- BLS as needed
- Bedside glucose

Hypovolemic Shock
Specific Management for Selected Conditions

<table>
<thead>
<tr>
<th>Non-hemorrhagic</th>
<th>Hemorrhagic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 20 mL/kg NS/LR bolus, repeat as needed</td>
<td>• Control external bleeding</td>
</tr>
<tr>
<td>• Consider colloid after 3rd NS/RL bolus</td>
<td>• 20 mL/kg NS/RL bolus repeat 2 or 3x as needed</td>
</tr>
<tr>
<td></td>
<td>• Transfuse PRBC’s as indicated</td>
</tr>
</tbody>
</table>

Distributive Shock
Specific Management for Selected Conditions

<table>
<thead>
<tr>
<th>Septic</th>
<th>Anaphylactic</th>
<th>Neurogenic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Algorithm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Septic Shock</td>
<td>• IM epinephrine</td>
<td>• 20 mL/kg NS/LR bolus, repeat PRN</td>
</tr>
<tr>
<td></td>
<td>• Antihistamines</td>
<td>• Vasopressor</td>
</tr>
<tr>
<td></td>
<td>• Corticosteroids</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Epinephrine infusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Albuterol</td>
<td></td>
</tr>
</tbody>
</table>
Cardiogenic Shock
Specific Management for Selected Conditions

<table>
<thead>
<tr>
<th>Brady / Tachyarrhythmia</th>
<th>CHD, Myocarditis, Cardiomyopathy, Poisoning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Algorithms:</td>
<td></td>
</tr>
<tr>
<td>• Bradycardia</td>
<td>• 5-10 mL/kg NS/RL bolus, repeat PRN</td>
</tr>
<tr>
<td>• Tachycardia with poor perfusion</td>
<td>• Vasoactive infusion</td>
</tr>
<tr>
<td></td>
<td>• Consider expert consultation</td>
</tr>
</tbody>
</table>

Obstructive Shock
Specific Management for Selected Conditions

<table>
<thead>
<tr>
<th>Ductal-Dependent</th>
<th>Tension Pneumothorax</th>
<th>Cardiac Tamponade</th>
<th>Pulmonary Embolism</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Prostaglandin</td>
<td>• Needle decompression</td>
<td>• Pericardiocentesis</td>
<td>• 20 mL/kg NS/RL bolus, repeat PRN</td>
</tr>
<tr>
<td>• Expert Consultation</td>
<td>• Tube thoracotomy</td>
<td>• 20 mL/kg NS/RL bolus</td>
<td>• Consider thrombolytics, anticoagulants</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V. Recognition of Shock Flowchart

- **Clinical Signs:**
  - **Hypovolemic Shock**
    - A - Airway-open and maintainable/not maintainable
    - B - Respiratory rate-increased
      - Effort-normal to increased
      - Breath sounds-normal, maybe crackles
    - C - Systolic blood pressure-Compensated to Hypotensive
      - Pulse pressure-narrow
      - Heart rate-increased
      - Pulse quality-weak
      - Skin-pale, cool
      - Cap refill-delayed
      - Urine output-decreased
    - D - Level of consciousness-irritable early, lethargic late
    - E - Variable
• Clinical Signs: Distributive Shock
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate-increased
      Effort-normal to increased
      Breath sounds-normal, maybe crackles
  C - Systolic blood pressure-Compensated to Hypotensive
      Pulse pressure-wide
      Heart rate-increased
      Pulse quality-bounding or weak
      Skin-warm or cool
      Cap refill-variable
      Urine output-decreased
  D - Level of consciousness-irritable early, lethargic late
  E - Variable
• Clinical Signs: Cardiogenic Shock
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate-increased
      Effort-labored
      Breath sounds-crackles, grunting
  C - Systolic blood pressure-Compensated to Hypotensive
      Pulse pressure-narrow
      Heart rate-increased
      Pulse quality-weak
      Skin-pale, cool
      Cap refill-delayed
      Urine output-decreased
  D - Level of consciousness-irritable early, lethargic late
  E - Variable
• Clinical Signs: Obstructive Shock
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate-increased
      Effort-labored
      Breath sounds-crackles, grunting
  C - Systolic blood pressure-Compensated to Hypotensive
      Pulse pressure-narrow
      Heart rate-increased
      Pulse quality-weak
      Skin-pale, cool
      Cap refill-delayed
      Urine output-decreased
  D - Level of consciousness-irritable early, lethargic late
VI. Recognition of Respiratory Problems Flowchart

