Welcome to American Heart Association
Pediatric Advanced Life Support

Remember to be successful in PALS, it is assumed that you have the ability to interpret cardiac rhythms and determine appropriate treatments. If this is your first time, we encourage people to audit for free, space permitting.

1. The test is now open book. You can order or download books directly from the AHA at https://shopcpr.heart.org/ You can also borrow, check the reference library at your facility, etc.

2. The AHA does require you to complete the pretest. We collect it from full providers/first timers only. If you use this link https://elearning.heart.org/course/427 This is the traditional pretest.

3. You can also choose PALS precourse self-assessment and precourse work from this link. https://elearning.heart.org/course/426 This gives you access to almost all the PALS videos and tons of extra content. In general, we will watch several of these videos in class. We think it's amazing that the AHA has made this a FREE service so that you can prepare/review anytime that you like. You can print a certificate of completion at the end if you wish.

4. If you feel like you need a rhythm review, we still like skill stat, but there are tons online and in your app store! http://www.skillstat.com/ make sure you know the life-threatening ones and the ones that make patients unstable: SVT, Brady rhythms, Heart Blocks, etc.

5. Study the H's and T's and ask yourself if you can name one treatment for each. Know your drugs: Epi, Atropine, Amiodarone, Lidocaine, Adenosine, Magnesium, and Norepinephrine (Levophed).

6. Feeling nerdy and love this stuff? https://cpr.heart.org/en/resuscitation-science/cpr-and-ecc-guidelines Scroll down and look at the Highlights of 2020 AHA Guidelines Update for CPR and ECC. It was our favorite, but the whole site offers great information.

Try not to be too nervous, we remember what that is like! Our gift is being able to discuss complex concepts in a simple way and we pride ourselves on having a non-threatening environment where questions are encouraged.

Next you will find the agenda for your course and algorithms from the free online AHA resources.

If you have any questions, please let us know-
Medical Education Angels
661-205-0927 text/call or mededangels@gmail.com

Your class will follow 1 of these agendas ☺

MEA PALS Hybrid Class

Participant must have completed the PALS precourse self-assessment and precourse work and **MUST** bring the certificate of completion with you. This will take about 2-3 hours. This is not the PALS Heart code as there is not the written exam at the end.

- High Performance Teams

-Skills Testing OPA/NPA/Respiratory Arrest, CPR/AED and Mega Code
-Written Exam 84% or greater to pass, 1 hour allowed for exam

MEA PALS Recertification Agenda

- Introduction and Science of Resuscitation
- IO access
- Coping with death
- Algorithms Review

-Skills Testing OPA/NPA/Respiratory Arrest, CPR/AED, infant/child choking, and Mega Code
-Written Exam 84% or greater to pass, 1 hour allowed for exam

MEA PALS Full Provider Agenda

- Course Introduction and Science of Resuscitation
- BLS
- High Performance Teams
- CPR Coach
- Systematic Approach
- Management of Respiratory Emergencies
- Management of Shock Emergencies
- IO Access
- Management of Arrhythmia Emergencies
- Post Cardiac Arrest
- Coping with Death

-Skills Testing OPA/NPA/Respiratory Arrest, CPR/AED, infant/child choking, and Mega Code
-Written Exam 84% or greater to pass, 1 hour allowed for exam

***On occasion, agendas are altered to include segments that are pertinent to the group.
Breaks are taken as needed, just ask!
Questions encouraged. ☺
Feel free to bring a drink or snack. No one tests well when they are hungry.
Please text or call us if you have any questions.

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PALS Systematic Approach Algorithm

