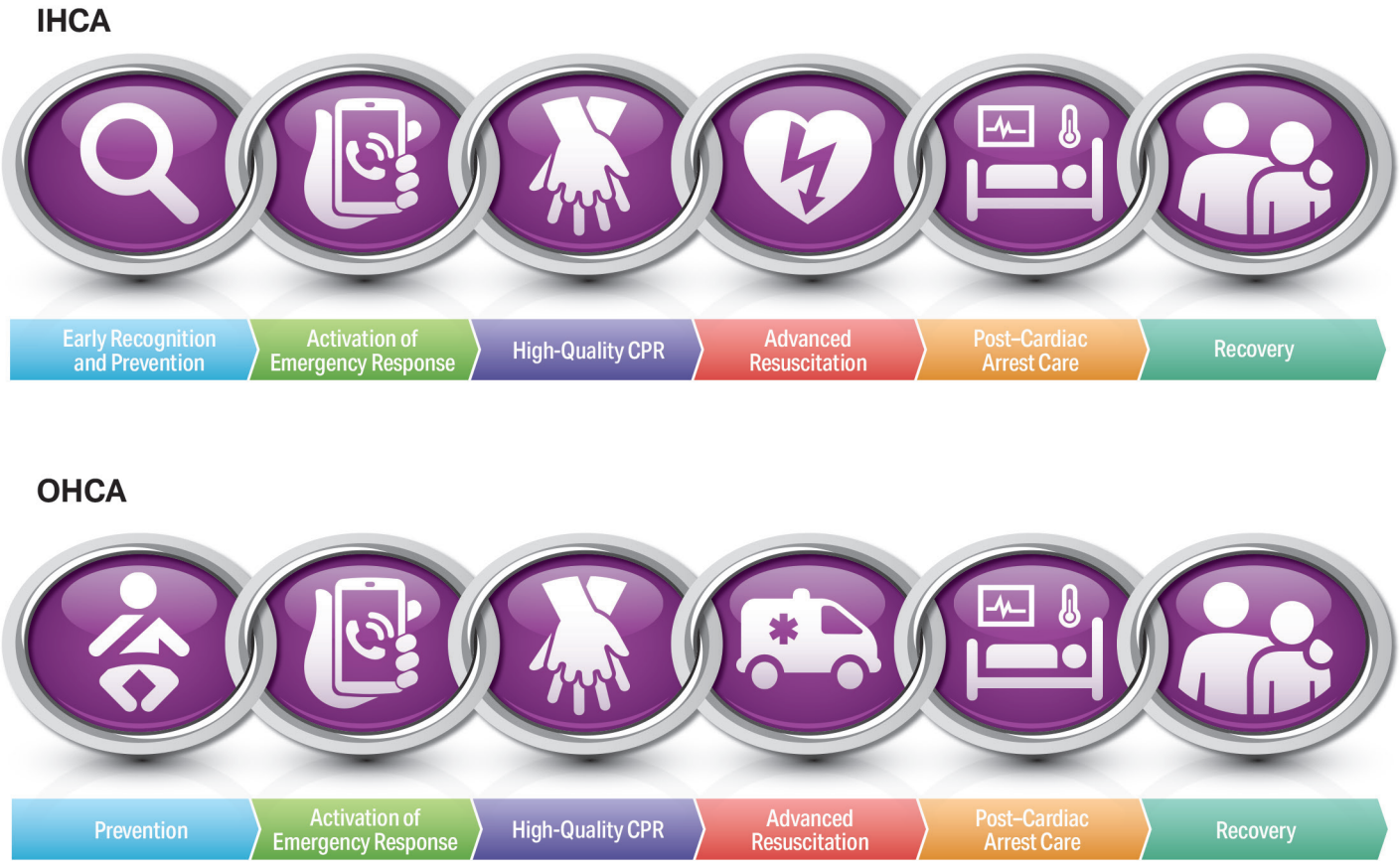
The causes of cardiac arrest in infants and children differ from cardiac arrest in adults, and a growing body of pediatric-specific evidence supports these recommendations.

Figure 10. AHA Chains of Survival for pediatric IHCA and OHCA.