- **Clinical Signs:** Upper Airway Obstruction
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate/effort-increased
    Breath sounds-stridor (typically inspiratory)-seal like cough- hoarseness
    Air movement-decreased
  C - Heart rate-increased
    Skin-pallor, cool skin (early) cyanosis (late)
  D - Level of consciousness-anxiety, agitation (early) lethargy, unresponsiveness (late)
  E - Variable

- **Clinical Signs:** Lower Airway Obstruction
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate/effort-increased
    Breath sounds-wheezing (typically expiratory) prolonged expiratory phase
    Air movement-decreased
  C - Heart rate-increased
    Skin-pallor, cool skin (early) cyanosis (late)
  D - Level of consciousness-anxiety, agitation (early) lethargy, unresponsiveness (late)
  E - Variable

- **Clinical Signs:** Lung Tissue (Parenchymal) Disease
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate/effort-increased
    Breath sounds-grunting, crackles, decreased breath sounds
    Air movement-decreased
  C - Heart rate-increased
    Skin-pallor, cool skin (early) cyanosis (late)
  D - Level of consciousness-anxiety, agitation (early) lethargy, unresponsiveness (late)
  E - Variable

- **Clinical Signs:** Disordered Control of Breathing
  A - Airway-open and maintainable/not maintainable
  B - Respiratory rate/effort-variable
    Breath sounds-normal
    Air movement-variable
  C - Heart rate-increased
    Skin-pallor, cool skin (early) cyanosis (late)
  D - Level of consciousness-anxiety, agitation (early) lethargy, unresponsiveness (late)
  E - Variable
VII. Normal Vital Signs for Pediatric Patients

- Normal Respiratory Rates

<table>
<thead>
<tr>
<th>Age</th>
<th>Breaths / Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant (&lt;1 year)</td>
<td>30 - 60</td>
</tr>
<tr>
<td>Toddler (1 – 3 years)</td>
<td>24 - 40</td>
</tr>
<tr>
<td>Preschooler (4 – 5 years)</td>
<td>22 - 34</td>
</tr>
<tr>
<td>School Age (6 – 12 years)</td>
<td>18 - 30</td>
</tr>
<tr>
<td>Adolescent (13 – 18 years)</td>
<td>12 - 18</td>
</tr>
</tbody>
</table>

* A respiratory rate more than 60 per minutes at any age is abnormal and should serve as a “red Flag.”

- Normal Heart Rates

<table>
<thead>
<tr>
<th>Age</th>
<th>Awake</th>
<th>Sleeping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn – 3 years</td>
<td>85 - 205</td>
<td>80 - 160</td>
</tr>
<tr>
<td>3 months – 2 years</td>
<td>100 - 190</td>
<td>75 - 160</td>
</tr>
<tr>
<td>2 years – 10 years</td>
<td>60 - 140</td>
<td>60 - 90</td>
</tr>
<tr>
<td>&gt; 10 years</td>
<td>60 - 100</td>
<td>50 - 90</td>
</tr>
</tbody>
</table>

* Heart rate should be appropriate for the child’s age, activity level and clinical condition. Heart rates vary in a sleeping or athletic child. “red Flag.”

- Minimum Systolic Blood Pressure Accepted (5th percentile)

<table>
<thead>
<tr>
<th>Age</th>
<th>Systolic Blood Pressure (mm HG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth (12h, &lt; 1000g)</td>
<td>39-59</td>
</tr>
<tr>
<td>Birth (12h, 3g)</td>
<td>60-76</td>
</tr>
<tr>
<td>Neonate (96h)</td>
<td>67-84</td>
</tr>
<tr>
<td>Infant (1-12mos)</td>
<td>72-104</td>
</tr>
<tr>
<td>Toddler (1 – 2 years)</td>
<td>86-106</td>
</tr>
<tr>
<td>Preschooler (3 – 5 years)</td>
<td>89-112</td>
</tr>
<tr>
<td>School Age (6 – 12 years)</td>
<td>97-115</td>
</tr>
<tr>
<td>Adolescent (10-11 years)</td>
<td>102-120</td>
</tr>
</tbody>
</table>
VIII. Algorithms for Pediatrics

- Pulseless Arrest

**Box 1** - Pulseless Arrest
- BLS Algorithm: Continue CPR
- Give Oxygen when available
- Attach Monitor/defibrillator when available