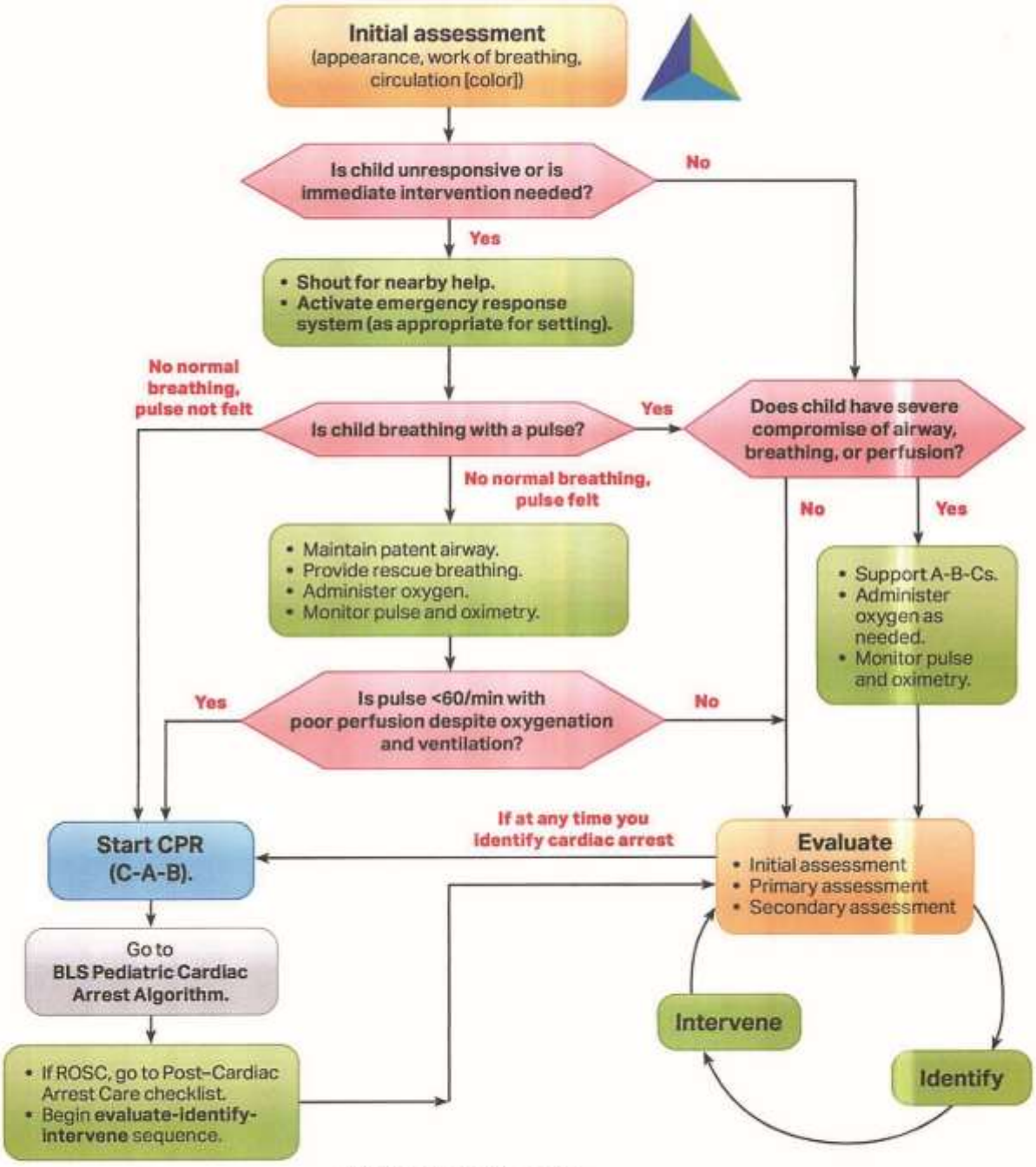

Figure 11. Pediatric Cardiac Arrest Algorithm.