PALS Systematic Approach Algorithm

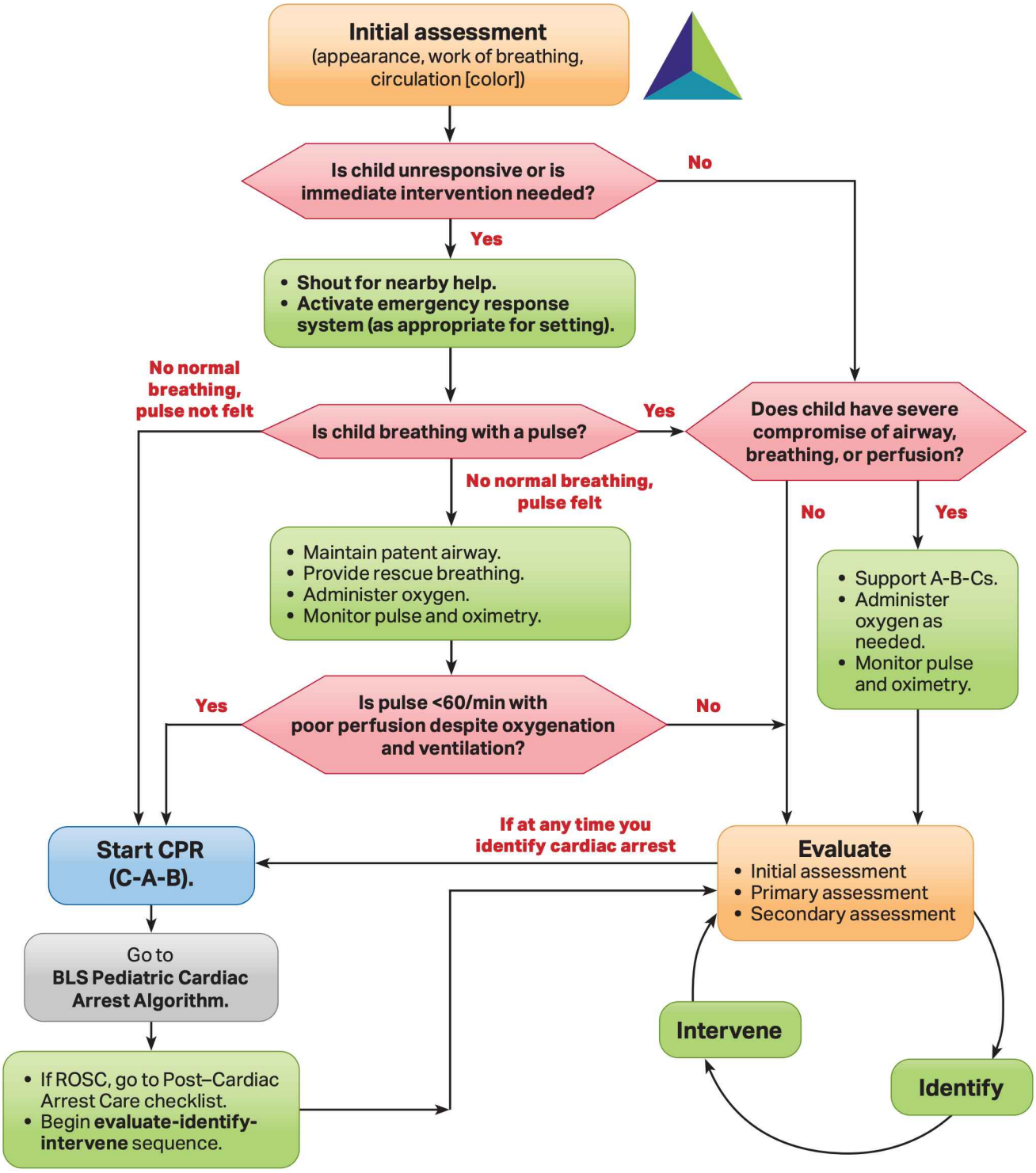
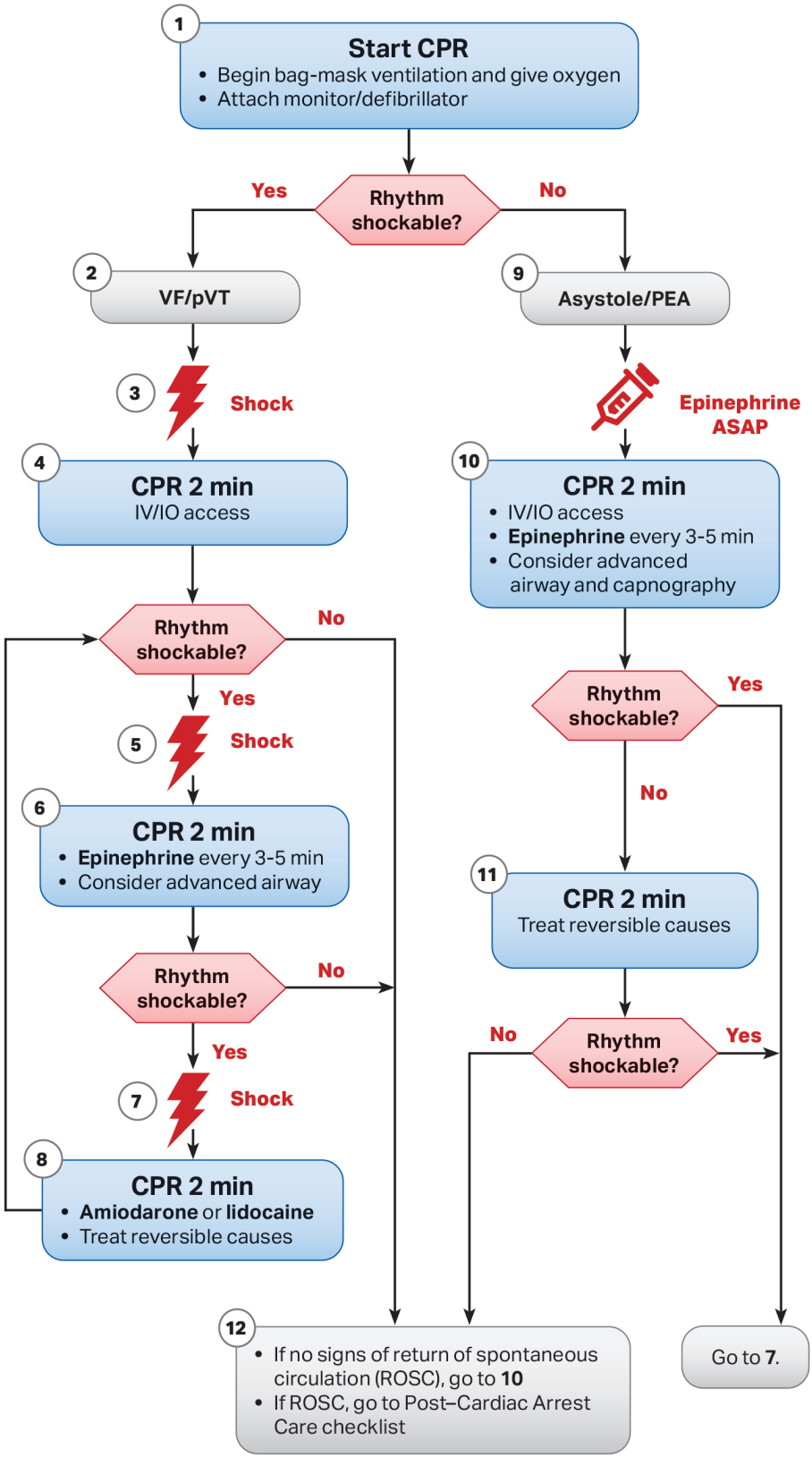


Figure 11. Pediatric Cardiac Arrest Algorithm.



