



National Medical Certifications Services, Inc.

**Pediatric Advanced Life Support (PALS)
Recertification Preparatory Materials**

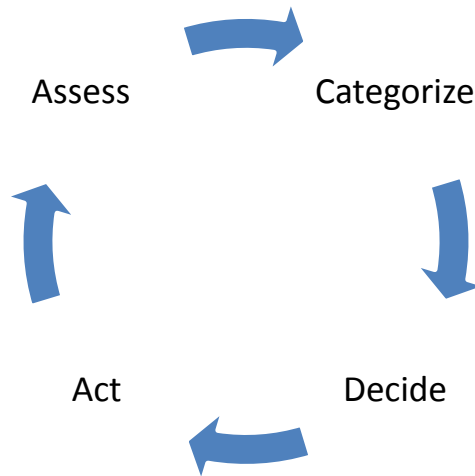


PEDIATRIC ADVANCED LIFE SUPPORT (PALS) RECERTIFICATION

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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.

	Type	Severity
Respiratory	<ul style="list-style-type: none">• Upper airway obstruction• Lower airway obstruction• Lung tissue disease• Disordered control of breathing	<ul style="list-style-type: none">• Respiratory distress• Respiratory failure
Circulatory	<ul style="list-style-type: none">• Hypovolemic Shock• Obstructive Shock• Distributive/Septic Shock• Cardiogenic Shock	<ul style="list-style-type: none">• Compensated Shock• Hypotensive Shock

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

	Type	Severity
Respiratory	<ul style="list-style-type: none"> • Upper airway obstruction • Lower airway obstruction • Lung tissue disease • Disordered control of breathing 	<ul style="list-style-type: none"> • Respiratory distress • Respiratory failure
Circulatory	<ul style="list-style-type: none"> • Hypovolemic Shock • Obstructive Shock • Distributive/Septic Shock • Cardiogenic Shock 	<ul style="list-style-type: none"> • Compensated Shock • Hypotensive Shock

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		
Croup	Anaphylaxis	Aspiration Foreign Body
<ul style="list-style-type: none"> • Racemic epinephrine • Corticosteroids 	<ul style="list-style-type: none"> • IM epinephrine • Albuterol • Antihistamines • Corticosteroids 	<ul style="list-style-type: none"> • Allow position of comfort • Specialty consultation

Lower Airway Obstruction Specific Management for Selected Conditions	
Bronchiolitis	Asthma
<ul style="list-style-type: none"> • Nasal suctioning • Bronchodilator trial 	<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • Albuterol • Antibiotics as needed 	<ul style="list-style-type: none"> • Consider noninvasive or invasive ventilator support with PEEP • Consider vasoactive support • Consider diuretic

Disordered Control of Breathing Specific Management for Selected Conditions		
Increased ICP	Poisoning / Overdose	Neuromuscular Disease
<ul style="list-style-type: none"> • Avoid hypoxemia • Avoid hypercarbia • Avoid hyperthermia 	<ul style="list-style-type: none"> • Antidote (if available) • Contact Poison Control 	<ul style="list-style-type: none"> • Consider noninvasive or invasive ventilator support

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	
Nonhemorrhagic	Hemorrhagic
<ul style="list-style-type: none"> • 20 mL/kg NS/LR bolus, repeat as needed • Consider colloid after 3rd NS/RL bolus 	<ul style="list-style-type: none"> • Control external bleeding • 20 mL/kg NS/RL bolus repeat 2 or 3x as needed • Transfuse PRBC's as indicated

Distributive Shock Specific Management for Selected Conditions		
Septic	Anaphylactic	Neurogenic
Management Algorithm <ul style="list-style-type: none"> • Septic Shock 	<ul style="list-style-type: none"> • IM epinephrine • Antihistamines • Corticosteroids • Epinephrine infusion • Albuterol 	<ul style="list-style-type: none"> • 20 mL/kg NS/LR bolus, repeat PRN • Vasopressor

