Pediatric Advanced Life Support (PALS)
Recertification Preparatory Materials
# 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>Respiratory</td>
<td></td>
</tr>
<tr>
<td>Upper airway obstruction</td>
<td>Respiratory distress</td>
</tr>
<tr>
<td>Lower airway obstruction</td>
<td>Respiratory failure</td>
</tr>
<tr>
<td>Lung tissue disease</td>
<td></td>
</tr>
<tr>
<td>Disordered control of breathing</td>
<td></td>
</tr>
<tr>
<td>Circulatory</td>
<td></td>
</tr>
<tr>
<td>Hypovolemic Shock</td>
<td>Compensated Shock</td>
</tr>
<tr>
<td>Obstructive Shock</td>
<td>Hypotensive Shock</td>
</tr>
<tr>
<td>Distributive/Septic Shock</td>
<td></td>
</tr>
<tr>
<td>Cardiogenic Shock</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>
<tr>
<td>• Upper airway obstruction</td>
<td>• Respiratory distress</td>
</tr>
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<td>• Hypovolemic Shock</td>
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<td>• Obstructive Shock</td>
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</tr>
<tr>
<td>• Distributive/Septic Shock</td>
<td></td>
</tr>
<tr>
<td>• Cardiogenic Shock</td>
<td></td>
</tr>
</tbody>
</table>

Respiratory + Circulatory = Cardiopulmonary failure
### 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>
</table>
| • Racemic epinephrine  
  • Corticosteroids | • IM epinephrine  
  • Albuterol  
  • Antihistamines  
  • Corticosteroids | • Allow position of comfort  
  • Specialty consultation |

#### Lower Airway Obstruction
**Specific Management for Selected Conditions**

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

#### Lung Tissue (Parenchymal) Disease
**Specific Management for Selected Conditions**

| Pneumonia / Pneumonitis  
*Infectious Chemical Aspiration* | Pulmonary Edema  
*Cardiogenic or ARDS* |
|-----------------------------|----------------|
| • Albuterol  
  • Antibiotics as needed | • Consider noninvasive or invasive ventilator support with PEEP  
  • Consider vasoactive support  
  • Consider diuretic |
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>Nonhemorrhagic</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>• IM epinephrine</td>
<td>• 20 mL/kg NS/LR bolus, repeat PRN</td>
</tr>
<tr>
<td>• Septic Shock</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>

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### 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>• 5-10 mL/kg NS/RL bolus, repeat PRN</td>
</tr>
<tr>
<td>• Bradycardia</td>
<td>• Vasoactive infusion</td>
</tr>
<tr>
<td>• Tachycardia with poor perfusion</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>• Peri-cardiocentesis</td>
<td>• 20 mL/kg NS/RL bolus, repeat PRN</td>
</tr>
<tr>
<td>• Expert Consultation</td>
<td>• Tube thoracostomy</td>
<td>• 20 mL/kg NS/RL bolus</td>
<td>• Consider thrombolytics, anticoagulants</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-crackless, 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-crackless, 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

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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

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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>Infant (&lt;1 year)</td>
<td>30 - 60</td>
</tr>
<tr>
<td>Toddler (1 – 3 years)</td>
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</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 - Check Rhythm**
Is it a shockable rhythm?

**Box 8 - Asystole / PEA**

**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**

YES, go to page 12

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Continue CPR while defibrillator is charging.

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

**Resume CPR immediately after the shock**
Consider antiarrythmics (e.g. *Amidarone* 5 mg/kg IV/IO once, or *Lidocaine* 1 mg/kg IV/IO)
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)
• Bradycardia with a Pulse

BRADYCARDIA with a pulse
Causing Cardiorespiratory Compromise

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

Bradycardia still causing Cardiopulmonary compromise?

NO

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

NO

YES

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

Persistent symptomatic bradycardia

YES

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)

• Give Epinephrine
  - IV/IO: 0.01 mg/kg (1:10 000:0.1 ml/kg
  - Endotracheal tube: 0.1 mg/kgR
  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

• If Pulseless Arrest develops go to Algorithm for Pulseless Arrest

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Tachycardia with Adequate Perfusion

- **BLS Algorithm:** Assess and support ABCs as needed (assess signs of circulation and pulse; provide oxygen and ventilation
- Provide \( O_2 \)
- Attach monitor/defibrillator
- Evaluate 12-lead ECG if practical

**QRS Normal (≤0.08 sec)**
- Evaluate rhythm
- What is the QRS duration?

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

- 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

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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

QRS Wide (≥0.08 sec)  
Probable ventricular tachycardia

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

Search for and treat cause!

Consider Vagal Maneuvers (no delays)

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 doseL 12 mg). Use Rapid Bolus Technique
- 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

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

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).

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)
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)

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

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

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

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, nonbreathing victim).

