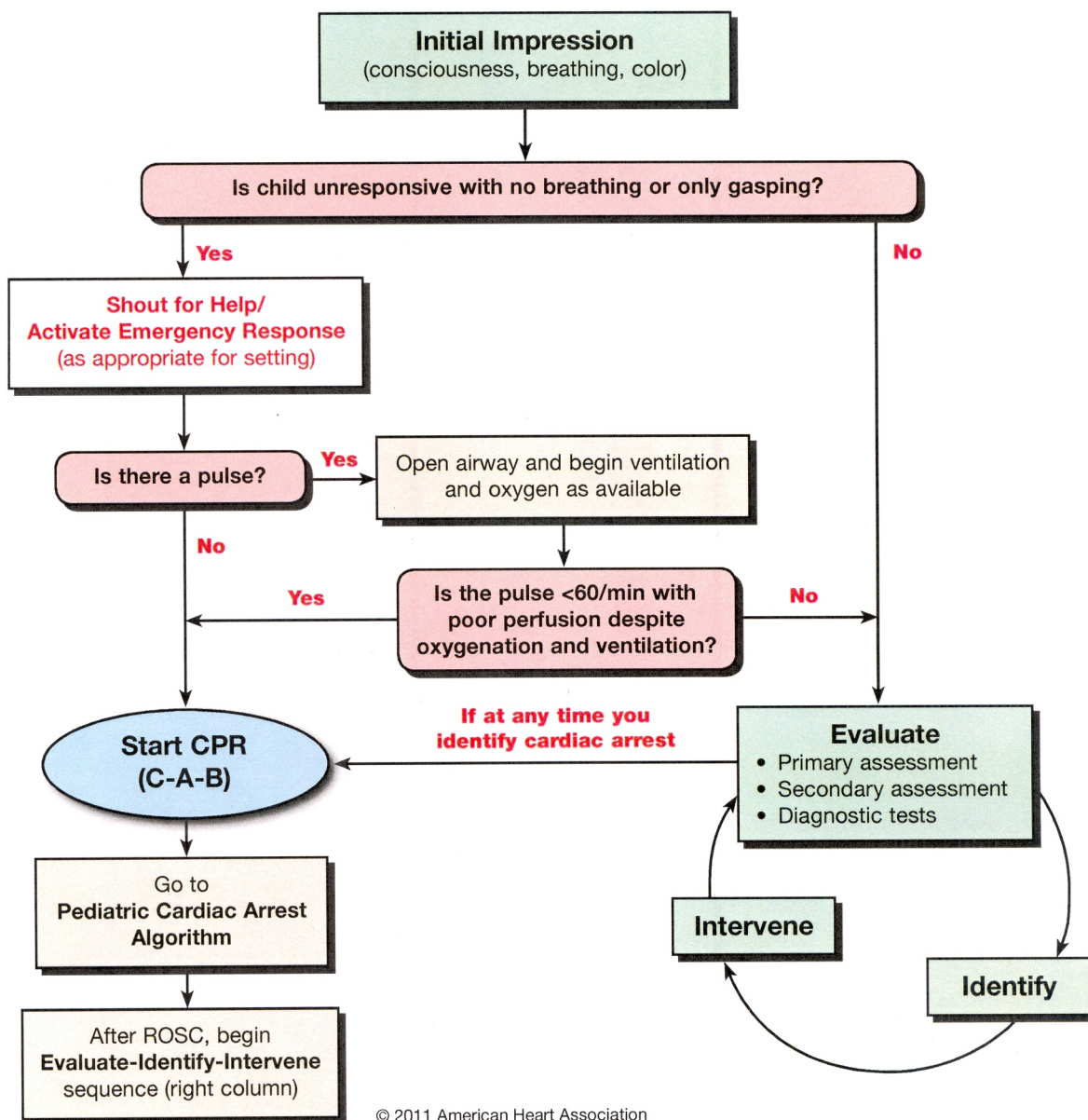


## PALS Systematic Approach Algorithm

The PALS Systematic Approach Algorithm outlines the approach to caring for a critically ill or injured child.