Cardiogenic Shock Specific Management for Selected Conditions	
Brady / Tachyarrhythmia	CHD, Myocarditis, Cardiomyopathy, Poisoning
Management Algorithms: <ul style="list-style-type: none"> • Bradycardia • Tachycardia with poor perfusion 	<ul style="list-style-type: none"> • 5-10 mL/kg NS/RL bolus, repeat PRN • Vasoactive infusion • Consider expert consultation

Obstructive Shock Specific Management for Selected Conditions			
Ductal-Dependent	Tension Pneumothorax	Cardiac Tamponade	Pulmonary Embolism
<ul style="list-style-type: none"> • Prostaglandin • Expert Consultation 	<ul style="list-style-type: none"> • Needle decompression • Tube thoracostomy 	<ul style="list-style-type: none"> • Peri-cardiocentesis • 20 mL/kg NS/RL bolus 	<ul style="list-style-type: none"> • 20 mL/kg NS/RL bolus, repeat PRN • Consider thrombolytics, anticoagulants • Expert consultation

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

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**

Age	Breaths / Minute
Infant (<1 year)	30 - 60
Toddler (1 – 3 years)	24 - 40
Preschooler (4 – 5 years)	22 - 34
School Age (6 – 12 years)	18 - 30
Adolescent (13 – 18 years)	12 - 18

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

- **Normal Heart Rates**

Age	Awake	Sleeping
Newborn – 3 years	85 - 205	80 - 160
3 months – 2 years	100 - 190	75 - 160
2 years – 10 years	60 - 140	60 - 90
> 10 years	60 - 100	50 - 90

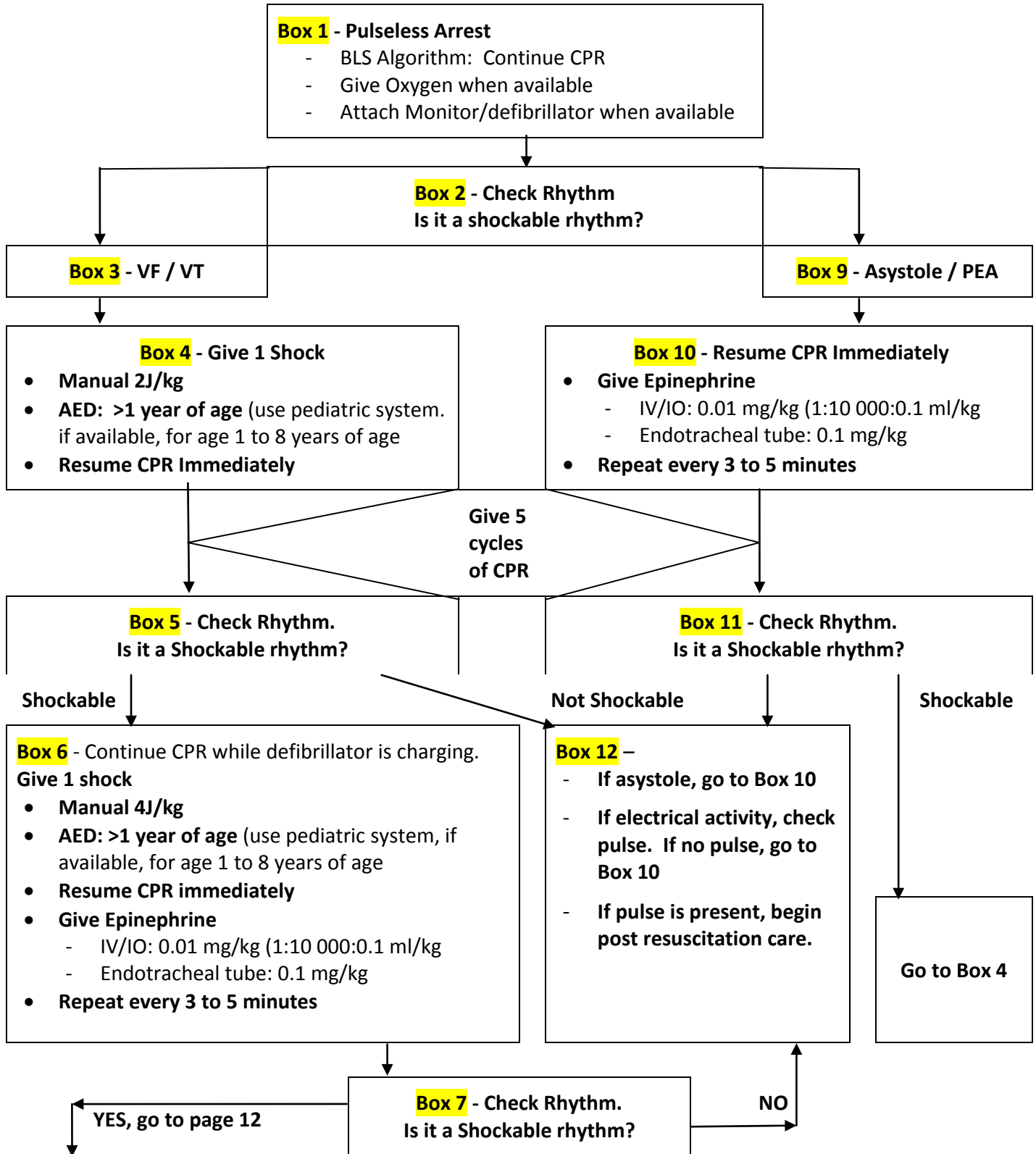
* **Heart rate should be appropriate for the child’s age, activity level and clinical condition. Heart rates vary in a sleeping or athletic child. “red Flag.”**

