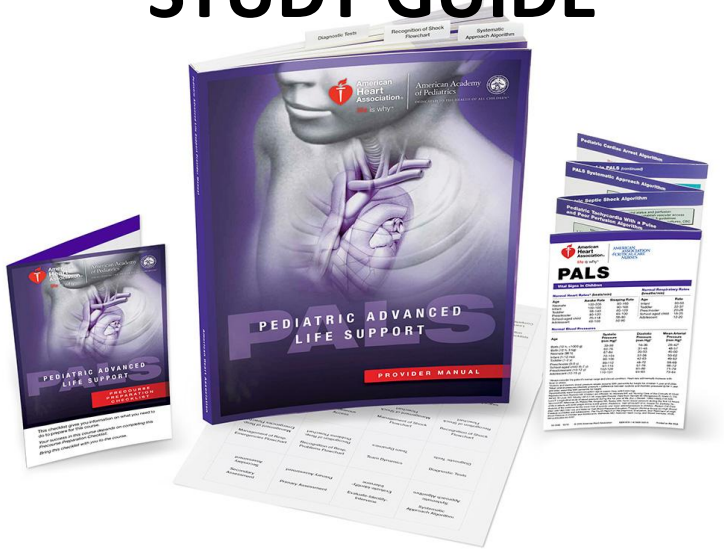
EMS Training LLC

"Saving Lives Through Quality Training"

PEDIATRIC ADVANCED LIFE SUPPORT STUDY GUIDE



American Heart Association | AUTHORIZED TRAINING PROVIDER

2020 BLS Science Summary Table

This table compares 2015 science with 2020 science, providing a quick reference to what has changed and what is new in the science of basic life support.

BLS topic	2015	2020
Chains of Survival	5 links in the IHCA and OHCA Chains of Survival for adults and pediatric	A sixth link, Recovery, was added to the IHCA and OHCA Chains of Survival for adults and pediatric.
Early Initiation of CPR by Lay Rescuers	Lay rescuers should not check for a pulse and should assume cardiac arrest if an adult suddenly collapses or an unresponsive victim is not breathing normally.	Laypersons should initiate CPR for presumed cardiac arrest because the risk of harm to the patient is low if the patient is not in cardiac arrest.
Changes to the Pediatric Assisted Ventilation Rate	• Rescue breathing: 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. • Infant or child CPR with an advanced airway: Ventilate at a rate of about 1 breath every 6 seconds (10/min) without interrupting chest compressions.	• For infants and children with a pulse but absent or inadequate respiratory effort: Give 1 breath every 2 to 3 seconds (20 to 30 breaths/min). • CPR in infants and children with an advanced airway: Target a respiratory rate range of 1 breath every 2 to 3 seconds (20-30 breaths/min), accounting for age and clinical condition. Rates exceeding these recommendations may compromise hemodynamics.

BLS topic	2020
Opioid Overdose	Two new opioid-associated emergency algorithms have been added for lay rescuers and trained rescuers.
Cardiac Arrest in Pregnancy	A new cardiac arrest in pregnancy algorithm has been added to address these special cases.
Real-Time Audiovisual Feedback	Use audiovisual feedback devices during CPR for real-time optimization of CPR performance.
Systems of Care	• Mobile phone technology can be used for emergency dispatch systems to alert bystanders to nearby events that may require CPR or AED. • Organizations that treat patients with cardiac arrest should collect processes-of-care data and outcomes.
Debriefing for Rescuers	Consider debriefing and follow-up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after cardiac arrest events.
Infant Compressions	• Single rescuers should compress the sternum with 2 fingers or 2 thumbs placed just below the nipple line. • If the rescuer is unable to achieve appropriate depth for infants with 2 fingers or 2 thumbs, use the heel of 1 hand.

Abbreviations: AED, automated external defibrillator; BLS, basic life support; CPR, cardiopulmonary resuscitation; EMS, emergency medical services; IHCA, in-hospital cardiac arrest; OHCA, out-of-hospital cardiac arrest; PALS, pediatric advanced life support; PBLS, pediatric basic life support.