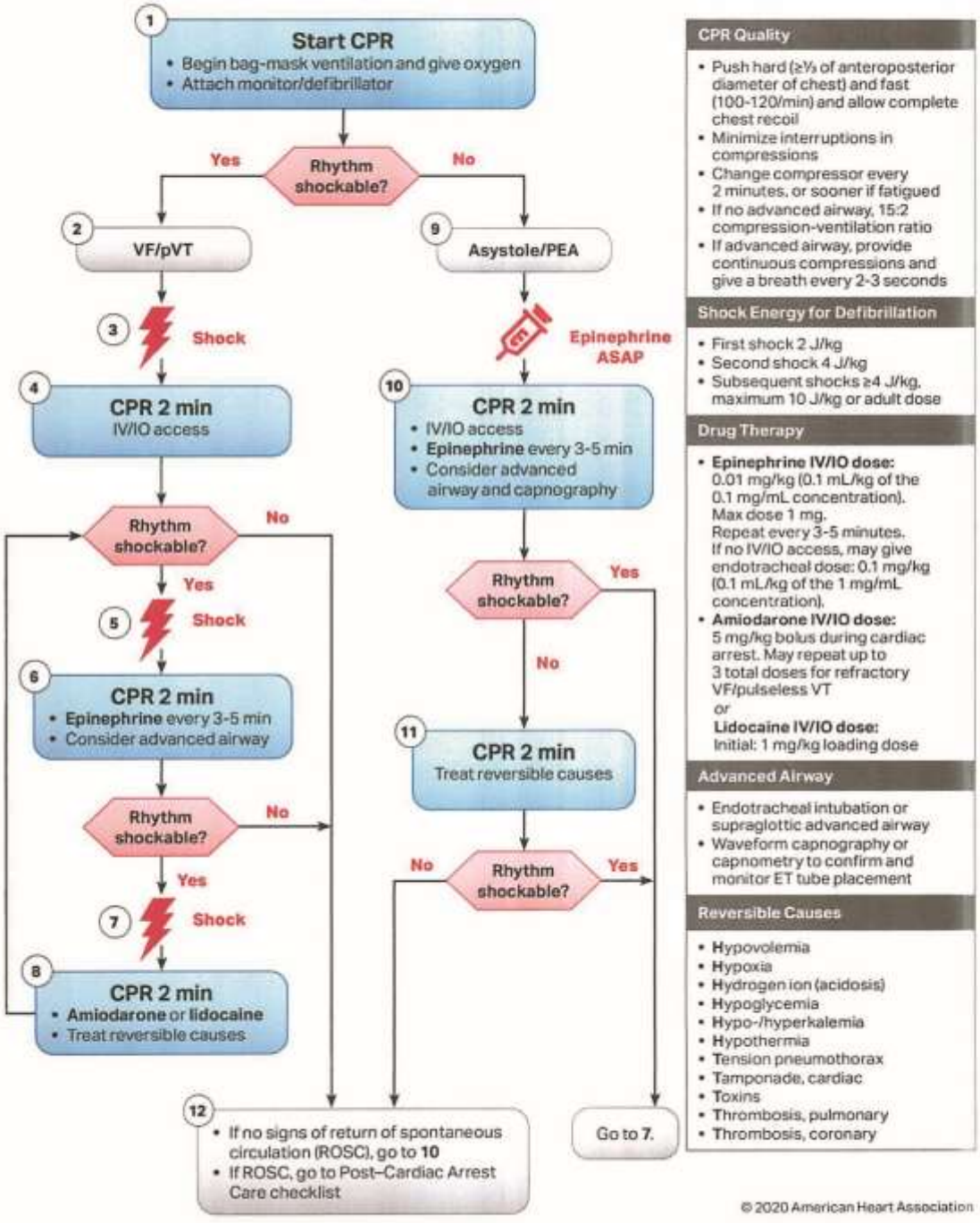

Figure 12. Pediatric Bradycardia With a Pulse Algorithm.