- **Minimum Systolic Blood Pressure Accepted (5th percentile)**

Age	Systolic Blood Pressure (mm HG)
Infant (<1 year)	30 - 60
Toddler (1 – 3 years)	24 - 40
Preschooler (4 – 5 years)	22 - 34
School Age (6 – 12 years)	18 - 30
Adolescent (13 – 18 years)	12 - 18

VIII. Algorithms for Pediatrics

• Pulseless Arrest



↓ 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

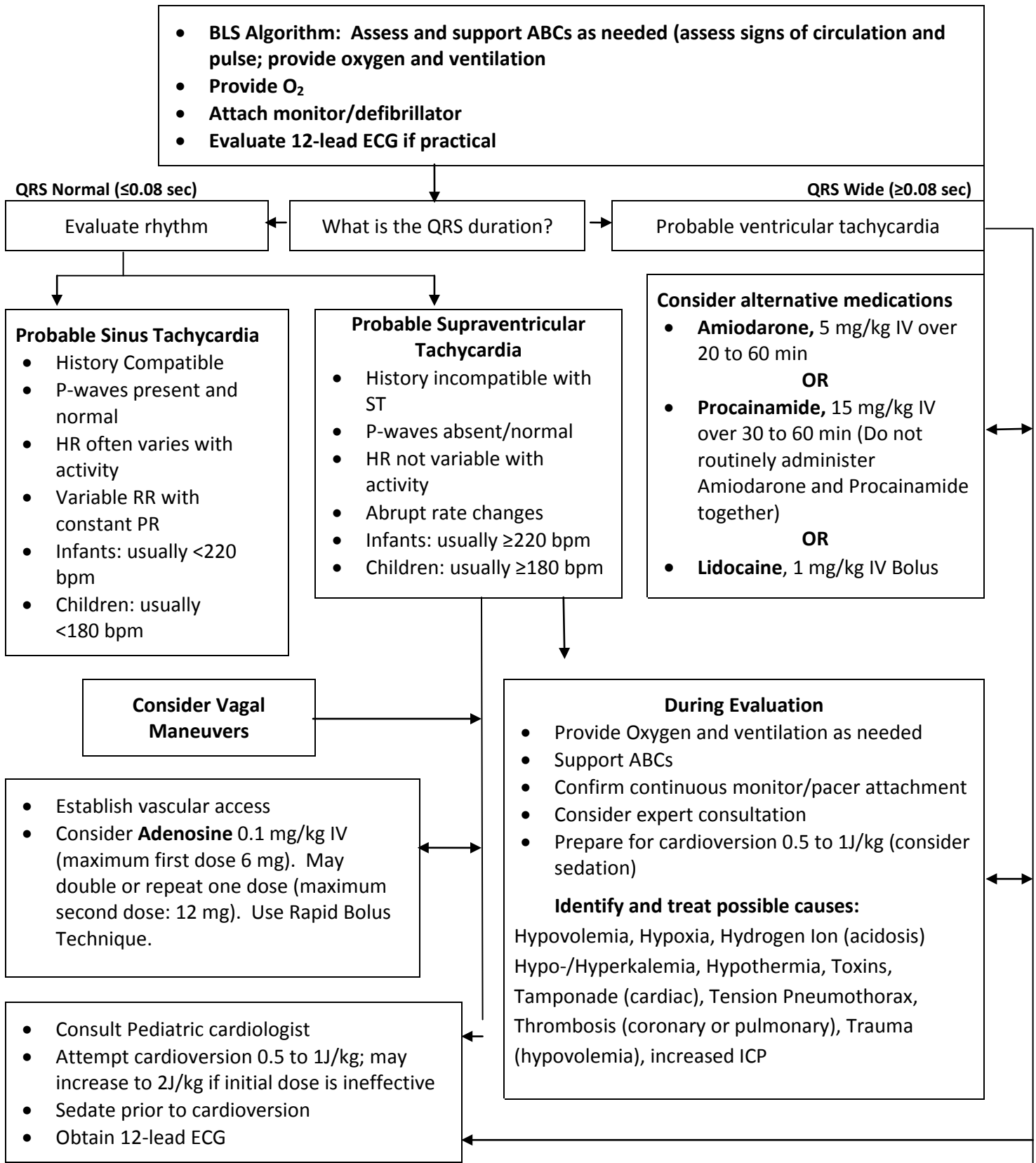
After 5 cycles of CPR, go to Box 5

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)

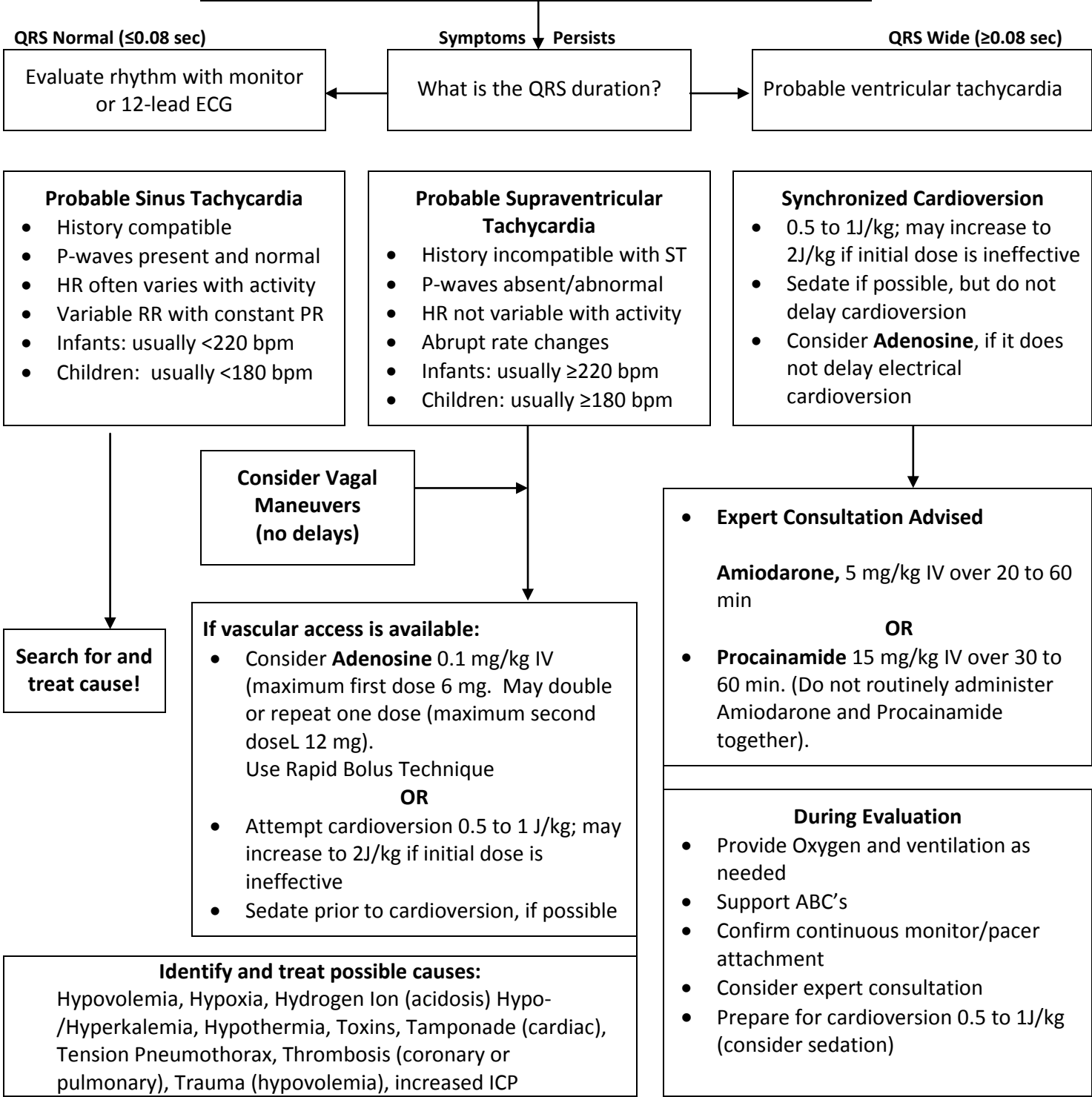
• **Tachycardia with Adequate Perfusion**