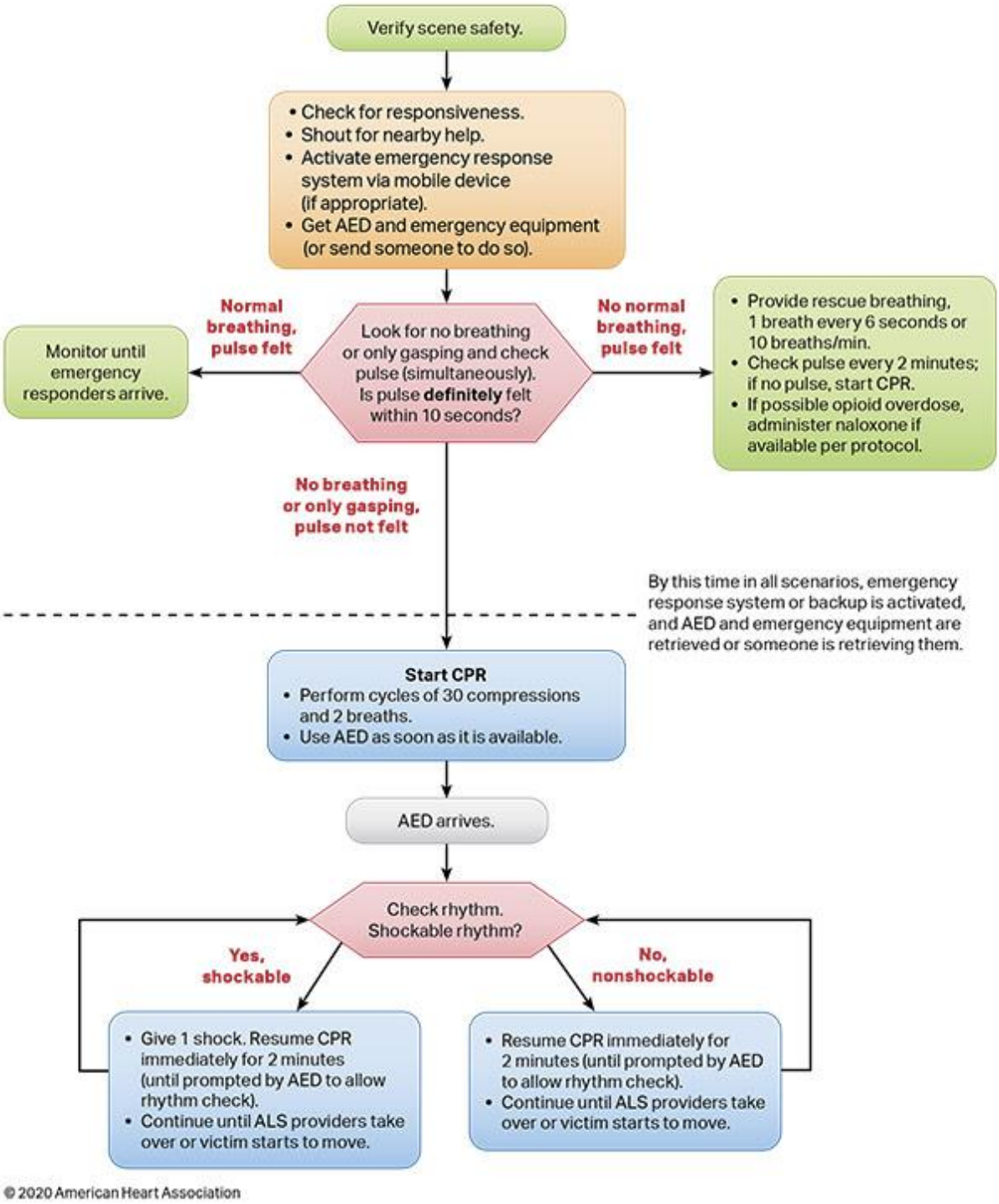
Summary of High-Quality CPR Components for BLS Providers

American Heart Association.