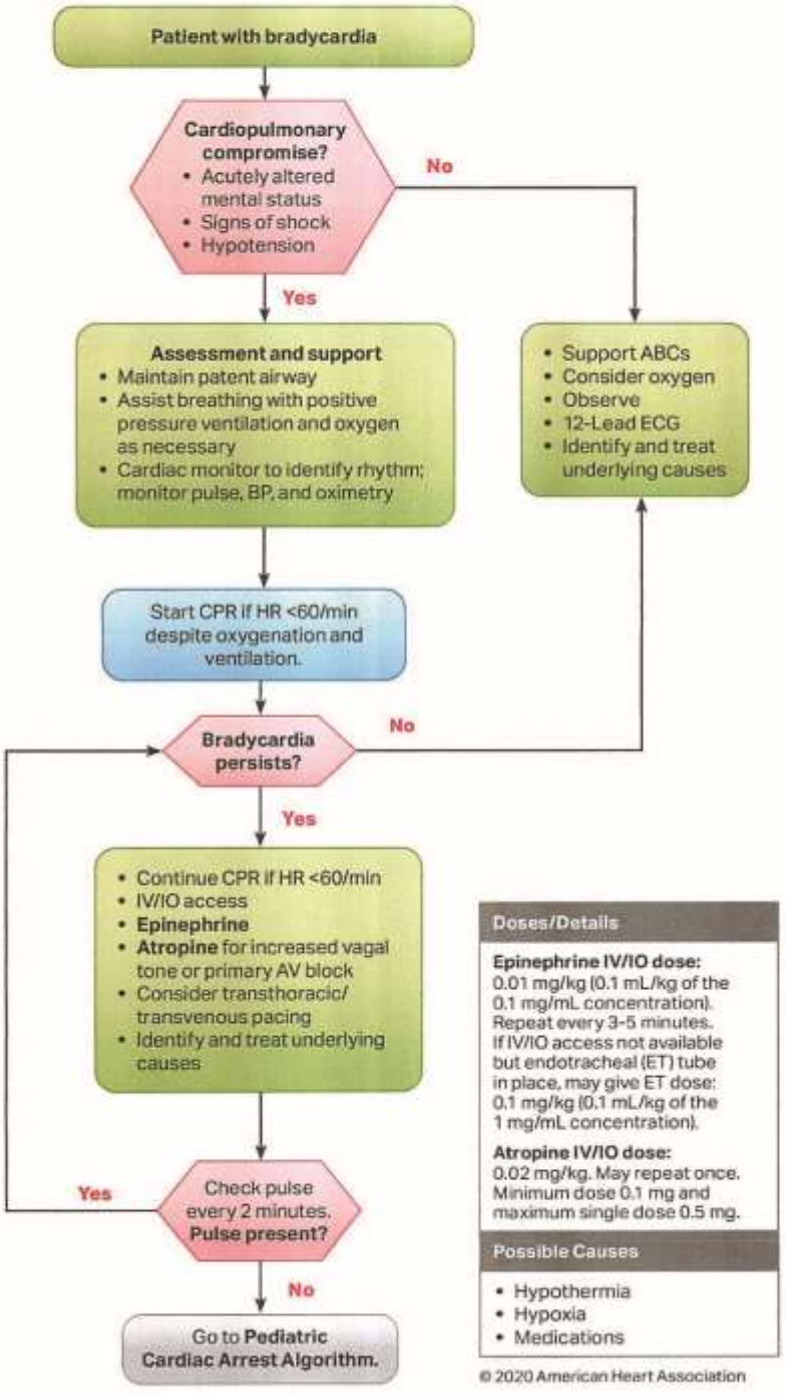

Figure 13. Pediatric Tachycardia With a Pulse Algorithm.