# Management of Shock Flowchart



Management of Shock Flowchart			
<ul style="list-style-type: none"><li>• Oxygen</li><li>• Pulse oximetry</li><li>• ECG monitor</li></ul>		<ul style="list-style-type: none"><li>• IV/IO access</li><li>• BLS as indicated</li><li>• Point-of-care glucose testing</li></ul>	
Hypovolemic Shock			
Specific Management for Selected Conditions			
Nonhemorrhagic		Hemorrhagic	
<ul style="list-style-type: none"><li>• 20 mL/kg NS/LR bolus, repeat as needed</li><li>• Consider colloid</li></ul>		<ul style="list-style-type: none"><li>• Control external bleeding</li><li>• 20 mL/kg NS/LR bolus, repeat 2 or 3× as needed</li><li>• Transfuse PRBCs as indicated</li></ul>	
Distributive Shock			
Specific Management for Selected Conditions			
Septic	Anaphylactic	Neurogenic	
Management Algorithm: <ul style="list-style-type: none"><li>• Septic Shock</li></ul>	<ul style="list-style-type: none"><li>• IM epinephrine (or autoinjector)</li><li>• Fluid boluses (20 mL/kg NS/LR)</li><li>• Albuterol</li><li>• Antihistamines, corticosteroids</li><li>• Epinephrine infusion</li></ul>	<ul style="list-style-type: none"><li>• 20 mL/kg NS/LR bolus, repeat PRN</li><li>• Vasopressor</li></ul>	
Cardiogenic Shock			
Specific Management for Selected Conditions			
Bradyarrhythmia/Tachyarrhythmia		Other (eg, CHD, Myocarditis, Cardiomyopathy, Poisoning)	
Management Algorithms: <ul style="list-style-type: none"><li>• Bradycardia</li><li>• Tachycardia With Poor Perfusion</li></ul>		<ul style="list-style-type: none"><li>• 5 to 10 mL/kg NS/LR bolus, repeat PRN</li><li>• Vasoactive infusion</li><li>• Consider expert consultation</li></ul>	
Obstructive Shock			
Specific Management for Selected Conditions			
Ductal-Dependent (LV Outflow Obstruction)	Tension Pneumothorax	Cardiac Tamponade	Pulmonary Embolism
<ul style="list-style-type: none"><li>• Prostaglandin E<sub>1</sub></li><li>• Expert consultation</li></ul>	<ul style="list-style-type: none"><li>• Needle decompression</li><li>• Tube thoracostomy</li></ul>	<ul style="list-style-type: none"><li>• Pericardiocentesis</li><li>• 20 mL/kg NS/LR bolus</li></ul>	<ul style="list-style-type: none"><li>• 20 mL/kg NS/LR bolus, repeat PRN</li><li>• Consider thrombolytics, anticoagulants</li><li>• Expert consultation</li></ul>



## Recognition of Shock Flowchart



Clinical Signs		Hypovolemic Shock	Distributive Shock	Cardiogenic Shock	Obstructive Shock
A	Patency	Airway open and maintainable/not maintainable			
B	Respiratory rate	Increased			
	Respiratory effort	Normal to increased		Labored	
	Breath sounds	Normal	Normal (± crackles)	Crackles, grunting	
C	Systolic blood pressure	Compensated Shock → Hypotensive Shock			
	Pulse pressure	Narrow	Variable	Narrow	
	Heart rate	Increased			
	Peripheral pulse quality	Weak	Bounding or weak	Weak	
	Skin	Pale, cool	Warm or cool	Pale, cool	
	Capillary refill	Delayed	Variable	Delayed	
	Urine output	Decreased			
D	Level of consciousness	Irritable early Lethargic late			
E	Temperature	Variable			

# Management of Respiratory Emergencies Flowchart



## Management of Respiratory Emergencies Flowchart

- Airway positioning
- Suction as needed
- Oxygen
- Pulse oximetry
- ECG monitor (as indicated)
- BLS as indicated

### Upper Airway Obstruction Specific Management for Selected Conditions

Croup	Anaphylaxis	Aspiration Foreign Body
<ul style="list-style-type: none"> <li>• Nebulized epinephrine</li> <li>• Corticosteroids</li> </ul>	<ul style="list-style-type: none"> <li>• IM epinephrine (or autoinjector)</li> <li>• Albuterol</li> <li>• Antihistamines</li> <li>• Corticosteroids</li> </ul>	<ul style="list-style-type: none"> <li>• Allow position of comfort</li> <li>• Specialty consultation</li> </ul>

### Lower Airway Obstruction Specific Management for Selected Conditions

Bronchiolitis	Asthma
<ul style="list-style-type: none"> <li>• Nasal suctioning</li> <li>• Bronchodilator trial</li> </ul>	<ul style="list-style-type: none"> <li>• Albuterol ± ipratropium</li> <li>• Corticosteroids</li> <li>• Subcutaneous epinephrine</li> <li>• Magnesium sulfate</li> <li>• Terbutaline</li> </ul>

### Lung Tissue Disease Specific Management for Selected Conditions

Pneumonia/Pneumonitis Infectious    Chemical    Aspiration	Pulmonary Edema Cardiogenic or Noncardiogenic (ARDS)
<ul style="list-style-type: none"> <li>• Albuterol</li> <li>• Antibiotics (as indicated)</li> </ul>	<ul style="list-style-type: none"> <li>• Consider noninvasive or invasive ventilatory support with PEEP</li> <li>• Consider vasoactive support</li> <li>• Consider diuretic</li> </ul>










### Disordered Control of Breathing Specific Management for Selected Conditions

Increased ICP	Poisoning/Overdose	Neuromuscular Disease
<ul style="list-style-type: none"> <li>• Avoid hypoxemia</li> <li>• Avoid hypercarbia</li> <li>• Avoid hyperthermia</li> </ul>	<ul style="list-style-type: none"> <li>• Antidote (if available)</li> <li>• Contact poison control</li> </ul>	<ul style="list-style-type: none"> <li>• Consider noninvasive or invasive ventilatory support</li> </ul>