CPR Quality

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Change compressor every 2 minutes, or sooner if fatigued
- If no advanced airway, 15:2 compression-ventilation ratio
- If advanced airway, provide continuous compressions and give a breath every 2-3 seconds

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 IV/IO dose:** 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration). Max dose 1 mg. Repeat every 3-5 minutes. If no IV/IO access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration).
- **Amiodarone IV/IO dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 3 total doses for refractory VF/pulseless VT
  or
  Lidocaine IV/IO dose: Initial: 1 mg/kg loading dose

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement

Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypoglycemia
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Figure 12. Pediatric Bradycardia With a Pulse Algorithm.

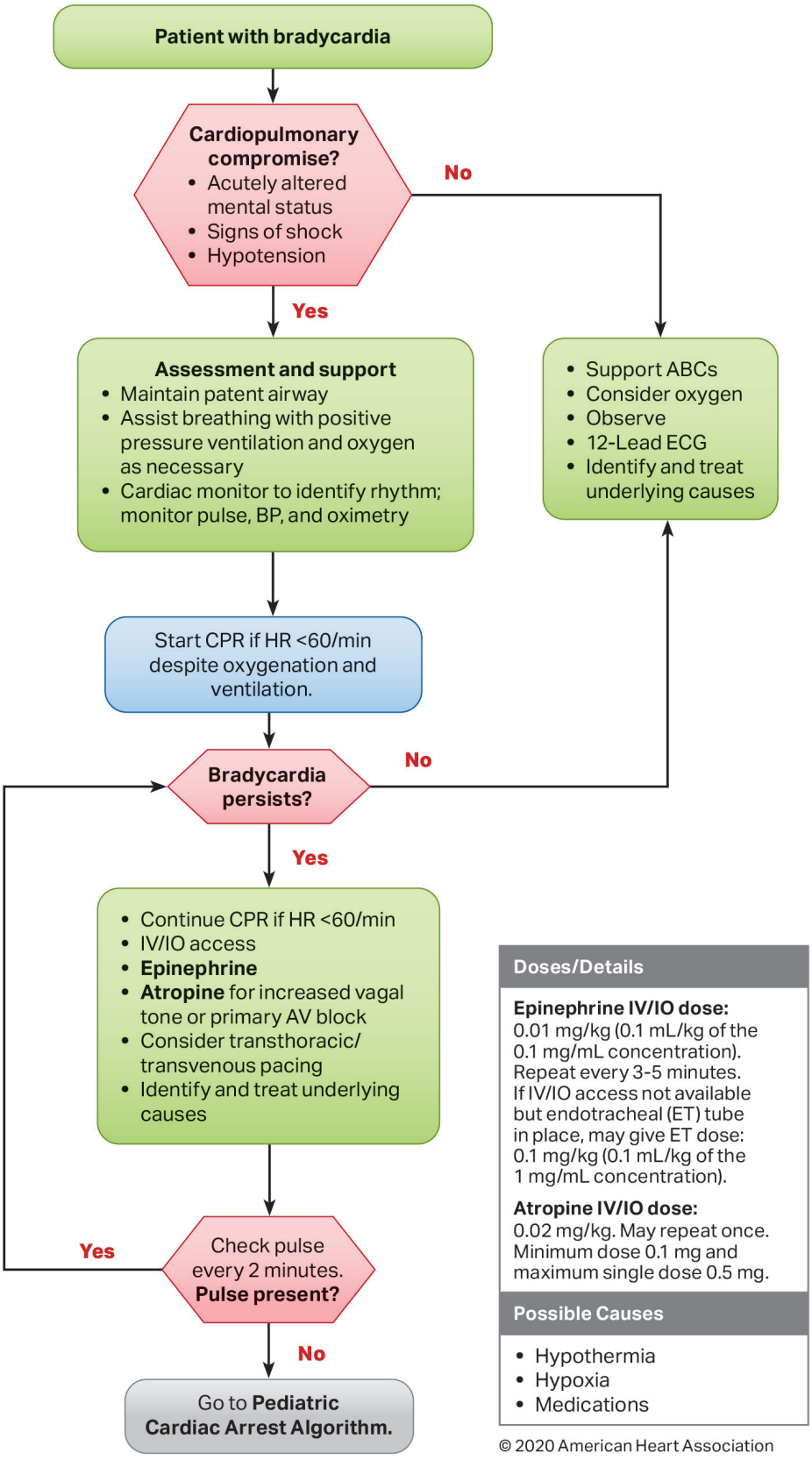


Figure 13. Pediatric Tachycardia With a Pulse Algorithm.