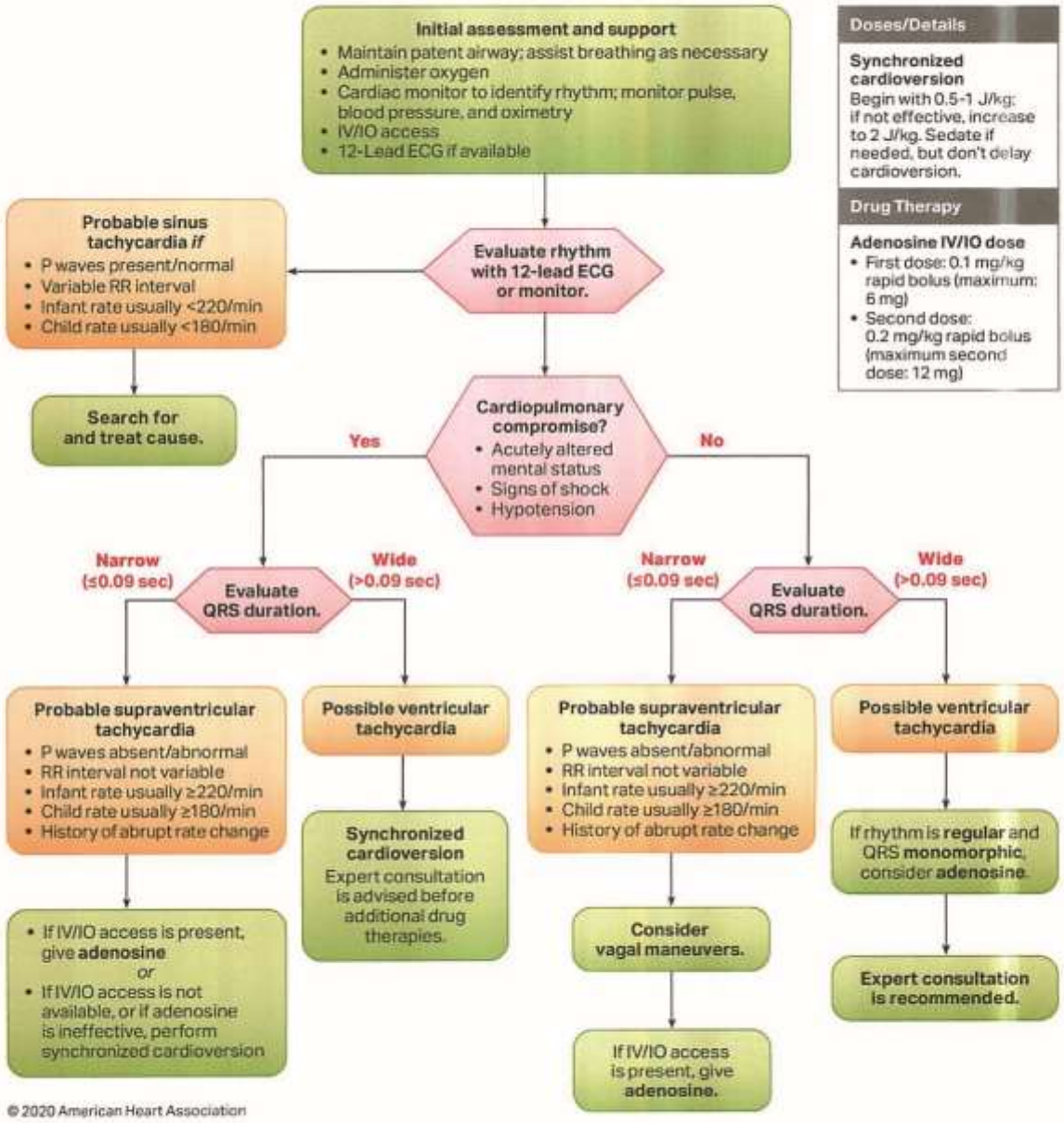

Figure 14. Pediatric Post-Cardiac Arrest Care Checklist.

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.	☐

2020 American Heart Association Guidelines for CPR and ECC:

Pediatric Basic and Advanced Life Support

Just the Facts: Recap

High-quality CPR is the foundation of resuscitation.

- Make sure you have adequate compression rate and depth.
- Allow for full chest recoil.
- Minimize interruptions.

Give early epinephrine for patients in nonshockable rhythms.

- Early epinephrine in patients with nonshockable rhythms improves the likelihood of survival.

Use naloxone in opioid overdose.

- Naloxone will reverse only respiratory arrest due to opioid overdose.
- There is no evidence for use in cardiac arrest.

Airway Management

1. **Aim for a rate of 20 to 30 breaths per minute.**
   Why? New guidelines suggest that this is the ideal rate for all infants and children receiving CPR with advanced airway in place or rescue breathing.

2. **Do not underestimate bag-mask ventilation.**
   Why? For out-of-hospital cardiac arrest, bag-mask ventilation results in the same resuscitation outcomes as advanced airway interventions such as endotracheal intubation.

3. **Consider a cuffed endotracheal tube.**
   Why? A cuffed endotracheal tube decreases the need for endotracheal tube changes.

4. **Do not routinely use cricoid pressure.**
   Why? The routine use of cricoid pressure does not reduce the risk of regurgitation during bag-mask ventilation and may impede intubation success.

Post–Cardiac Arrest Care

Resuscitation does not end with ROSC.

For all, ensure prevention and treatment of

- Hypotension
- Hypercapnia and hypocapnia
- Hyperoxia and hypoxia

For children who do not regain consciousness, consider

- Targeted temperature management
- Continuous EEG monitoring
- Delaying prognosis decisions until at least 72 hours after return to normal temperature

After cardiac arrest, survivors can have physical, cognitive, and emotional challenges and may need ongoing therapies and interventions.

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CPR.heart.org

Infographic by Kara Tostad, MD candidate.
Template designed by Sparsh Shah, MD.
Edited and reviewed by Sparsh Shah; Alvin Chin, MD, MSc; and Camilla Sasson, MD, FAHA.

Guidelines provided by
American Heart Association.