# Recognition of Respiratory Problems Flowchart



Pediatric Advanced Life Support					
Signs of Respiratory Problems					
Clinical Signs		Upper Airway Obstruction	Lower Airway Obstruction	Lung Tissue Disease	Disordered Control of Breathing
A	Patency	Airway open and maintainable/not maintainable			
B	Respiratory Rate/Effort	Increased			Variable
	Breath Sounds	Stridor (typically inspiratory) Barking cough Hoarseness	Wheezing (typically expiratory) Prolonged expiratory phase	Grunting Crackles Decreased breath sounds	Normal
	Air Movement	Decreased			Variable
C	Heart Rate	Tachycardia (early)		Bradycardia (late)	
	Skin	Pallor, cool skin (early)		Cyanosis (late)	
D	Level of Consciousness	Anxiety, agitation (early) Lethargy, unresponsiveness (late)			
E	Temperature	Variable			
Pediatric Advanced Life Support					
Identification of Respiratory Problems by Severity					
Respiratory Distress  Respiratory Failure					
A	Open and maintainable  Not maintainable				
B	Tachypnea  Bradypnea to apnea				
	Work of breathing (nasal flaring/retractions) Increased effort  Decreased effort  Apnea				
	Good air movement  Poor to absent air movement				
C	Tachycardia  Bradycardia				
	Pallor  Cyanosis				
D	Anxiety, agitation  Lethargy to unresponsiveness				
E	Variable temperature				



# Pediatric Cardiac Arrest Algorithm



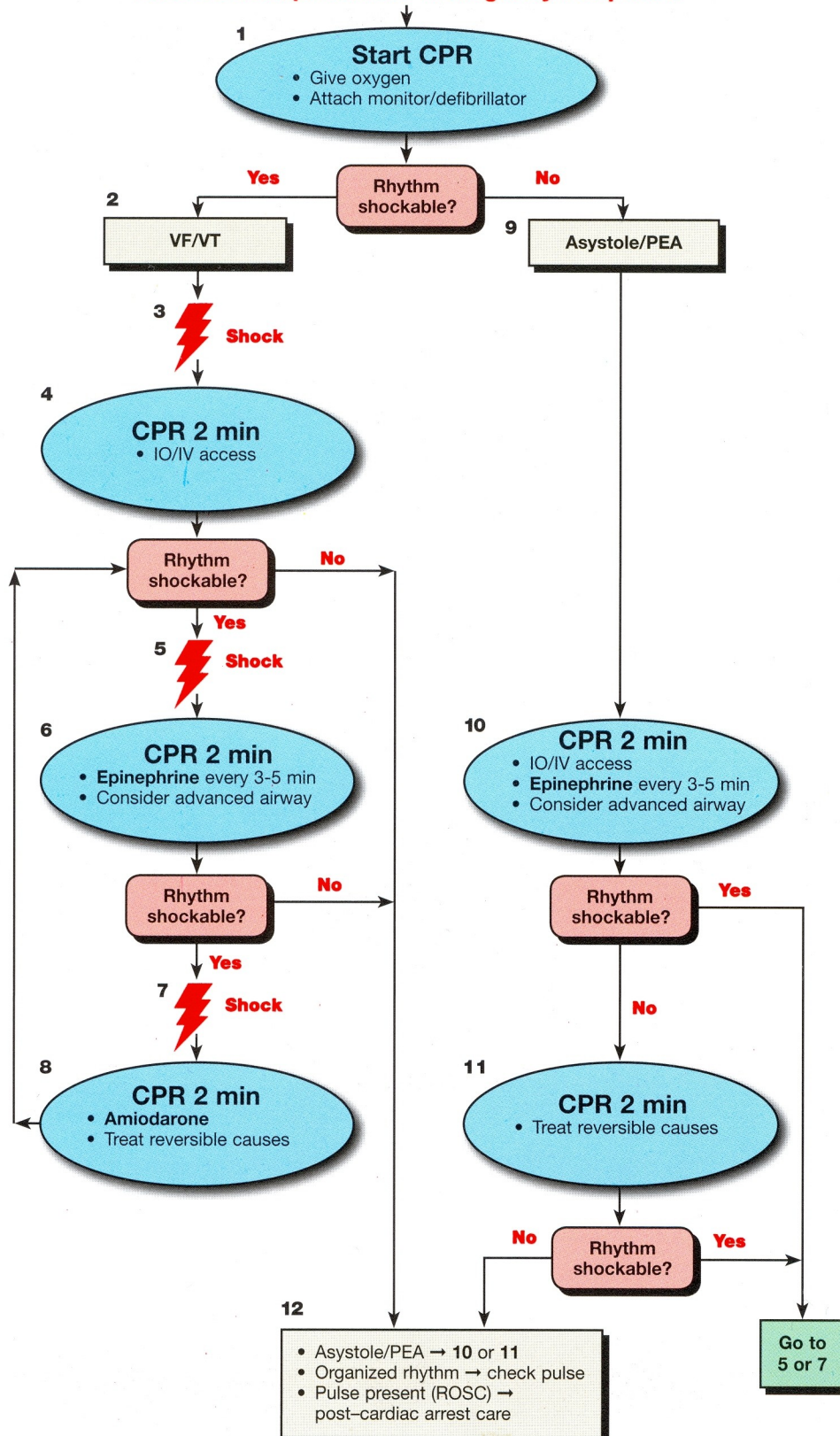
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## Pediatric Advanced Life Support