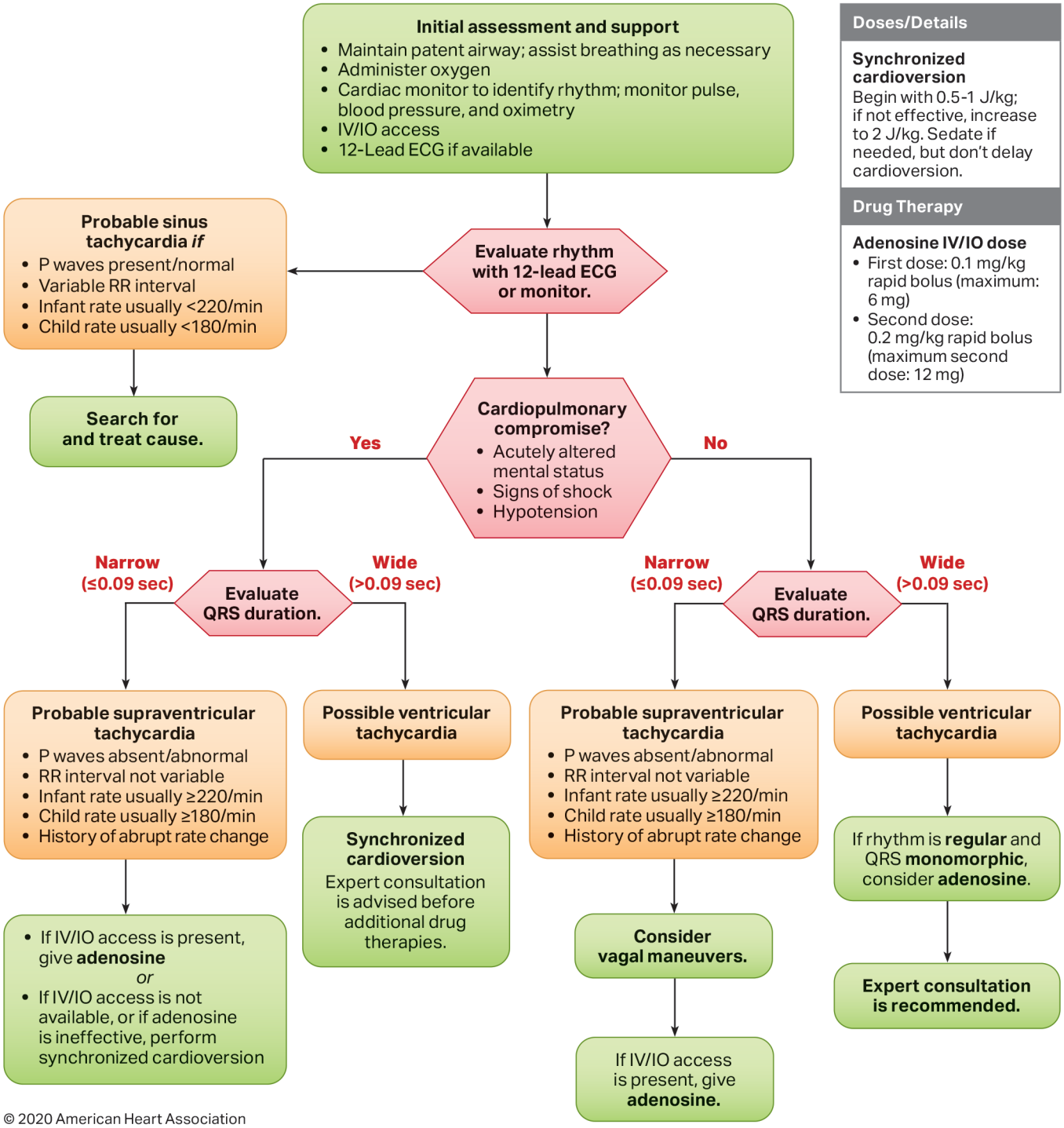


Figure 14. Pediatric Post–Cardiac Arrest Care Checklist.

Components of Post–Cardiac Arrest Care	Check
Oxygenation and ventilation	
Measure oxygenation and target normoxemia 94%-99% (or child's normal/appropriate oxygen saturation).	☐
Measure and target $Paco_2$ appropriate to the patient's underlying condition and limit exposure to severe hypercapnia or hypocapnia.	☐
Hemodynamic monitoring	
Set specific hemodynamic goals during post–cardiac arrest care and review daily.	☐
Monitor with cardiac telemetry.	☐
Monitor arterial blood pressure.	☐
Monitor serum lactate, urine output, and central venous oxygen saturation to help guide therapies.	☐
Use parenteral fluid bolus with or without inotropes or vasopressors to maintain a systolic blood pressure greater than the fifth percentile for age and sex.	☐
Targeted temperature management (TTM)	
Measure and continuously monitor core temperature.	☐
Prevent and treat fever immediately after arrest and during rewarming.	☐
If patient is comatose apply TTM (32˚C-34˚C) followed by (36˚C-37.5˚C) or only TTM (36˚C-37.5˚C).	☐
Prevent shivering.	☐
Monitor blood pressure and treat hypotension during rewarming.	☐
Neuromonitoring	
If patient has encephalopathy and resources are available, monitor with continuous electroencephalogram.	☐
Treat seizures.	☐
Consider early brain imaging to diagnose treatable causes of cardiac arrest.	☐
Electrolytes and glucose	
Measure blood glucose and avoid hypoglycemia.	☐
Maintain electrolytes within normal ranges to avoid possible life-threatening arrhythmias.	☐
Sedation	
Treat with sedatives and anxiolytics.	☐
Prognosis	
Always consider multiple modalities (clinical and other) over any single predictive factor.	☐
Remember that assessments may be modified by TTM or induced hypothermia.	☐
Consider electroencephalogram in conjunction with other factors within the first 7 days after cardiac arrest.	☐
Consider neuroimaging such as magnetic resonance imaging during the first 7 days.	☐

Recognizing Respiratory Problems Flowchart

PALS: Signs of respiratory problems					
Clinical signs		**Upper airway obstruction**	**Lower airway obstruction**	**Lung tissue disease**	**Disordered control of breathing**
Airway	Patency	Airway open and maintainable/not maintainable			
Breathing	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
Circulation	Heart rate	Tachycardia (early); bradycardia (late)			
	Skin	Pallor, cool skin (early); cyanosis (late)			
Disability	Level of consciousness	Anxiety, agitation (early); lethargy, unresponsiveness (late)			
Exposure	Temperature	Variable			