2019 American Heart Association Guidelines Update on

Pediatric Advanced Life Support

Advanced Airways in Pediatric Resuscitation

Most pediatric cardiac arrests are triggered by deterioration of **respiratory function.**

Out-of-hospital cardiac arrest

2019 Recommendation: Bag-mask ventilation is a reasonable alternative to advanced airway interventions (including endotracheal intubation or supraglottic airway).

In-hospital cardiac arrest

No Recommendation for or against the use of an advanced airway; advanced airway interventions may require more training and equipment.

New guidelines are largely based on **observational studies** involving only **out-of-hospital cardiac arrests.**

Targeted Temperature Management

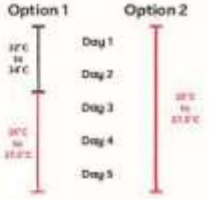
Targeted temperature management (TTM) involves **keeping core temperatures within a certain range** to induce **therapeutic hypothermia** in pediatric patients who remain comatose after cardiac arrest.

2019 Recommendation: Continuously monitor core temperature during TTM.

For patients between 24 hours and 18 years of age who remain comatose after cardiac arrest, **there are 2 reasonable options:**

Option 1: Use TTM to maintain 32°C to 34°C, followed by TTM to maintain 36°C to 37.5°C.

Option 2: Use TTM to maintain 36°C to 37.5°C.

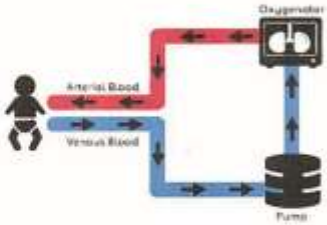


2019 Recommendation: TTM can be considered for both in-hospital and out-of-hospital cardiac arrest.

New TTM recommendations are based on the **THAPCA-IH trial** (Therapeutic Hypothermia After Pediatric Cardiac Arrest In-Hospital).

Extracorporeal CPR

Extracorporeal CPR refers to a cardiopulmonary bypass, which maintains organ perfusion while cardiac arrest causes are addressed.



2019 Recommendation: Consider extracorporeal CPR in pediatric patients with cardiac diagnoses who are experiencing in-hospital cardiac arrest **in a center with extracorporeal membrane oxygenation capability.**

Because of insufficient evidence, there are **no recommendations for or against extracorporeal CPR** in pediatric **out-of-hospital cardiac arrests** or **noncardiac diagnoses.**

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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>