Component	Adults and adolescents	Children (age 1 year to puberty)	Infants (age less than 1 year, excluding newborns)
Verifying scene safety	Make sure the environment is safe for rescuers and victim		
Recognizing cardiac arrest	Check for responsiveness No breathing or only gasping (ie, no normal breathing) No definite pulse felt within 10 seconds (Breathing and pulse check can be performed simultaneously in less than 10 seconds)		
Activating emergency response system	***If a mobile device is available, phone emergency services (9-1-1)***		
	If you are alone with no mobile phone, leave the victim to activate the emergency response system and get the AED before beginning CPR Otherwise, send someone and begin CPR immediately; use the AED as soon as it is available	***Witnessed collapse*** Follow steps for adults and adolescents on the left ***Unwitnessed collapse*** Give 2 minutes of CPR Leave the victim to activate the emergency response system and get the AED Return to the child or infant and resume CPR; use the AED as soon as it is available	
Compression-ventilation ratio *without advanced airway*	***1 or 2 rescuers*** 30:2	***1 rescuer*** 30:2 ***2 or more rescuers*** 15:2	
Compression-ventilation ratio *with advanced airway*	Continuous compressions at a rate of 100-120/min Give 1 breath every 6 seconds (10 breaths/min)	Continuous compressions at a rate of 100-120/min Give 1 breath every 2-3 seconds (20-30 breaths/min)	
Compression rate	100-120/min		
Compression depth	At least 2 inches (5 cm)*	At least one third AP diameter of chest Approximately 2 inches (5 cm)	At least one third AP diameter of chest Approximately 1½ inches (4 cm)
Hand placement	2 hands on the lower half of the breastbone (sternum)	2 hands or 1 hand (optional for very small child) on the lower half of the breastbone (sternum)	***1 rescuer*** 2 fingers or 2 thumbs in the center of the chest, just below the nipple line ***2 or more rescuers*** 2 thumb–encircling hands in the center of the chest, just below the nipple line If the rescuer is unable to achieve the recommended depth, it may be reasonable to use the heel of one hand
Chest recoil	Allow complete recoil of chest after each compression; do not lean on the chest after each compression		
Minimizing interruptions	Limit interruptions in chest compressions to less than 10 seconds with a CCF goal of 80%		

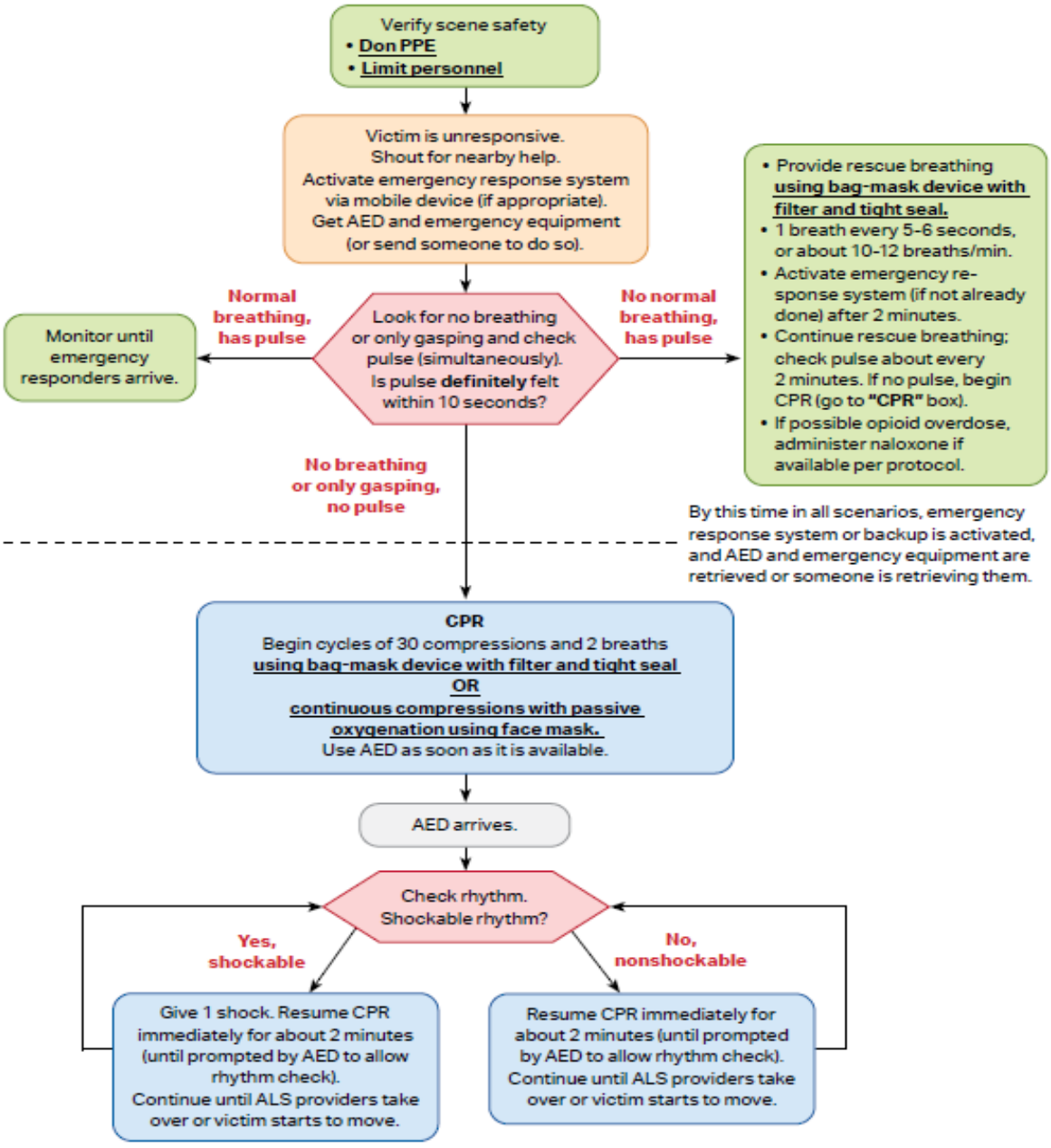
*Compression depth should be no more than 2.4 inches (6 cm).
Abbreviations: AED, automated external defibrillator; AP, anteroposterior; CCF, chest compression fraction; CPR, cardiopulmonary resuscitation.