### Shout for Help/Activate Emergency Response



### Doses/Details

#### CPR Quality

- Push hard ( $\geq 1/3$  of anterior-posterior diameter of chest) and fast (at least 100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 15:2 compression-ventilation ratio. If advanced airway, 8-10 breaths per minute with continuous chest compressions

#### Shock Energy for Defibrillation

First shock 2 J/kg, second shock 4 J/kg, subsequent shocks  $\geq 4$  J/kg, maximum 10 J/kg or adult dose.

#### Drug Therapy

- **Epinephrine IO/IV Dose:** 0.01 mg/kg (0.1 mL/kg of 1:10 000 concentration). Repeat every 3-5 minutes. If no IO/IV access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of 1:1000 concentration).
- **Amiodarone IO/IV Dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 2 times for refractory VF/pulseless VT.

#### 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 6-8 seconds (8-10 breaths per minute)

#### 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





# Pediatric Bradycardia With a Pulse and Poor Perfusion Algorithm

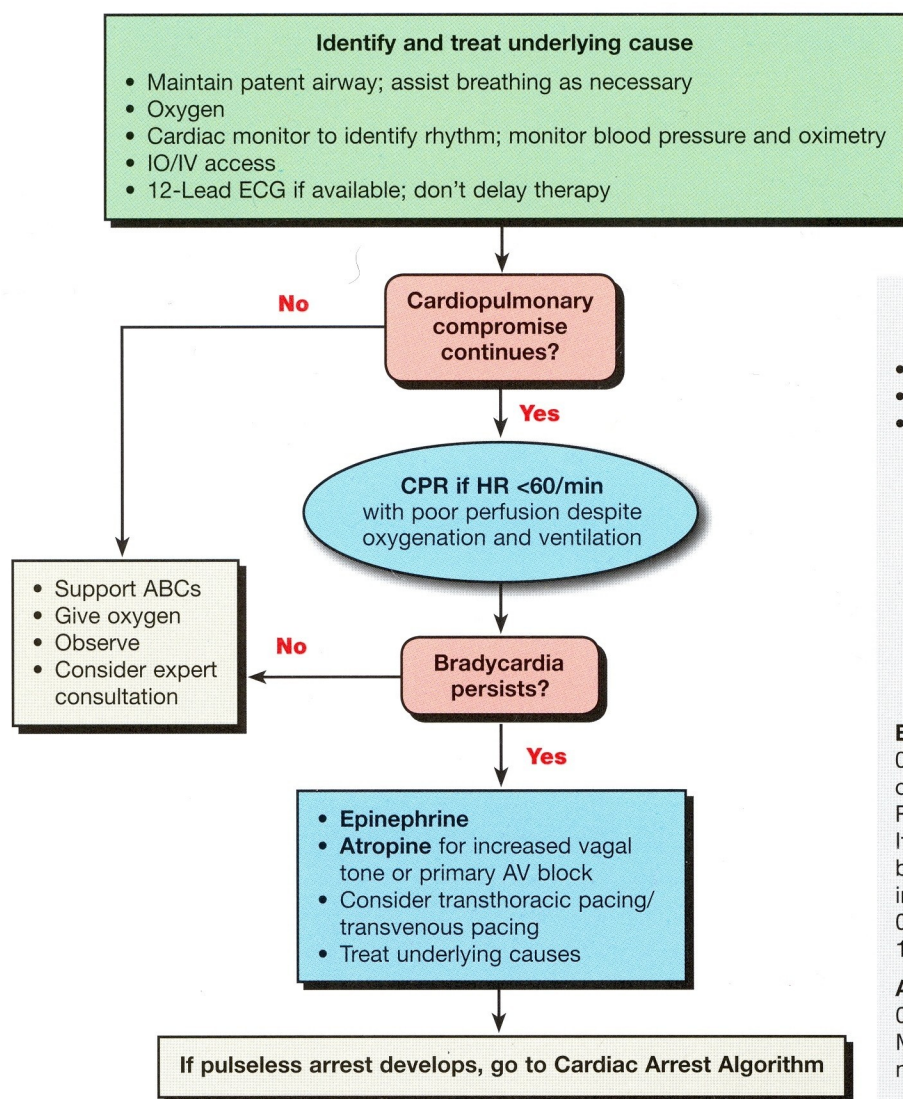


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## Pediatric Advanced Life Support