Drugs Used in PALS

Drug	Indications/dosages
Adenosine	**SVT** • 0.1 mg/kg IV/IO *rapid* push (max 6 mg), second dose 0.2 mg/kg IV/IO *rapid* push (max 12 mg)
Albuterol	**Asthma, anaphylaxis (bronchospasm), hyperkalemia** • MDI: 4 to 8 puffs via inhalation q 20 minutes PRN with spacer (or ET if intubated) • Nebulizer: 2.5 mg/dose (wt <20 kg) or 5 mg/dose (wt >20 kg) via inhalation q 20 minutes PRN • Continuous nebulizer: 0.5 mg/kg per hour via inhalation (max 20 mg/h)
Amiodarone	**SVT, VT (with pulses)** • 5 mg/kg IV/IO *load* over 20 to 60 minutes (max 300 mg), repeat to daily max 15 mg/kg (2.2 g in adolescents) **Pulseless arrest (ie, VF/pulseless VT)** • 5 mg/kg IV/IO *bolus* (max 300 mg), repeat to daily max 15 mg/kg (2.2 g in adolescents)
Atropine sulfate	**Bradycardia (symptomatic)** • 0.02 mg/kg IV/IO (max single dose 0.5 mg), may repeat dose once in 3 to 5 minutes, max total dose child 1 mg, max total dose adolescent 3 mg • 0.04 to 0.06 mg/kg ET **Toxins/overdose (eg, organophosphate, carbamate)** • <12 years: 0.05 mg/kg IV/IO initially; then repeated and doubling the dose every 5 minutes until *muscarinic symptoms reverse* • ≥12 years: 1 mg IV/IO initially; then repeated and doubling the dose every 5 minutes until muscarinic symptoms reverse
Calcium chloride 10%	**Hypocalcemia, hyperkalemia, hypermagnesemia, calcium channel blocker overdose** • 20 mg/kg (0.2 mL/kg) IV/IO *slow* push during arrest, repeat PRN
Calcium gluconate	**Hypocalcemia, hyperkalemia, hypermagnesemia, calcium channel blocker overdose** • 60 mg/kg (0.6 mL/kg) IV/IO *slow* push during arrest; repeat PRN
Dexamethasone	**Croup** • 0.6 mg/kg PO/IM/IV (max 16 mg) **Asthma** • 0.6 mg/kg PO/IM/IV every 24 hours (max 16 mg)
Dextrose (glucose)	**Hypoglycemia** • 0.5 to 1 g/kg IV/IO ($D_{25}W$ 2 to 4 mL/kg; $D_{10}W$ 5 to 10 mL/kg)
Epinephrine	**Pulseless arrest, bradycardia (symptomatic)** • 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration) IV/IO q 3 to 5 minutes (max single dose 1 mg) • 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration) ET q 3 to 5 minutes **Hypotensive shock** • 0.1 to 1 mcg/kg per minute IV/IO infusion (consider higher doses if needed) **Anaphylaxis** • IM autoinjector 0.3 mg (for patient weighing ≥30 kg) or IM junior autoinjector 0.15 mg (for patient weighing 10 to 30 kg) • 0.01 mg/kg (0.01 mL/kg of the 1 mg/mL concentration) IM q 15 minutes PRN (max single dose 0.3 mg) • 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration) IV/IO q 3 to 5 minutes (max single dose 1 mg) if hypotensive • 0.1 to 1 mcg/kg per minute IV/IO infusion if hypotension persists despite fluids and IM injection **Asthma** • 0.01 mg/kg (0.01 mL/kg of the 1 mg/mL concentration) subcutaneously q 15 minutes (max 0.3 mg or 0.3 mL) **Croup** • 0.25 to 0.5 mL *racemic* solution (2.25%) mixed in 3 mL NS via inhalation • 3 mg (3 mL of the 1 mg/mL concentration) epinephrine mixed with 3 mL NS (which yields 0.25 mL racemic epinephrine solution) via inhalation

Drugs Used in PALS *(continued)*

Drug	Indications/dosages
Etomidate	**RSI** • 0.2 to 0.4 mg/kg IV/IO infused over 30 to 60 seconds (max 20 mg) will produce rapid sedation that lasts for 10 to 15 minutes
Hydrocortisone	**Adrenal insufficiency** • 2 mg/kg IV bolus (max 100 mg)
Ipratropium bromide	**Asthma** • 250 to 500 mcg via inhalation q 20 minutes PRN × 3 doses
Lidocaine	**VF/pulseless VT, wide-complex tachycardia (with pulses)** • 1 mg/kg IV/IO bolus • Maintenance: 20 to 50 mcg/kg per minute IV/IO infusion (repeat bolus dose if infusion initiated >15 minutes after initial bolus) • 2 to 3 mg/kg ET
Magnesium sulfate	**Asthma (refractory status asthmaticus), torsades de pointes, hypomagnesemia** • 25 to 50 mg/kg IV/IO *bolus* (max 2 g) (pulseless VT) *or* over 10 to 20 minutes (VT with pulses) *or* slow infusion over 15 to 30 minutes (status asthmaticus)
Methyl-prednisolone	**Asthma (status asthmaticus), anaphylactic shock** • Load: 2 mg/kg IV/IO/IM (max 60 mg); only use acetate salt IM • Maintenance: 0.5 mg/kg IV/IO q 6 hours (max 120 mg/d)
Milrinone	**Myocardial dysfunction and increased SVR/PVR** • Loading dose: 50 mcg/kg IV/IO over 10 to 60 minutes followed by 0.25 to 0.75 mcg/kg per minute IV/IO infusion
Naloxone	**Narcotic (opiate) reversal** • Total *reversal required* (for narcotic toxicity secondary to overdose): 0.1 mg/kg IV/IO/IM/subcutaneous bolus q 2 minutes PRN (max 2 mg) • Total *reversal not required* (eg, for respiratory depression associated with therapeutic narcotic use): 1 to 5 mcg/kg IV/IO/IM/subcutaneously; titrate to desired effect • Maintain reversal: 0.002 to 0.16 mg/kg per hour IV/IO infusion
Nitroglycerin	**Heart failure, cardiogenic shock** • Initiate at 0.25 to 0.5 mcg/kg per minute IV/IO infusion; titrate by 1 mcg/kg per minute q 15 to 20 minutes as tolerated. Typical dose range 1 to 5 mcg/kg per minute (max 10 mcg/kg per minute) • In adolescents, start with 5 to 10 mcg *per minute* (**not** per kilogram per minute) and increase to max 200 mcg *per minute*
Nitroprusside	**Cardiogenic shock (ie, associated with high SVR), severe hypertension** • 0.3 to 1 mcg/kg per minute initial dose; then titrate up to 8 mcg/kg per minute PRN
Norepinephrine	**Hypotensive (usually distributive) shock (ie, low SVR and fluid refractory)** • 0.05 to 2 mcg/kg per minute IV/IO infusion; titrate to desired effect
Prostaglandin E_1 (PGE_1)	**Ductal-dependent congenital heart disease (all forms)** • 0.05 to 0.1 mcg/kg per minute IV/IO infusion initially; then 0.01 to 0.05 mcg/kg per minute IV/IO
Sodium bicarbonate	**Metabolic acidosis (severe), hyperkalemia** • 1 mEq/kg IV/IO slow bolus **Sodium channel blocker overdose (eg, tricyclic antidepressant)** • 1 to 2 mEq/kg IV/IO bolus until serum pH is >7.45 (7.50 to 7.55 for severe poisoning) followed by IV/IO infusion of 150 mEq $NaHCO_3$/L solution titrated to maintain alkalosis
Vasopressin	**Catecholamine-resistant hypotension** • 0.0002 to 0.002 unit/kg per minute (0.2 to 2 milliunits/kg per minute) continuous infusion