PALS: Identifying respiratory problems by severity	
Progression of respiratory distress to respiratory failure*	
Airway	Respiratory distress: open and maintainable Respiratory failure: not maintainable
Breathing	Respiratory distress: tachypnea Respiratory failure: bradypnea to apnea
	Respiratory distress: work of breathing (nasal flaring/retractions) Respiratory failure: increased effort progresses to decreased effort and then to apnea
	Respiratory distress: good air movement Respiratory failure: poor to absent air movement
Circulation	Respiratory distress: tachycardia Respiratory failure: bradycardia
	Respiratory distress: pallor Respiratory failure: cyanosis
Disability	Respiratory distress: anxiety, agitation Respiratory failure: lethargy to unresponsiveness
Exposure	Variable temperature

*Respiratory failure requires immediate intervention.

Managing Respiratory Emergencies Flowchart

Managing 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**
• Nebulized epinephrine • Corticosteroids	• IM epinephrine (or autoinjector) • Albuterol • Antihistamines • Corticosteroids	• Allow position of comfort • Specialty consultation
Lower airway obstruction **Specific management for selected conditions**		
Bronchiolitis	**Asthma**	
• Nasal suctioning • Consider bronchodilator trial	• Albuterol ± ipratropium • Corticosteroids • Magnesium sulfate • IM epinephrine (if severe) • Terbutaline	
Lung tissue disease **Specific management for selected conditions**		
Pneumonia/pneumonitis **Infectious, chemical, aspiration**	**Pulmonary edema** **Cardiogenic or noncardiogenic (ARDS)**	
• Albuterol • Antibiotics (as indicated) • Consider noninvasive or invasive ventilatory support with PEEP	• Consider noninvasive or invasive ventilatory support with PEEP • Consider vasoactive support • Consider diuretic	
Disordered control of breathing **Specific management for selected conditions**		
Increased ICP	**Poisoning/overdose**	**Neuromuscular disease**
• Avoid hypoxemia • Avoid hypercarbia • Avoid hyperthermia • Avoid hypotension	• Antidote (if available) • Contact poison control	• Consider noninvasive or invasive ventilatory support

Recognizing Shock Flowchart

Clinical signs		Hypovolemic shock	Distributive shock	Cardiogenic shock	Obstructive shock
Airway	**Patency**	Airway open and maintainable/not maintainable			
Breathing	**Respiratory rate**	Increased			
	Respiratory effort	Normal to increased		Labored	
	Breath sounds	Normal	Normal (± crackles)	Crackles, grunting	
Circulation	**Systolic blood pressure**	Compensated shock can progress to hypotensive shock if left untreated			
	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			
Disability	**Level of consciousness**	Irritable early, lethargic late			
Exposure	**Temperature**	Variable			

Managing Shock Flowchart

<table>
<tr><th colspan="4">Managing shock flowchart</th></tr>
<tr><td colspan="2">• Oxygen
• Pulse oximetry
• ECG monitor</td><td colspan="2">• IV/IO access
• BLS as indicated
• Point-of-care glucose testing</td></tr>
<tr><td colspan="4">Hypovolemic shock:
Specific management for selected conditions</td></tr>
<tr><td colspan="2">Nonhemorrhagic</td><td colspan="2">Hemorrhagic</td></tr>
<tr><td colspan="2">• 20 mL/kg NS/LR bolus, repeat as needed
• Consider colloid</td><td colspan="2">• Control external bleeding
• 20 mL/kg NS/LR bolus, repeat 2 or 3x as needed
• Transfuse PRBCs as indicated</td></tr>
<tr><td colspan="4">Distributive shock:
Specific management for selected conditions</td></tr>
<tr><td>Septic</td><td>Anaphylactic</td><td colspan="2">Neurogenic</td></tr>
<tr><td>Management algorithm:
• Septic Shock</td><td>• IM epinephrine (or autoinjector)
• Fluid boluses (10-20 mL/kg NS/LR)
• Albuterol
• Antihistamines, corticosteroids
• Epinephrine infusion</td><td colspan="2">• 20 mL/kg NS/LR bolus, repeat PRN
• Vasopressor</td></tr>
<tr><td colspan="4">Cardiogenic shock:
Specific management for selected conditions</td></tr>
<tr><td colspan="2">Bradyarrhythmia/tachyarrhythmia</td><td colspan="2">Other (eg, CHD, myocarditis, cardiomyopathy, poisoning)</td></tr>
<tr><td colspan="2">Management algorithms:
• Bradycardia
• Tachycardia</td><td colspan="2">• 5 to 10 mL/kg NS/LR bolus, repeat PRN
• Inotropic and/or vasoactive infusion
• Consider expert consultation
• Antidote for poisoning</td></tr>
<tr><td colspan="4">Obstructive shock:
Specific management for selected conditions</td></tr>
<tr><td>Ductal-dependent (LV outflow obstruction)</td><td>Tension pneumothorax</td><td>Cardiac tamponade</td><td>Pulmonary embolism</td></tr>
<tr><td>• Prostaglandin E1
• Expert consultation</td><td>• Needle decompression
• Tube thoracostomy</td><td>• Pericardiocentesis
• 20 mL/kg NS/LR bolus</td><td>• 20 mL/kg NS/LR bolus, repeat PRN
• Consider thrombolytics, anticoagulants
• Expert consultation</td></tr>
</table>