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

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Postarrest Treatment of Shock and Maintenance Fluid Requirements

Estimation of Maintenance Fluid Requirements

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 2 mL/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:

\[60 \text{ mL/h} + (1 \text{ mL/kg per hour} \times 10 \text{ kg}) = 70 \text{ mL/h}\]

Postarrest Stabilization

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

Reassess – Signs of shock continue

What is blood pressure?

Hypotensive (decompensated) shock?

Consider further fluid boluses Epinephrine (0.1 to 1 ug/kg per minute) or Dopamine at higher doses (up to 20 ug/kg per minute) Norepinephrine (0.1 to 2 ug/kg per minute)

Normotensive (compensated) shock?

Consider further fluid boluses Dobutamine (2 to 20 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 0.75 ug/kg per minute.

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X. Overview of Resuscitation in the Delivery Room

Approximate Time

<table>
<thead>
<tr>
<th>30 Sec</th>
<th>Birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear of meconium?</td>
<td>YES</td>
</tr>
<tr>
<td>Breathing or crying?</td>
<td>Routine Care</td>
</tr>
<tr>
<td>Good muscle tone?</td>
<td>• Provide warmth</td>
</tr>
<tr>
<td>Color pink?</td>
<td>• Clear airway</td>
</tr>
<tr>
<td>Term gestation?</td>
<td>• Dry</td>
</tr>
</tbody>
</table>

NO

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

Breathing | Supportive care

Apnea or <100 |

Provide positive pressure ventilation

Ventilating | Ongoing care

HR > 100 and pink

Ongoing care

HR < 60

Provide positive pressure ventilation

Administer chest compressions

Administer epinephrine

HR > 100 and pink

30 Sec

30 Sec

30 Sec

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18
<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&lt;br&gt;Max single dose: 12 mg</td>
</tr>
<tr>
<td>Amiodarone: For refractory pulseless VT / VF for perfusing tachycardias</td>
<td>5 mg/kg Bolus IV/IO&lt;br&gt;Loading: 5 mg/kg IV/VO over 20-60 min</td>
<td>Max 15 mg/kg/day&lt;br&gt;Repeat to max 15 mg/kg/day IV</td>
</tr>
<tr>
<td>Atropine sulfate</td>
<td>0.02 mg/kg IV/VO/TT</td>
<td>Min dose: 0.1 MG&lt;br&gt;Max single dose: 0.5 mg child, 1 mg adolescent&lt;br&gt;May double 2nd dose</td>
</tr>
<tr>
<td>Ca&lt;sub&gt;2&lt;/sub&gt; 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)&lt;br&gt;TT: 0.1 mg/kg (1:1000, 0.1 mL/kg)</td>
<td>Subsequent doses: IV/IO/TT: 0.01-0.1 mg/kg&lt;br&gt;(1:1000, 0.1 mL/kg). IV/VO doses as high as 0.2 mg/kg of 1:1000 may be effective&lt;br&gt;Repeat q 3-5 min</td>
</tr>
<tr>
<td>Epinephrine for Asystolic or pulseless arrest</td>
<td>First dose: IV/IO: 0.01 mg/kg (1:10 000, 0.1 mL/kg)&lt;br&gt;Subsequent doses: IV/IO/TT: 0.01-0.1 mg/kg (1:1000, 0.1 mL/kg). IV/VO doses as high as 0.2 mg/kg of 1:1000 may be effective&lt;br&gt;Repeat q 3-5 min</td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td>0.5-1 g/kg IV/VO&lt;br&gt;Max dose: 2-4 mL/kg&lt;br&gt;Of 25% solution</td>
<td>5% = 10-20 mL/kg&lt;br&gt;10% = 5-10 mL/kg,&lt;br&gt;25% = 2-4 mL/kg (in large vein)</td>
</tr>
<tr>
<td>Lidocaine Infusion</td>
<td>1 mg/kg&lt;br&gt;IV/IO/TT</td>
<td></td>
</tr>
<tr>
<td>Magnesium Sulfate</td>
<td>25-50 mg/kg/min over 10-20 min</td>
<td>Max dose: 2 g</td>
</tr>
</tbody>
</table>

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<table>
<thead>
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<th>Drugs</th>
<th>Dosage (Pediatric)</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Milrenone    | Loading dose 50-70 ug/kg IV/IO over 10-60 min  
Infusion dose 0.5–0.75 ug/kg/min IV/IO | Monitor BP, ECG                                             |
| Naloxone     | If <5 years old or <20 kg: 0.1 mg/kg  
If <5 years old or >20 kg: 2 mg       | Titrate to desired effect                                    |
| Prostaglandin E1 | 0.05-0.1 ug/kg/min                                                                 | Titrate, monitor for apnea, hypotension, hypoglycemia, 
hypocalcemia                                           |
| Sodium bicarbonate | 1 mEq/kg per dose                                                           | Infuse slowly and only if ventilation is adequate            |

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