Adult Basic Life Support Algorithm for Healthcare Providers



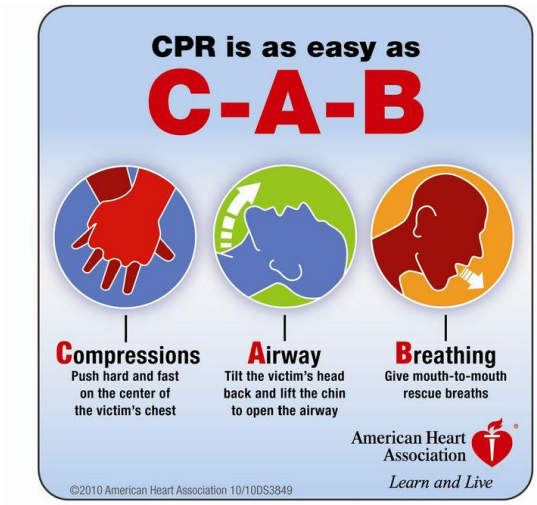
BLS Healthcare Provider Adult Cardiac Arrest Algorithm for Suspected or Confirmed COVID-19 Patients

Updated April 2020



Students should complete the mandatory PALS Precourse Work and Precourse Assessment prior to attending class. This free and useful tool provided by the American Heart Association can be used multiple times until you are proficient in the subject. It is also a good review tool if you have never taken Pediatric Advanced Cardiac Life Support before or if this is an annual review. You can complete it here on the e-learning platform at https://elearning.heart.org/course/426. Please print and bring in your assessment score to class.

The updated 2020 American Heart Association Chains of Survival. There are now In-Hospital and Out-of-Hospital updated Chains of Survival.



The foundation of good Pediatric Advanced Life Support is high quality Basic Life Support. The goal of the 2020 Emergency Cardiovascular Care Curriculum is to ensure high quality BLS with a high chest compression fraction during CPR. We can achieve a high CCF by reducing the pauses and delays in compressions. Studies have shown that healthcare providers don't compress deeply enough due to a fear of hurting the patient. But ask yourself this, "what is the better outcome: death or broken ribs?" Thus, the new course incorporates feedback devices and new AEDs now have feedback mechanisms. To ensure high quality BLS during CPR, by delivering a ratio of 30:2 ventilations for one person CPR and two person CPR 15:2 ventilation healthcare providers must maintain 100 to 120 compressions per minute with a depth of 1 inches (5cm) in children and 1 ½ inches (4cm) in infant, and rotate compressors every 2 minutes. Infants and Children go into cardiac arrest usually secondary to respiratory failure, which is why it's important to secure the airway and ventilation appropriately. It is also imperative to attach the AED as soon as it is available. If no infant/child pads are available the provider may use an Adult AED with Adult Pads, ensuring to place the pads anterior/posterior, and they don't overlap or touch. Remember to utilize the CAB Sequence (Compressions, Airway and Breathing) for unresponsive patients, and the ABC Sequence (Airway, Breathing and Circulation) for responsive patients who are conscious with a pulse.