### Cardiopulmonary Compromise

- Hypotension
- Acutely altered mental status
- Signs of shock

### 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.



# Pediatric Tachycardia With a Pulse and Adequate Perfusion Algorithm

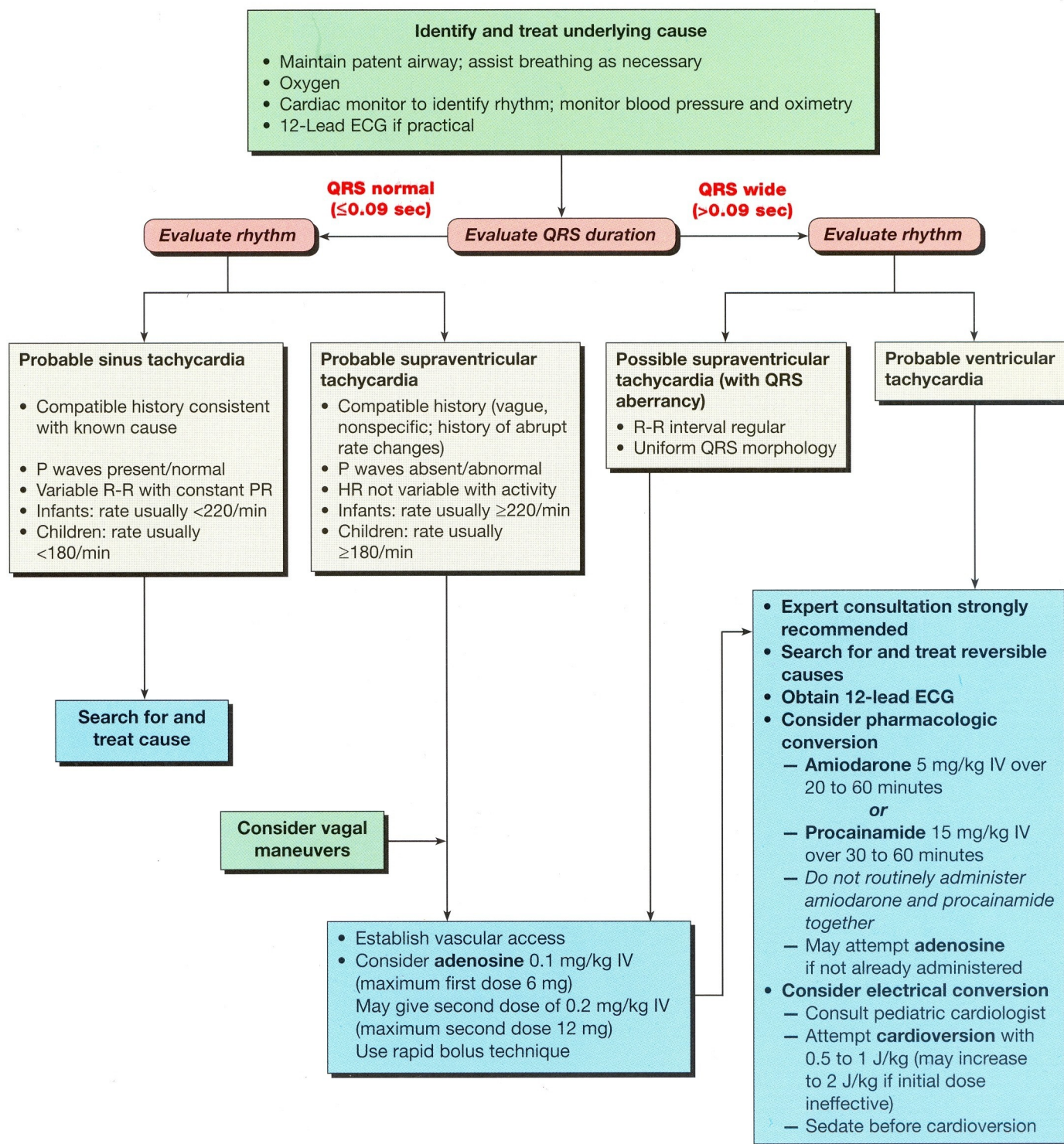


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## Pediatric Advanced Life Support