Pediatric Basic and Advanced Life Support

Summary of Key Issues and Major Changes

More than 20 000 infants and children have a cardiac arrest each year in the United States. Despite increases in survival and comparatively good rates of good neurologic outcome after pediatric IHCA, survival rates from pediatric OHCA remain poor, particularly in infants. Recommendations for pediatric basic life support (PBLS) and CPR in infants, children, and adolescents have been combined with recommendations for pediatric advanced life support (PALS) in a single document in the 2020 Guidelines. The causes of cardiac arrest in infants and children differ from cardiac arrest in adults, and a growing body of pediatric-specific evidence supports these recommendations. Key issues, major changes, and enhancements in the 2020 Guidelines include the following:

- Algorithms and visual aids were revised to incorporate the best science and improve clarity for PBLS and PALS resuscitation providers.
- Based on newly available data from pediatric resuscitations, the recommended assisted ventilation rate has been increased to 1 breath every 2 to 3 seconds (20-30 breaths per minute) for all pediatric resuscitation scenarios.
- Cuffed ETTs are suggested to reduce air leak and the need for tube exchanges for patients of any age who require intubation.
- The routine use of cricoid pressure during intubation is no longer recommended.
- To maximize the chance of good resuscitation outcomes, epinephrine should be administered as early as possible, ideally within 5 minutes of the start of cardiac arrest from a nonshockable rhythm (asystole and pulseless electrical activity).
- For patients with arterial lines in place, using feedback from continuous measurement of arterial blood pressure may improve CPR quality.
- After ROSC, patients should be evaluated for seizures; status epilepticus and any convulsive seizures should be treated.
- Because recovery from cardiac arrest continues long after the initial hospitalization, patients should have formal assessment and support for their physical, cognitive, and psychosocial needs.
- A titrated approach to fluid management, with epinephrine or norepinephrine infusions if vasopressors are needed, is appropriate in resuscitation from septic shock.
- On the basis largely of extrapolation from adult data, balanced blood component resuscitation is reasonable for infants and children with hemorrhagic shock.
- Opioid overdose management includes CPR and the timely administration of naloxone by either lay rescuers or trained rescuers.
- Children with acute myocarditis who have arrhythmias, heart block, ST-segment changes, or low cardiac output are at high risk of cardiac arrest. Early transfer to an intensive care unit is important, and some patients may require mechanical circulatory support or extracorporeal life support (ECLS).
- Infants and children with congenital heart disease and single ventricle physiology who are in the process of staged reconstruction require special considerations in PALS management.
- Management of pulmonary hypertension may include the use of inhaled nitric oxide, prostacyclin, analgesia, sedation, neuromuscular blockade, the induction of alkalosis, or rescue therapy with ECLS.

Algorithms and Visual Aids

The writing group updated all algorithms to reflect the latest science and made several major changes to improve the visual training and performance aids:

- A new pediatric Chain of Survival was created for IHCA in infants, children, and adolescents (Figure 10).
- A sixth link, Recovery, was added to the pediatric OHCA Chain of Survival and is included in the new pediatric IHCA Chain of Survival (Figure 10).
- The Pediatric Cardiac Arrest Algorithm and the Pediatric Bradycardia With a Pulse Algorithm have been updated to reflect the latest science (Figures 11 and 12).
- The single Pediatric Tachycardia With a Pulse Algorithm now covers both narrow- and wide-complex tachycardias in pediatric patients (Figure 13).
- Two new Opioid-Associated Emergency Algorithms have been added for lay rescuers and trained rescuers (Figures 5 and 6).
- A new checklist is provided for pediatric post–cardiac arrest care (Figure 14).

Major New and Updated Recommendations

Changes to the Assisted Ventilation Rate: Rescue Breathing

2020 (Updated): (PBLS) For infants and children with a pulse but absent or inadequate respiratory effort, it is reasonable to give 1 breath every 2 to 3 seconds (20-30 breaths/min).

2010 (Old): (PBLS) If there is a palpable pulse 60/min or greater but there is inadequate breathing, give rescue breaths at a rate of about 12 to 20/min (1 breath every 3-5 seconds) until spontaneous breathing resumes.

Changes to the Assisted Ventilation Rate: Ventilation Rate During CPR With an Advanced Airway

2020 (Updated): (PALS) When performing CPR in infants and children with an advanced airway, it may be reasonable to target a respiratory rate range of 1 breath every 2 to 3 seconds (20-30/min), accounting for age and clinical condition. Rates exceeding these recommendations may compromise hemodynamics.

2010 (Old): (PALS) If the infant or child is intubated, ventilate at a rate of about 1 breath every 6 seconds (10/min) without interrupting chest compressions.

Why: New data show that higher ventilation rates (at least 30/min in infants [younger than 1 year] and at least 25/min in children) are associated with improved rates of ROSC and survival in pediatric IHCA. Although there are no data about the ideal ventilation rate during CPR without an advanced airway, or for children in respiratory arrest with or without an advanced airway, for simplicity of training, the respiratory arrest recommendation was standardized for both situations.

Cuffed ETTs

2020 (Updated): It is reasonable to choose cuffed ETTs over uncuffed ETTs for intubating infants and children. When a cuffed ETT is used, attention should be paid to ETT size, position, and cuff inflation pressure (usually <20-25 cm H_2O).

2010 (Old): Both cuffed and uncuffed ETTs are acceptable for intubating infants and children. In certain circumstances (eg, poor lung compliance, high airway resistance, or a large glottic air leak) a cuffed ETT may be preferable to an uncuffed tube, provided that attention is paid to [ensuring appropriate] ETT size, position, and cuff inflation pressure.

Why: Several studies and systematic reviews support the safety of cuffed ETTs and demonstrate decreased need for tube changes and reintubation. Cuffed tubes may decrease the risk of aspiration. Subglottic stenosis is rare when cuffed ETTs are used in children and careful technique is followed.