• **Tachycardia with Pulses and Poor Perfusion**

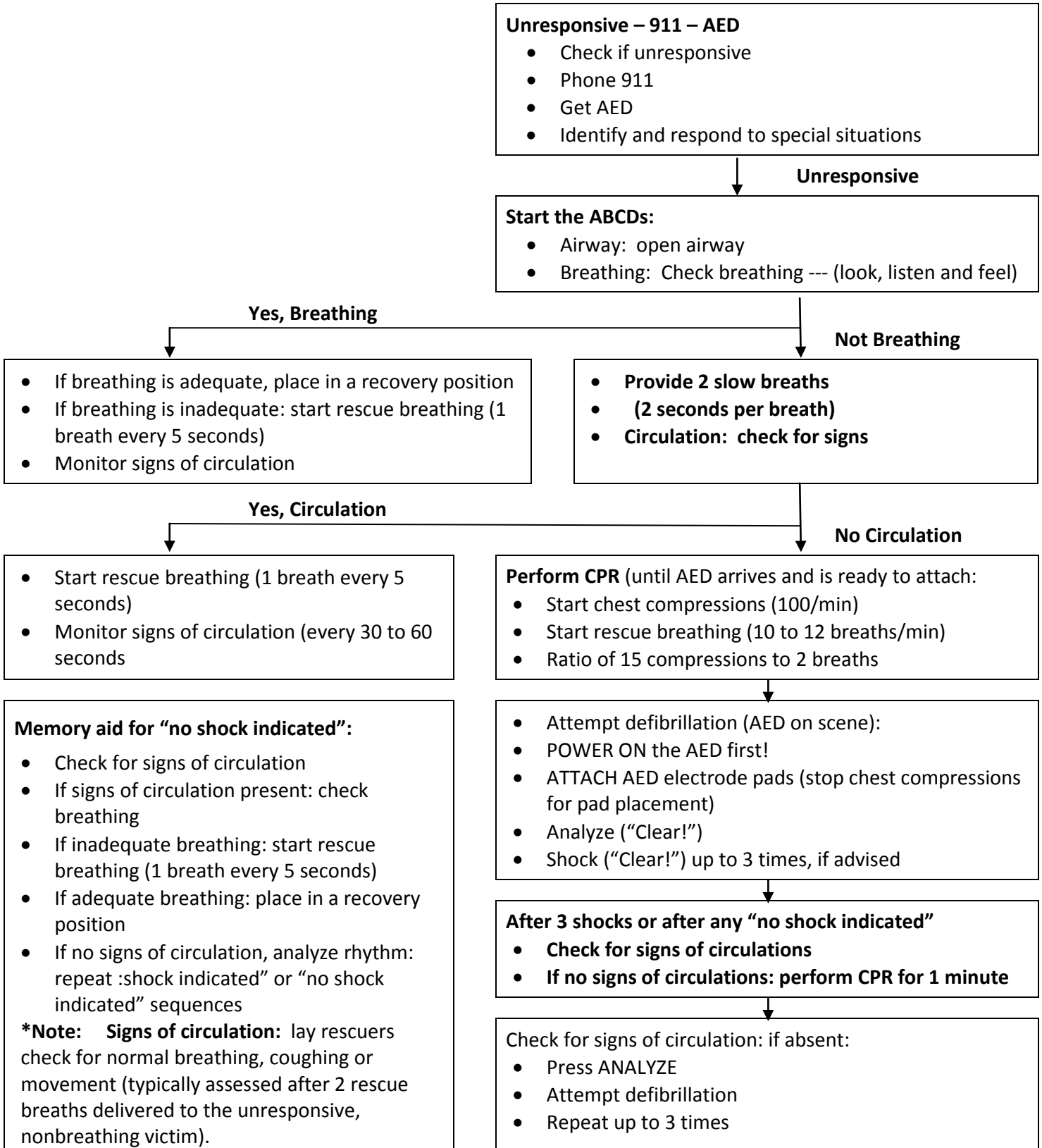
Tachycardia with Pulses and Poor Perfusion