**Box 2** - Check Rhythm
Is it a shockable rhythm?

**Box 3** - VF / VT

**Box 4** - Give 1 Shock
- Manual 2J/kg
- AED: >1 year of age (use pediatric system if available, for age 1 to 8 years of age
- Resume CPR Immediately

**Box 5** - Check Rhythm
Is it a Shockable rhythm?

**Box 6** - Continue CPR while defibrillator is charging. Give 1 shock
- Manual 4J/kg
- AED: >1 year of age (use pediatric system, if available, for age 1 to 8 years of age
- Resume CPR Immediately
- Give Epinephrine
  - IV/IO: 0.01 mg/kg (1:10 000:0.1 ml/kg
  - Endotracheal tube: 0.1 mg/kg
- Repeat every 3 to 5 minutes

**Box 7**

**Box 8**

**Box 9** - Asystole / PEA

**Box 10** - Resume CPR Immediately
- Give Epinephrine
  - IV/IO: 0.01 mg/kg (1:10 000:0.1 ml/kg
  - Endotracheal tube: 0.1 mg/kg
- Repeat every 3 to 5 minutes

**Box 11** - Check Rhythm
Is it a Shockable rhythm?

**Box 12** –
- If asystole, go to Box 10
- If electrical activity, check pulse. If no pulse, go to Box 10
- If pulse is present, begin post resuscitation care.

Go to Box 4
Box 7 - Check Rhythm.
Is it a Shockable rhythm?

YES, go to page 12

YES, continued from page 11

Continue CPR while defibrillator is charging.

Give 1 shock
- Manual: 4J/kg
- AED: >1 year of age

Resume CPR immediately after the shock

Consider antiarrhythmics (e.g. Amiodarone 5 mg/kg IV/IO once, or Lidocaine 1 mg/kg IV/VO)

Consider Magnesium, 25 to 50 mg/kg. Max 2 g IV/VO for Torsades de Pointes

After 5 cycles of CPR, go to Box 5

During CPR
- Push hard and fast (100/min)
- Ensure full chest recoil
- Minimize interruptions in chest compressions
- One cycle of CPR: 15 compressions then 2 breaths: 5 cycles = 2 min
- Avoid hyperventilation
- Secure airway and confirm placement
- After an advanced airway is placed, rescuers no longer deliver “cycles” of CPR
- Give continuous compressions without pauses for breaths
- Give 8-10 breaths/min
- Check Rhythm every 2 minutes
- Rotate compressors every 2 minutes, with rhythm checks
- Search for and treat possible contributing factors:

  Hypovolemia, Hypoxia, Hydrogen Ion (acidosis) Hypo/Hyperkalemia, Hypoglycemia, Hypothermia, Toxins Tamponade (cardiac), Tension Pneumothorax, Thrombosis (coronary or pulmonary), Trauma (hypovolemia)
Brady Cardiac with a Pulse

- Support ABCs as needed
- Give oxygen
- Attach Monitor/defibrillator

Bradycardia still causing Cardiorespiratory Compromise?

- Support ABCs as needed
- Give oxygen if needed
- Observe
- Consider expert consultation

Perform CPR, if despite Oxygenation and ventilation HR <60, with poor perfusion

Persistent symptomatic bradycardia

- Give Epinephrine
  - IV/IO: 0.01 mg/kg (1:10 000:0.1 ml/kg)
  - Endotracheal tube: 0.1 mg/kg
  - Repeat every 3 to 5 minutes

- If increased vagal tone or Primary AV Block:
  - Give Atropine, first dose: 0.02 mg/kg.
  - May repeat (Minimum dose: 0.1 mg; Max dose 1 mg)

- Consider cardiac pacing

Reminders
- If Pulseless Arrest develops, go to Pulseless Arrest Algorithm
- During CPR
  - Push hard and fast (100/min)
  - Ensure full chest recoil
- Support ABCs
- Secure airway if needed and confirm placement
- Minimize interruptions in chest compressions
- Search for and treat possible contributing factors:
  - Hypovolemia
  - Hypoxia
  - Hydrogen Ion (acidosis)
  - Hypo-/Hyperkalemia
  - Hypoglycemia
  - Hypothermia
  - Toxins
  - Tamponade, Cardiac
  - Tension Pneumothorax
  - Thrombosis (coronary or pulmonary)
  - Trauma (hypovolemia, increased ICP)
• **Tachycardia with Adequate Perfusion**

  - **BLS Algorithm:** Assess and support ABCs as needed (assess signs of circulation and pulse; provide oxygen and ventilation
  - **Provide O₂**
  - **Attach monitor/defibrillator**
  - **Evaluate 12-lead ECG if practical**