American Heart Association. | AMERICAN ASSOCIATION of CRITICAL-CARE NURSES

PALS

Vital Signs in Children

These 3 tables are reproduced or modified from Hazinski MF. Children are different. In: *Nursing Care of the Critically Ill Child*. 3rd ed. Mosby; 2013:1-18, copyright Elsevier.

Normal Heart Rates*

Age	Awake rate (beats/min)	Sleeping rate (beats/min)
Neonate	100-205	90-160
Infant	100-180	90-160
Toddler	98-140	80-120
Preschooler	80-120	65-100
School-age child	75-118	58-90
Adolescent	60-100	50-90

*Always consider the patient's normal range and clinical condition. Heart rate will normally increase with fever or stress.

Normal Respiratory Rates*

Age	Rate (breaths/min)
Infant	30-53
Toddler	22-37
Preschooler	20-28
School-age child	18-25
Adolescent	12-20

*Consider the patient's normal range. The child's respiratory rate is expected to increase in the presence of fever or stress.

Data from Fleming S et al. *Lancet*. 2011;377(9770):1011-1018.

Normal Blood Pressures

Age	Systolic pressure (mm Hg)*	Diastolic pressure (mm Hg)*	Mean arterial pressure (mm Hg)†
Birth (12 h, <1000 g)	39-59	16-36	28-42‡
Birth (12 h, 3 kg)	60-76	31-45	48-57
Neonate (96 h)	67-84	35-53	45-60
Infant (1-12 mo)	72-104	37-56	50-62
Toddler (1-2 y)	86-106	42-63	49-62
Preschooler (3-5 y)	89-112	46-72	58-69
School-age child (6-9 y)	97-115	57-76	66-72
Preadolescent (10-12 y)	102-120	61-80	71-79
Adolescent (12-15 y)	110-131	64-83	73-84

*Systolic and diastolic blood pressure ranges assume 50th percentile for height for children 1 year and older.

†Mean arterial pressures (diastolic pressure + [difference between systolic and diastolic pressures/3]) for 1 year and older, assuming 50th percentile for height.

‡Approximately equal to postconception age in weeks (may add 5 mm Hg).

Data from Gemelli M et al. *Eur J Pediatr*. 1990;149(5)318-320; Versmold HT et al. *Pediatrics*. 1981;67(5):607-613; Haque IU, Zaritsky AL. *Pediatr Crit Care Med*. 2007;8(2):138-144; and National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. *The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents*. NHLBI; 2005. NIH publication 05-5267.

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