# Pediatric Tachycardia With a Pulse and Poor Perfusion Algorithm



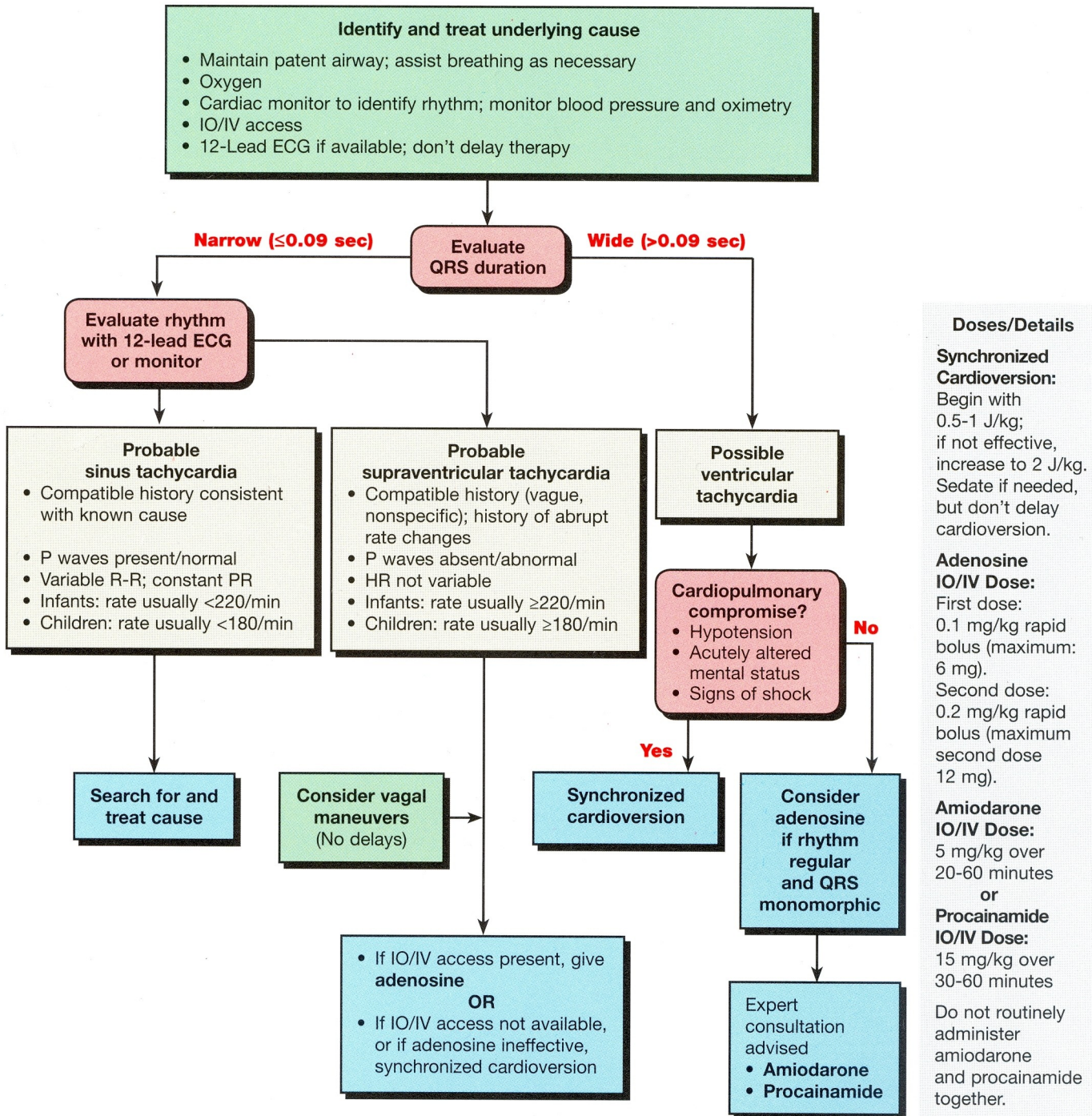
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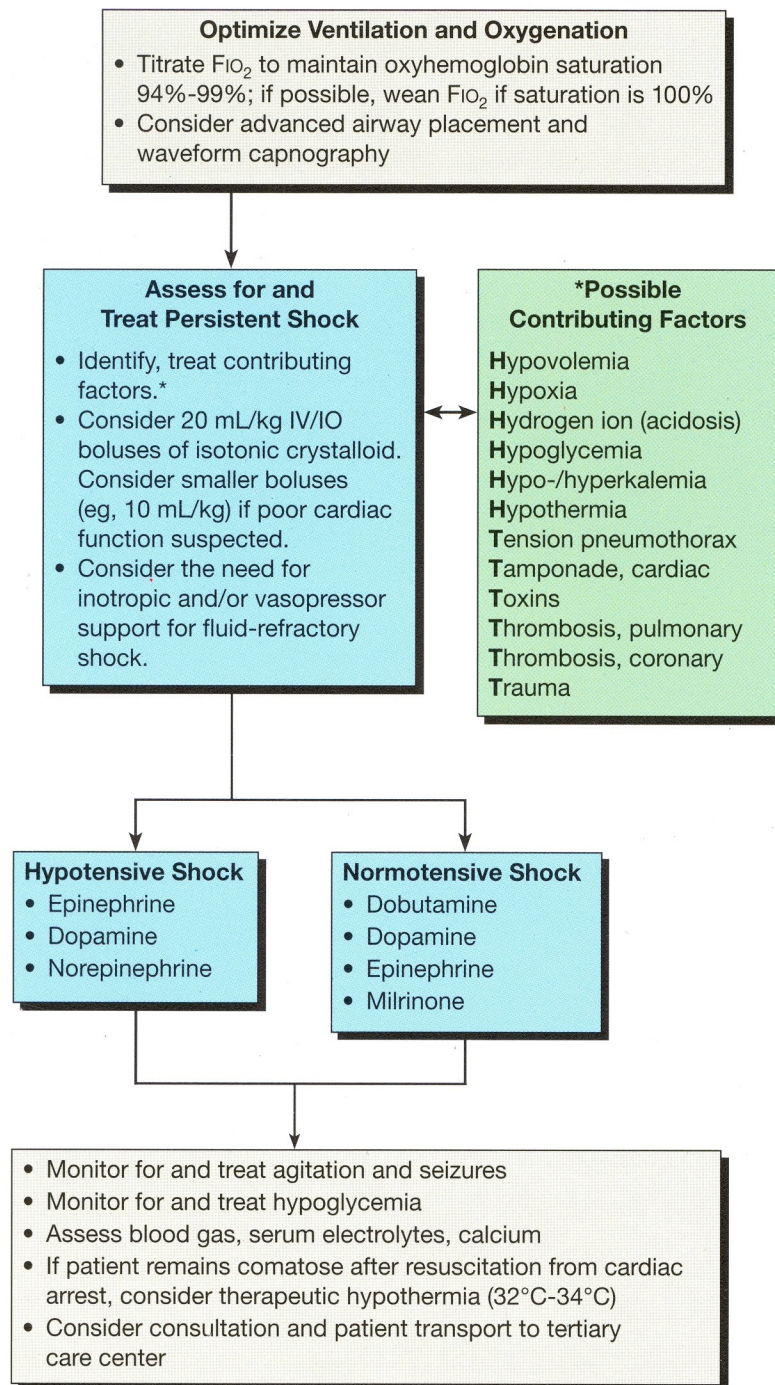
## Pediatric Advanced Life Support