Steps for use of an Automated External Defibrillator

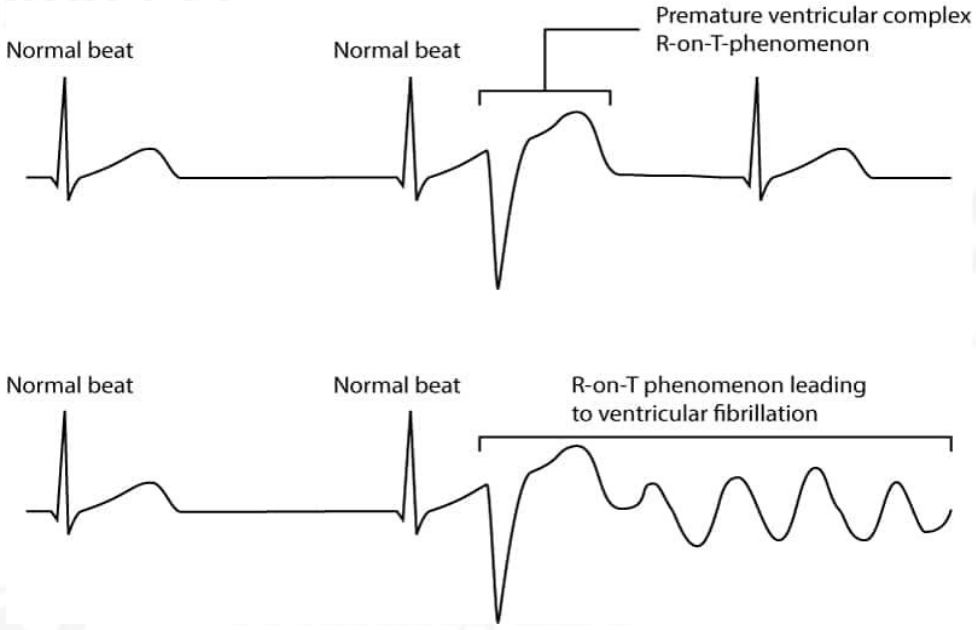
1. Power on AED
2. Follow the Prompts
3. Defibrillate when indicated by the machine

Attach the AED as soon as it becomes available and prepare to deliver a shock when indicated. If you witness the arrest of a patient who goes into a shockable rhythm such as Ventricular Fibrillation or Ventricular Tachycardia, you should immediately defibrillate at the device's command. Use the Adult AED and pads on patients over 8 years of age or over 40kg. If the patient's age is unknown, chest development in women and underarm hair in men is an indicator of adulthood.