- Assess and support ABCs as
- Provide O₂
- Attach monitor/defibrillator

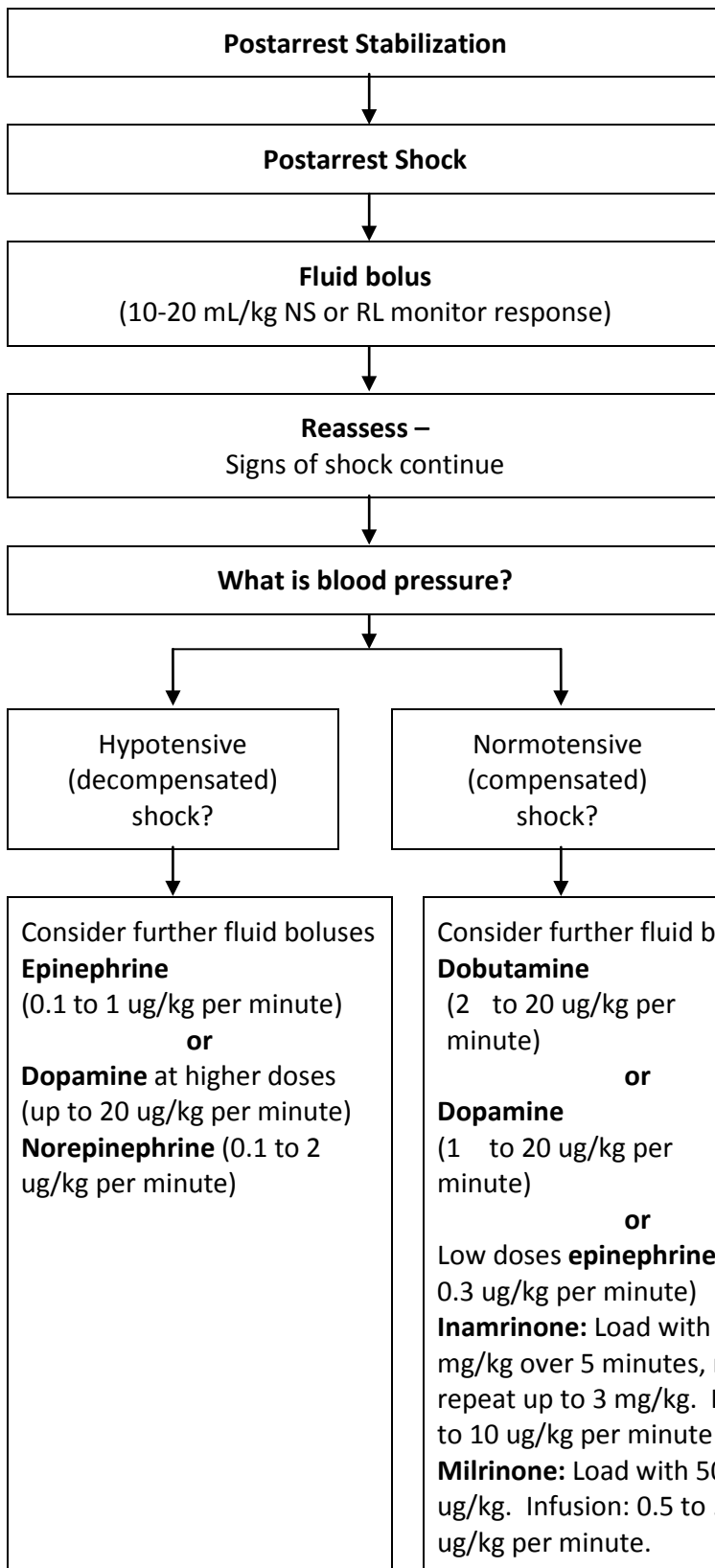


IX. AED Treatment Algorithm for Pre-Hospital Care of Children >8

For Emergency Cardiovascular Care Pending Arrival of Emergency Medical Personnel



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:

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

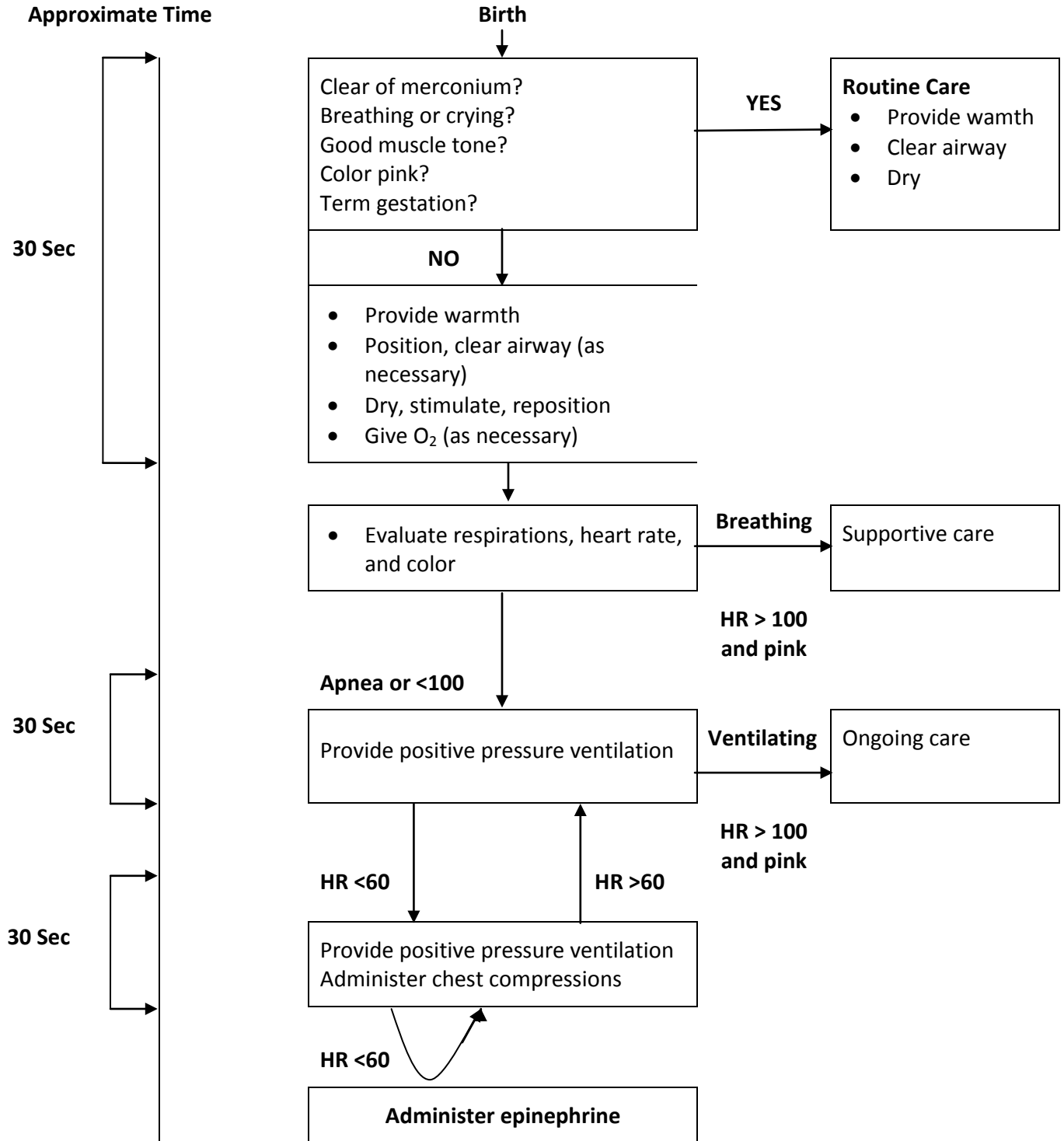
Children 10 to 20 kg: Infusion of d5/0.2% NaCl at a rate of 40 mL/h plus 2mL/kg per hour for each kilogram between 10 and 20 kg. For example, the maintenance rate for a 15-kg child is as follows:

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

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:

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

X. Overview of Resuscitation in the Delivery Room



XI. Drugs Used in Pediatric Advanced Life Support

Drugs	Dosage (Pediatric)	Remarks
Adenosine	0.1 mg/kg (up to 6 mg) 0.2 0.2 mg/kg for second dose	Rapid IV push Max single dose: 12 mg
Amiodarone: For refractory pulseless <u>VT / VF</u> for perfusing tachycardias	5 mg/kg Bolus IV/IO Loading: 5 mg/kg IV/VO over 20-60 min	Max 15 mg/kg/day Repeat to max 15 mg/kg/day IV
Atropine sulfate	0.02 mg/kg IV/VO/TT	Min dose: 0.1 MG Max single dose: 0.5 mg child, 1 mg adolescent May double 2 nd dose
Ca ₂ chloride 10%	20 mg/kg IV/VO	Slow IV 10 bolus
Dobutamine	2-20 ug/kg/min	Titrate to desired effect
Dopamine	2-20 ug/kg/min	a-Pressor effects at higher doses .15 ug/kg/min
Epinephrine for Bradycardia	IV/IO: 0.01 mg/kg (1:10 000, 0.1 mL/kg) TT: 0.1 mg/kg (1:1000, 0.1 mL/kg)	
Epinephrine for Asystolic or pulseless arrest	First dose: IV/IO: 0.01 mg/kg (1:10 000, 0.1 mL/kg)	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 Repeat q 3-5 min
Epinephrine Infusion	Initial at 0.1 ug/kg/min	Titrate to desired effect (0.1-1 ug/kg/min)
Glucose	0.5-1 g/kg IV/VO Max dose: 2-4 mL/kg Of 25% solution	5% = 10-20 mL/kg 10% = 5-10 mL/kg, 25% = 2-4 mL/kg (in large vein)
Lidocaine <hr/> Infusion	1 mg/kg 20-50 ug/kg/min	IV/IO/TT
Magnesium Sulfate	25-50 mg/kg/min over 10-20 min	Max dose: 2 g

Drugs	Dosage (Pediatric)	Remarks
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.