## Pediatric Advanced Life Support

### Management of Shock After ROSC



### 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  $\times$  8 kg  
= 32 mL per hour
- **Children 10-20 kg:** 4 mL/kg per hour for the first 10 kg + 2 mL/kg per hour for each kg above 10 kg  
*Example:* For a 15-kg child, estimated maintenance fluid rate  
= (4 mL/kg per hour  $\times$  10 kg)  
+ (2 mL/kg per hour  $\times$  5 kg)  
= 40 mL/hour + 10 mL/hour  
= 50 mL/hour
- **Children >20 kg:** 4 mL/kg per hour for the first 10 kg + 2 mL/kg per hour for kg 11-20 + 1 mL/kg per hour for each kg above 20 kg.  
*Example:* For a 28-kg child, estimated maintenance fluid rate  
= (4 mL/kg per hour  $\times$  10 kg)  
+ (2 mL/kg per hour  $\times$  10 kg)  
+ (1 mL/kg per hour  $\times$  8 kg)  
= 40 mL per hour + 20 mL per hour  
+ 8 mL per hour  
= 68 mL per hour

Following 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.



# Pediatric Septic Shock Algorithm

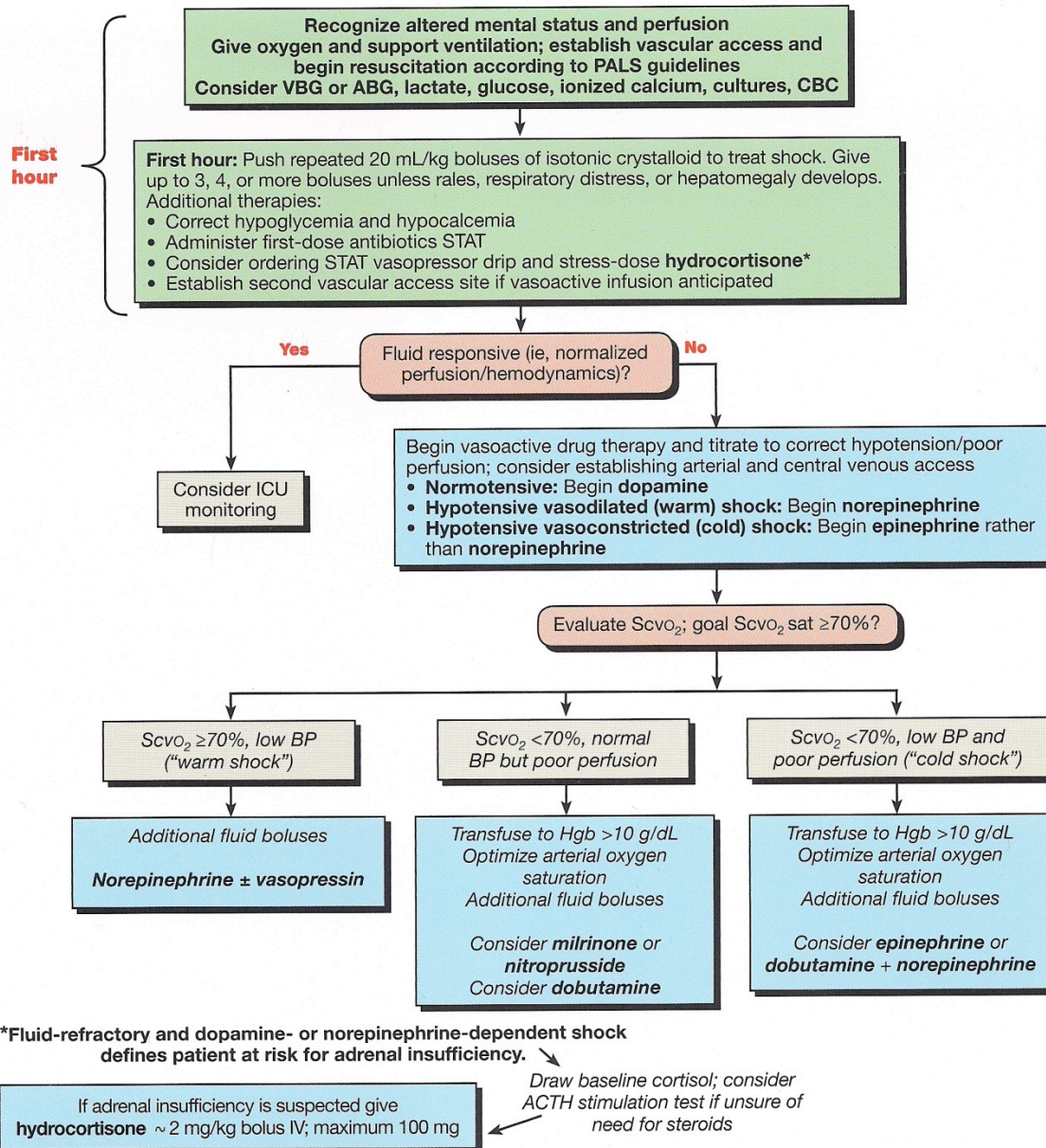


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## Pediatric Advanced Life Support



Modified from Brierley J, Carcillo JA, Choong K, Cornell T, Decaen A, Deymann A, Doctor A, Davis A, Duff J, Dugas MA, Duncan A, Evans B, Feldman J, Felmet K, Fisher G, Frankel L, Jeffries H, Greenwald B, Gutierrez J, Hall M, Han YY, Hanson J, Hazelzet J, Hernan L, Kiff J, Kissoon N, Kon A, Irazusta J, Lin J, Lorts A, Mariscalco M, Mehta S, Nadel S, Nguyen T, Nicholson C, Peters M, Okhuysen-Cawley R, Poulton T, Relves M, Rodriguez A, Rozenfeld R, Schnitzler E, Shanley T, Kache S, Skippen P, Torres A, von Dessauer B, Weingarten J, Yeh T, Zaritsky A, Stojadinovic B, Zimmerman J, Zuckerberg A. Clinical practice parameters for hemodynamic support of pediatric and neonatal septic shock: 2007 update from the American College of Critical Care Medicine. *Crit Care Med*. 2009;37(2):666-688.