**QRS Normal (≤0.08 sec)**

**Evaluate rhythm**

**QRS Wide (≥0.08 sec)**

**Probable ventricular tachycardia**

**Consider alternative medications**

- **Amiodarone,** 5 mg/kg IV over 20 to 60 min
  - **OR**
  - **Procainamide,** 15 mg/kg IV over 30 to 60 min (Do not routinely administer Amiodarone and Procainamide together)
  - **OR**
  - **Lidocaine,** 1 mg/kg IV Bolus

**Probable Sinus Tachycardia**

- History Compatible
- P-waves present and normal
- HR often varies with activity
- Variable RR with constant PR
- Infants: usually <220 bpm
- Children: usually <180 bpm

**Probable Supraventricular Tachycardia**

- History incompatible with ST
- P-waves absent/normal
- HR not variable with activity
- Abrupt rate changes
- Infants: usually ≥220 bpm
- Children: usually ≥180 bpm

**Consider Vagal Maneuvers**

- Establish vascular access
- Consider **Adenosine** 0.1 mg/kg IV (maximum first dose 6 mg). May double or repeat one dose (maximum second dose: 12 mg). Use Rapid Bolus Technique.

**During Evaluation**

- Provide Oxygen and ventilation as needed
- Support ABCs
- Confirm continuous monitor/pacer attachment
- Consider expert consultation
- Prepare for cardioversion 0.5 to 1J/kg (consider sedation)

  **Identify and treat possible causes:**
  Hypovolemia, Hypoxia, Hydrogen Ion (acidosis)
  Hypo-/Hyperkalemia, Hypothermia, Toxins,
- Consult Pediatric cardiologist
- Attempt cardioversion 0.5 to 1J/kg; may increase to 2J/kg if initial dose is ineffective
- Sedate prior to cardioversion
- Obtain 12-lead ECG

Tamponade (cardiac), Tension Pneumothorax, Thrombosis (coronary or pulmonary), Trauma (hypovolemia), increased ICP

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- Tachycardia with Pulses and Poor Perfusion

**Tachycardia with Pulses and Poor Perfusion**
- Assess and support ABCs as
- Provide O₂
- Attach monitor/defibrillator

**QRS Normal (≤0.08 sec)**
Evaluate rhythm with monitor or 12-lead ECG

**Probable Sinus Tachycardia**
- History compatible
- P-waves present and normal
- HR often varies with activity
- Variable RR with constant PR
- Infants: usually <220 bpm
- Children: usually <180 bpm

**Probable Supraventricular Tachycardia**
- History incompatible with ST
- P-waves absent/abnormal
- HR not variable with activity
- Abrupt rate changes
- Infants: usually ≥220 bpm
- Children: usually ≥180 bpm

**Synchronized Cardioversion**
- 0.5 to 1J/kg; may increase to 2J/kg if initial dose is ineffective
- Sedate if possible, but do not delay cardioversion
- Consider Adenosine, if it does not delay electrical cardioversion

**QRS Wide (≥0.08 sec)**

Probable ventricular tachycardia

**Search for and treat cause!**

**If vascular access is available:**
- Consider Adenosine 0.1 mg/kg IV (maximum first dose 6 mg. May double or repeat one dose (maximum second dose 12 mg). Use Rapid Bolus Technique

**Consider Vagal Maneuvers (no delays)**

**Symptoms Persist**

What is the QRS duration?

**Probable Sinus Tachycardia**
- History compatible
- P-waves present and normal
- HR often varies with activity
- Variable RR with constant PR
- Infants: usually <220 bpm
- Children: usually <180 bpm

**Probable Supraventricular Tachycardia**
- History incompatible with ST
- P-waves absent/abnormal
- HR not variable with activity
- Abrupt rate changes
- Infants: usually ≥220 bpm
- Children: usually ≥180 bpm

**Synchronized Cardioversion**
- 0.5 to 1J/kg; may increase to 2J/kg if initial dose is ineffective
- Sedate if possible, but do not delay cardioversion
- Consider Adenosine, if it does not delay electrical cardioversion

**Expert Consultation Advised**

- Amiodarone, 5 mg/kg IV over 20 to 60 min
  OR
- Procainamide 15 mg/kg IV over 30 to 60 min. (Do not routinely administer Amiodarone and Procainamide together).
OR
- Attempt cardioversion 0.5 to 1 J/kg; may increase to 2J/kg if initial dose is ineffective
- Sedate prior to cardioversion, if possible