Cricoid Pressure During Intubation

2020 (Updated): Routine use of cricoid pressure is not recommended during endotracheal intubation of pediatric patients.

2010 (Old): There is insufficient evidence to recommend routine application of cricoid pressure to prevent aspiration during endotracheal intubation in children.

Why: New studies have shown that routine use of cricoid pressure reduces intubation success rates and does not reduce the rate of regurgitation. The writing group has reaffirmed previous recommendations to discontinue cricoid pressure if it interferes with ventilation or the speed or ease of intubation.

Emphasis on Early Epinephrine Administration

2020 (Updated): For pediatric patients in any setting, it is reasonable to administer the initial dose of epinephrine within 5 minutes from the start of chest compressions.

2015 (Old): It is reasonable to administer epinephrine in pediatric cardiac arrest.

Why: A study of children with IHCA who received epinephrine for an initial nonshockable rhythm (asystole and pulseless electrical activity) demonstrated that, for every minute of delay in administration of epinephrine, there was a significant decrease in ROSC, survival at 24 hours, survival to discharge, and survival with favorable neurological outcome.

Patients who received epinephrine within 5 minutes of CPR initiation compared with those who received epinephrine more than 5 minutes after CPR initiation were more likely to survive to discharge. Studies of pediatric OHCA demonstrated that earlier epinephrine administration increases rates of ROSC, survival to intensive care unit admission, survival to discharge, and 30-day survival.

In the 2018 version of the Pediatric Cardiac Arrest Algorithm, patients with nonshockable rhythms received epinephrine every 3 to 5 minutes, but early administration of epinephrine was not emphasized. Although the sequence of resuscitation has not changed, the algorithm and recommendation language have been updated to emphasize the importance of giving epinephrine as early as possible, particularly when the rhythm is nonshockable.

Invasive Blood Pressure Monitoring to Assess CPR Quality

2020 (Updated): For patients with continuous invasive arterial blood pressure monitoring in place at the time of cardiac arrest, it is reasonable for providers to use diastolic blood pressure to assess CPR quality.

2015 (Old): For patients with invasive hemodynamic monitoring in place at the time of cardiac arrest, it may be reasonable for rescuers to use blood pressure to guide CPR quality.

Why: Providing high-quality chest compressions is critical to successful resuscitation. A new study shows that, among pediatric patients receiving CPR with an arterial line in place, rates of survival with favorable neurologic outcome were improved if the diastolic blood pressure was at least 25 mm Hg in infants and at least 30 mm Hg in children.[8]

Detecting and Treating Seizures After ROSC

2020 (Updated): When resources are available, continuous electroencephalography monitoring is recommended for the detection of seizures following cardiac arrest in patients with persistent encephalopathy.

2020 (Updated): It is recommended to treat clinical seizures following cardiac arrest.

2020 (Updated): It is reasonable to treat nonconvulsive status epilepticus following cardiac arrest in consultation with experts.

2015 (Old): An electroencephalography for the diagnosis of seizure should be promptly performed and interpreted and then should be monitored frequently or continuously in comatose patients after ROSC.

2015 (Old): The same anticonvulsant regimens for the treatment of status epilepticus caused by other etiologies may be considered after cardiac arrest.

Why: For the first time, the Guidelines provide pediatric-specific recommendations for managing seizures after cardiac arrest. Nonconvulsive seizures, including nonconvulsive status epilepticus, are common and cannot be detected without electroencephalography. Although outcome data from the post–cardiac arrest population are lacking, both convulsive and nonconvulsive status epilepticus are associated with poor outcome, and treatment of status epilepticus is beneficial in pediatric patients in general.

Evaluation and Support for Cardiac Arrest Survivors

2020 (New): It is recommended that pediatric cardiac arrest survivors be evaluated for rehabilitation services.

2020 (New): It is reasonable to refer pediatric cardiac arrest survivors for ongoing neurologic evaluation for at least the first year after cardiac arrest.

Why: There is growing recognition that recovery from cardiac arrest continues long after the initial hospitalization. Survivors may require ongoing integrated medical, rehabilitative, caregiver, and community support in the months to years after their cardiac arrest. A recent AHA scientific statement highlights the importance of supporting patients and families during this time to achieve the best possible long-term outcome.[6]

Septic Shock

Fluid Boluses

2020 (Updated): In patients with septic shock, it is reasonable to administer fluid in 10 mL/kg or 20 mL/kg aliquots with frequent reassessment.

2015 (Old): Administration of an initial fluid bolus of 20 mL/kg to infants and children with shock is reasonable, including those with conditions such as severe sepsis, severe malaria, and dengue.

Choice of Vasopressor

2020 (New): In infants and children with fluid-refractory septic shock, it is reasonable to use either epinephrine or norepinephrine as an initial vasoactive infusion.

2020 (New): In infants and children with fluid-refractory septic shock, if epinephrine or norepinephrine are unavailable, dopamine may be considered.

Corticosteroid Administration

2020 (New): For infants and children with septic shock unresponsive to fluids and requiring vasoactive support, it may be reasonable to consider stress-dose corticosteroids.

Why: Although fluids remain the mainstay of initial therapy for infants and children in shock, especially in hypovolemic and septic shock, fluid overload can lead to increased morbidity. In recent trials of patients with septic shock, those who received higher fluid volumes or faster fluid resuscitation were more likely to develop clinically significant fluid overload and require mechanical ventilation. The writing group reaffirmed previous recommendations to reassess patients after each fluid bolus and to use either crystalloid or colloid fluids for septic shock resuscitation.