# Pediatric Color-Coded Length-Based Resuscitation Tape

## Pediatric Advanced Life Support

Equipment	GRAY* 3-5 kg	PINK Small Infant 6-7 kg	RED Infant 8-9 kg	PURPLE Toddler 10-11 kg	YELLOW Small Child 12-14 kg	WHITE Child 15-18 kg	BLUE Child 19-23 kg	ORANGE Large Child 24-29 kg	GREEN Adult 30-36 kg
Resuscitation bag		Infant/child	Infant/child	Child	Child	Child	Child	Child	Adult
Oxygen mask (NRB)		Pediatric	Pediatric	Pediatric	Pediatric	Pediatric	Pediatric	Pediatric	Pediatric/adult
Oral airway (mm)		50	50	60	60	60	70	80	80
Laryngoscope blade (size)		1 Straight	1 Straight	1 Straight	2 Straight	2 Straight	2 Straight or curved	2 Straight or curved	3 Straight or curved
ET tube (mm) <sup>†</sup>		3.5 Uncuffed 3.0 Cuffed	3.5 Uncuffed 3.0 Cuffed	4.0 Uncuffed 3.5 Cuffed	4.5 Uncuffed 4.0 Cuffed	5.0 Uncuffed 4.5 Cuffed	5.5 Uncuffed 5.0 Cuffed	6.0 Cuffed	6.5 Cuffed
ET tube insertion length (cm)	3 kg 9-9.5 4 kg 9.5-10 5 kg 10-10.5	10.5-11	10.5-11	11-12	13.5	14-15	16.5	17-18	18.5-19.5
Suction catheter (F)		8	8	10	10	10	10	10	10-12
BP cuff	Neonatal #5/infant	Infant/child	Infant/child	Child	Child	Child	Child	Child	Small adult
IV catheter (ga)		22-24	22-24	20-24	18-22	18-22	18-20	18-20	16-20
IO (ga)		18/15	18/15	15	15	15	15	15	15
NG tube (F)		5-8	5-8	8-10	10	10	12-14	14-18	16-18
Urinary catheter (F)	5	8	8	8-10	10	10-12	10-12	12	12
Chest tube (F)		10-12	10-12	16-20	20-24	20-24	24-32	28-32	32-38

Abbreviations: BP, blood pressure; ET, endotracheal; F, French; IO, intraosseous; IV, intravenous; NG, nasogastric; NRB, nonrebreathing.

\*For Gray column, use Pink or Red equipment sizes if no size is listed.

<sup>†</sup>Per 2010 AHA Guidelines, in the hospital cuffed or uncuffed tubes may be used (see below for sizing of cuffed tubes).

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