During Evaluation
- Provide Oxygen and ventilation as needed
- Support ABC’s
- Confirm continuous monitor/pacer attachment
- Consider expert consultation
- Prepare for cardioversion 0.5 to 1J/kg (consider sedation)

Identify and treat possible causes:
Hypovolemia, Hypoxia, Hydrogen Ion (acidosis) Hypo-/Hyperkalemia, Hypothermia, Toxins, Tamponade (cardiac), Tension Pneumothorax, Thrombosis (coronary or pulmonary), Trauma (hypovolemia), increased ICP

IX. AED Treatment Algorithm for Pre-Hospital Care of Children >8
For Emergency Cardiovascular Care Pending Arrival of Emergency Medical Personnel

Unresponsive – 911 – AED
- Check if unresponsive
- Phone 911
- Get AED
- Identify and respond to special situations

Unresponsive

Start the ABCDs:
- Airway: open airway
- Breathing: Check breathing --- (look, listen and feel)

Not Breathing

Yes, Breathing

- If breathing is adequate, place in a recovery position
- If breathing is inadequate: start rescue breathing (1 breath every 5 seconds)
- Monitor signs of circulation

Not Breathing

Yes, Circulation

- Start rescue breathing (1 breath every 5 seconds)
- Monitor signs of circulation (every 30 to 60 seconds)

No Circulation

Perform CPR (until AED arrives and is ready to attach:
- Start chest compressions (100/min)
- Start rescue breathing (10 to 12 breaths/min)
- Ratio of 15 compressions to 2 breaths

No Circulation

Memory aid for “no shock indicated”:
- Check for signs of circulation

Not Breathing

Yes, Breathing

- Provide 2 slow breaths
  (2 seconds per breath)
- Circulation: check for signs

No Circulation

Perform CPR (until AED arrives and is ready to attach:
- Start chest compressions (100/min)
- Start rescue breathing (10 to 12 breaths/min)
- Ratio of 15 compressions to 2 breaths

No Circulation

Memory aid for “no shock indicated”:
- Check for signs of circulation
If signs of circulation present: check breathing
• If inadequate breathing: start rescue breathing (1 breath every 5 seconds)
• If adequate breathing: place in a recovery position
• If no signs of circulation, analyze rhythm: repeat "shock indicated" or "no shock indicated" sequences

*Note: Signs of circulation: lay rescuers check for normal breathing, coughing or movement (typically assessed after 2 rescue breaths delivered to the unresponsive, non-breathing victim).

Analyze ("Clear!")
• Shock ("Clear!") up to 3 times, if advised

After 3 shocks or after any “no shock indicated”
• Check for signs of circulations
• If no signs of circulations: perform CPR for 1 minute

Check for signs of circulation: if absent:
• Press ANALYZE
• Attempt defibrillation
• Repeat up to 3 times

Post-arrest Treatment of Shock

Post-arrest Stabilization

Post-arrest Shock

Fluid bolus
(10-20 mL/kg NS or RL monitor response)

Reassess – Signs of shock continue

What is blood pressure?

Hypotensive
(decompensated)
shock?

<table>
<thead>
<tr>
<th>Consider further fluid boluses</th>
<th>Epinephrine (0.1 to 1 ug/kg per minute) or Dobutamine (2 to 20 ug/kg per minute)</th>
</tr>
</thead>
</table>

Normotensive
(compensated)
shock?

Infants <10 kg: Infusion of 0.2% normal saline in 5% dextrose (d5/0.2% NaCl) at a rate of 4 mL/kg per hour. For example, the maintenance rate for an 8-kg baby is as follows:

\[
4 \text{ mL/kg per hour} \times 8 \text{ kg} = 32 \text{ mL/h}
\]

Children 10 to 20 kg: Infusion of d5/0.2% NaCl at a rate of 40 mL/h plus 2mL/kg per hour for each kilogram between 10 and 20 kg. For example, the maintenance rate for a 15-kg child is as follows:

\[
40 \text{ mL/h} + (2 \text{mL/kg per hour} \times 5 \text{ kg}) = 50\text{mL/h}
\]

Children >20 kg: Infusion of d5/0.2% NaCl at a rate of 60 mL/h plus 1 mL/kg per hour for each kilogram above 20 kg. For example the maintenance rate for a 30-kg child is as follows:

\[
60 \text{ mL/h} + (1 \text{ mL/kg per hour} \times 10 \text{ kg}) = 70 \text{ mL/h}
\]
Dopamine at higher doses (up to 20 ug/kg per minute)  
Norepinephrine (0.1 to 2 ug/kg per minute)  

or  
Dopamine (1 to 20 ug/kg per minute)  
or  
Low doses epinephrine (0.05 to 0.3 ug/kg per minute)  
Inamrinone: Load with 0.75 to 1 mg/kg over 5 minutes, may repeat up to 3 mg/kg. Infusion: 5 to 10 ug/kg per minute  
Milrinone: Load with 50 to 75 ug/kg. Infusion: 0.5 to 0.075 ug/kg per minute.