Previous versions of the Guidelines did not provide recommendations about choice of vasopressor or the use of corticosteroids in septic shock. Two RCTs suggest that epinephrine is superior to dopamine as the initial vasopressor in pediatric septic shock, and norepinephrine is also appropriate. Recent clinical trials suggest a benefit from corticosteroid administration in some pediatric patients with refractory septic shock.

Hemorrhagic Shock

2020 (New): Among infants and children with hypotensive hemorrhagic shock following trauma, it is reasonable to administer blood products, when available, instead of crystalloid for ongoing volume resuscitation.

Why: Previous versions of the Guidelines did not differentiate the treatment of hemorrhagic shock from other causes of hypovolemic shock. A growing body of evidence (largely from adults but with some pediatric data) suggests a benefit to early, balanced resuscitation using packed red blood cells, fresh frozen plasma, and platelets. Balanced resuscitation is supported by recommendations from the several US and international trauma societies.

Opioid Overdose

2020 (Updated): For patients in respiratory arrest, rescue breathing or bag-mask ventilation should be maintained until spontaneous breathing returns, and standard PBLS or PALS measures should continue if return of spontaneous breathing does not occur.

2020 (Updated): For a patient with suspected opioid overdose who has a definite pulse but no normal breathing or only gasping (ie, a respiratory arrest), in addition to providing standard PBLS or PALS, it is reasonable for responders to administer intramuscular or intranasal naloxone.

2020 (Updated): For patients known or suspected to be in cardiac arrest, in the absence of a proven benefit from the use of naloxone, standard resuscitative measures should take priority over naloxone administration, with a focus on high-quality CPR (compressions plus ventilation).

2015 (Old): Empiric administration of intramuscular or intranasal naloxone to all unresponsive opioid-associated life-threatening emergency patients may be reasonable as an adjunct to standard first aid and non–healthcare provider BLS protocols.

2015 (Old): ACLS providers should support ventilation and administer naloxone to patients with a perfusing cardiac rhythm and opioid-associated respiratory arrest or severe respiratory depression. Bag-mask ventilation should be maintained until spontaneous breathing returns, and standard ACLS measures should continue if return of spontaneous breathing does not occur.

2015 (Old): We can make no recommendation regarding the administration of naloxone in confirmed opioid-associated cardiac arrest.

Why: The opioid epidemic has not spared children. In the United States in 2018, opioid overdose caused 65 deaths in children younger than 15 years and 3618 deaths in people 15 to 24 years old,[9] and many more children required resuscitation. The 2020 Guidelines contain new recommendations for managing children with respiratory arrest or cardiac arrest from opioid overdose.

These recommendations are identical for adults and children, except that compression-ventilation CPR is recommended for all pediatric victims of suspected cardiac arrest. Naloxone can be administered by trained providers, laypersons with focused training, and untrained laypersons. Separate treatment algorithms are provided for managing opioid-associated resuscitation emergencies by laypersons, who cannot reliably check for a pulse (Figure 5), and by trained rescuers (Figure 6). Opioid-associated OHCA is the subject of a 2020 AHA scientific statement.[10]

Myocarditis

2020 (New): Given the high risk of cardiac arrest in children with acute myocarditis who demonstrate arrhythmias, heart block, ST-segment changes, and/or low cardiac output, early consideration of transfer to ICU monitoring and therapy is recommended.

2020 (New): For children with myocarditis or cardiomyopathy and refractory low cardiac output, prearrest use of ECLS or mechanical circulatory support can be beneficial to provide end-organ support and prevent cardiac arrest.

2020 (New): Given the challenges to successful resuscitation of children with myocarditis and cardiomyopathy, once cardiac arrest occurs, early consideration of extracorporeal CPR may be beneficial.

Why: Although myocarditis accounts for about 2% of sudden cardiovascular deaths in infants,[11] 5% of sudden cardiovascular deaths in children,[11] and 6% to 20% of sudden cardiac death in athletes, previous[12,13] PALS guidelines did not contain specific recommendations for management. These recommendations are consistent with the 2018 AHA scientific statement on CPR in infants and children with cardiac disease.[14]

Single Ventricle: Recommendations for the Treatment of Preoperative and Postoperative Stage I Palliation (Norwood/Blalock-Tausig Shunt) Patients

2020 (New): Direct (superior vena cava catheter) and/or indirect (near infrared spectroscopy) oxygen saturation monitoring can be beneficial to trend and direct management in the critically ill neonate after stage I Norwood palliation or shunt placement.

2020 (New): In the patient with an appropriately restrictive shunt, manipulation of pulmonary vascular resistance may have little effect, whereas lowering systemic vascular resistance with the use of systemic vasodilators (alpha-adrenergic antagonists and/or phosphodiesterase type III inhibitors), with or without the use of oxygen, can be useful to increase systemic delivery of oxygen (DO_2.)

2020 (New): ECLS after stage I Norwood palliation can be useful to treat low systemic DO_2.

2020 (New): In the situation of known or suspected shunt obstruction, it is reasonable to administer oxygen, vasoactive agents to increase shunt perfusion pressure, and heparin (50-100 units/kg bolus) while preparing for catheter-based or surgical intervention.

2020 (Updated): For neonates prior to stage I repair with pulmonary overcirculation and symptomatic low systemic cardiac output and DO_2, it is reasonable to target a $PaCO_2$ of 50 to 60 mm Hg. This can be achieved during mechanical ventilation by reducing minute ventilation or by administering analgesia/sedation with or without neuromuscular blockade.

2010 (Old): Neonates in a prearrest state due to elevated pulmonary-to-systemic flow ratio prior to Stage I repair might benefit from a $PaCO_2$ of 50 to 60 mm Hg, which can be achieved during mechanical ventilation by reducing minute ventilation, increasing the inspired fraction of CO_2, or administering opioids with or without chemical paralysis.