X. Overview of Resuscitation in the Delivery Room

Approximate Time

Birth

Clear of meconium?  
Breathing or crying?  
Good muscle tone?  
Color pink?  
Term gestation?

YES
  
Routine Care  
• Provide warmth  
• Clear airway  
• Dry

NO

• Provide warmth  
• Position, clear airway (as necessary)  
• Dry, stimulate, reposition  
• Give O₂ (as necessary)

Breathing

• Evaluate respirations, heart rate, and color

Supportive care

Apnea or <100

Provide positive pressure ventilation

Ongoing care

Ventilating

HR > 100 and pink

HR > 100
XI. Drugs Used in Pediatric Advanced Life Support

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Dosage (Pediatric)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenosine</td>
<td>0.1 mg/kg (up to 6 mg) 0.2 0.2 mg/kg for second dose</td>
<td>Rapid IV push</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max single dose: 12 mg</td>
</tr>
<tr>
<td>Amiodarone:</td>
<td>5 mg/kg Bolus IV/IO</td>
<td>Max 15 mg/kg/day</td>
</tr>
<tr>
<td>For refractory pulseless</td>
<td></td>
<td>Repeat to max 15 mg/kg/day IV</td>
</tr>
<tr>
<td>VT/VF for perfusing tachycardia</td>
<td>Loading: 5 mg/kg IV/VO over 20-60 min</td>
<td></td>
</tr>
<tr>
<td>Atropine sulfate</td>
<td>0.02 mg/kg IV/VO/TT</td>
<td>Min dose: 0.1 MG</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Max single dose: 0.5 mg child, 1 mg adolescent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>May double 2nd dose</td>
</tr>
<tr>
<td>Ca² chloride 10%</td>
<td>20 mg/kg IV/VO</td>
<td>Slow IV 10 bolus</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>2-20 ug/kg/min</td>
<td>Titrate to desired effect</td>
</tr>
<tr>
<td>Dopamine</td>
<td>2-20 ug/kg/min</td>
<td>a-Pressor effects at higher doses .15 ug/kg/min</td>
</tr>
<tr>
<td>Epinephrine for Bradycardia</td>
<td>IV/IO: 0.01 mg/kg (1.10 000, 0.1 mL/kg)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TT: 0.1 mg/kg (1:1000, 0.1 mL/kg)</td>
<td></td>
</tr>
<tr>
<td>Epinephrine for Asystolic or</td>
<td>First dose: IV/IO: 0.01 mg/kg</td>
<td>Subsequent doses: IV/IO/TT: 0.01-0.1 mg/kg</td>
</tr>
<tr>
<td>pulseless arrest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drugs</td>
<td>Dosage (Pediatric)</td>
<td>Remarks</td>
</tr>
<tr>
<td>----------------------------</td>
<td>--------------------------------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Milrinone</td>
<td>Loading dose 50-70 ug/kg IV/IO over 10-60 min</td>
<td>Monitor BP, ECG</td>
</tr>
<tr>
<td></td>
<td>Infusion dose 0.5–0.75 ug/kg/min IV/IO</td>
<td></td>
</tr>
<tr>
<td>Naloxone</td>
<td>If &lt;5 years old or &lt;20 kg: 0.1 mg/kg</td>
<td>Titrate to desired effect</td>
</tr>
<tr>
<td></td>
<td>If &lt;5 years old or &gt;20 kg: 2 mg</td>
<td></td>
</tr>
<tr>
<td>Prostaglandin E1</td>
<td>0.05–0.1 ug/kg/min</td>
<td>Titrate, monitor for apnea, hypotension, hypoglycemia, hypocalcemia</td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>1 mg/kg per dose</td>
<td>Infuse slowly and only if ventilation is adequate</td>
</tr>
</tbody>
</table>

For TT administration, dilute medication with NS to a volume of 3-5 mL and follow with several positive-pressure ventilations.