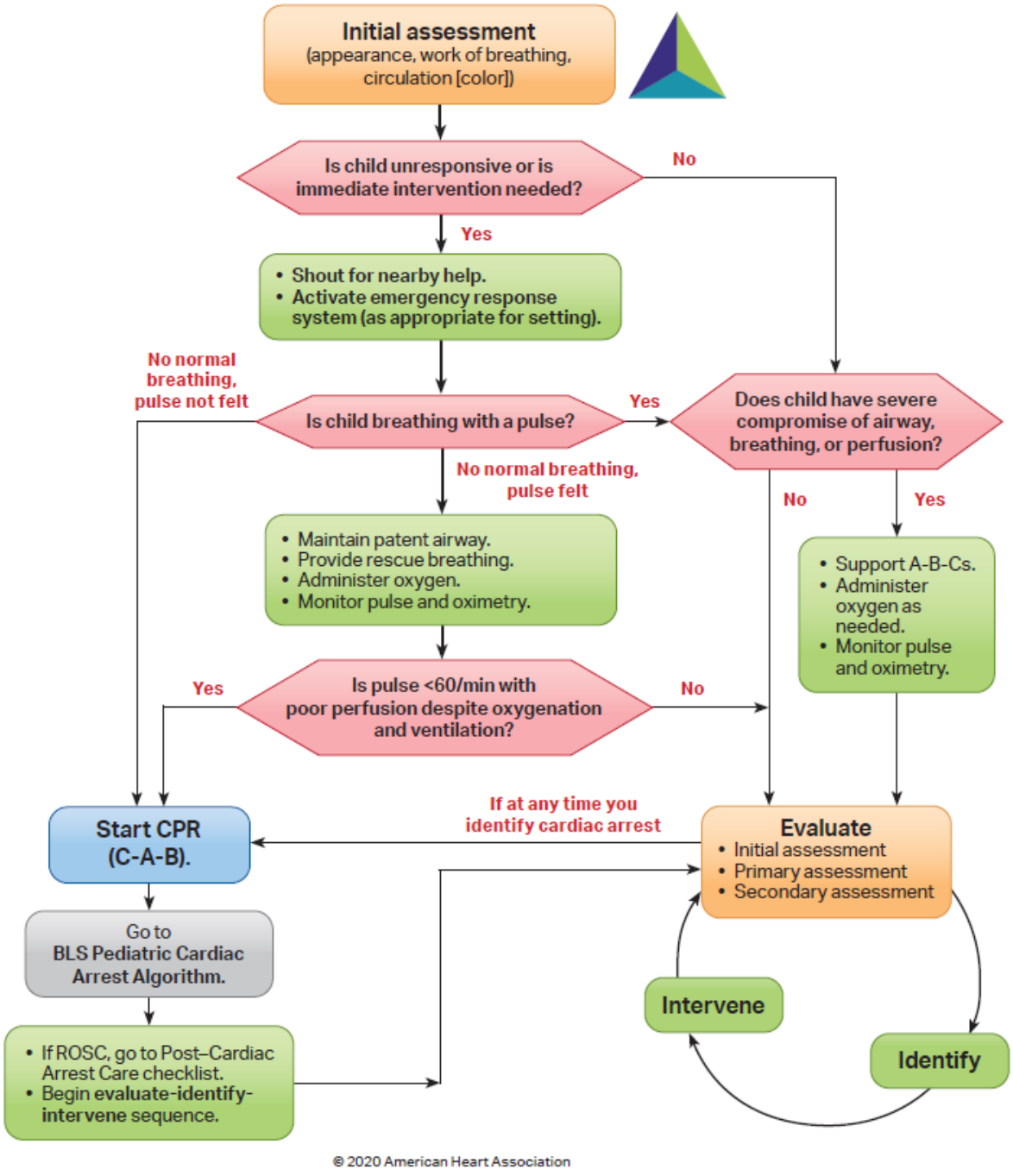
Monophasic vs Biphasic Defibrillators: Previous generations of defibrillators were monophasic in nature, meaning that they conducted the electricity across the heart in one direction. This mechanism required a higher energy dosage of around 360 Joules. Conversely, biphasic defibrillators deliver the electricity across the heart in two directions and take impedance into account. Therefore, the biphasic method delivers a more precise dose of energy to the heart muscle with less energy and is more successful in terminating ventricular dysrhythmias. The defibrillation dose for PALS is 2 Joules/kg, followed by 4 J/kg, subsequent shocks ≥ 4 J/Kg max 10 J/kg.

Manufacturer's Recommendation: Due to the myriad of new technologies and development in biphasic defibrillators, some manufacturers have included instructions for defibrillation. If you are not sure of the electrical dose, you should follow the manufacturer's recommendations for energy dosage during cardiac arrest.

Synchronized Cardioversion vs. Defibrillation: Unlike defibrillation, synchronized cardioversion is performed on conscious patients with a heart rate. The goal of synchronized cardioversion is to terminate the fast heart rate; therefore, the shock is synchronized on the R wave. Because patients are conscious during the procedure, you should administer a sedative and analgesic when appropriate. Defibrillation is an unsynchronized dose designed to stop the lethal dysrhythmia which is why it's important to start CPR immediately after delivering a shock. High Quality BLS and defibrillation saves lives. The defibrillator cannot prevent cardiac arrest; only eating healthy and leading a healthy lifestyle can. In PALS you should deliver synchronized cardioversions at 0.5- 1 J/kg initially and reassess, increase as necessary second dose at 2 J/kg



PALS Systematic Approach Algorithm



PALS Systematic Assessment

- Initial assessment: ABC's
- Evaluate - Identify - Intervene
- Secondary assessment and ongoing assessments

Use the S.A.M.P.L.E. mnemonic to assess the current complaint. Signs and Symptoms, Allergies, Medication, Past medical history, Last oral intake, event leading up to the emergency.

Use the O.P.Q.R.S.T. mnemonic for pain assessment

Onset

Provocation/Palliation

Quality (Scale 1 to 5)

Radiation

Severity (sharp, dull, stabbing)

Time

Hypotension is defined as a systolic blood pressure of less than **70 + Age (2)**. Patients who are hypotensive are considered **Unstable**. Although there are other signs and symptoms that may accompany or exacerbate their condition, it's important to focus on the vital signs. Unstable patients usually require electrical therapy such as synchronized cardioversion and bolus medications. **Stable** patients are able to receive medication drips, with electrical therapy available as a final option if medication doesn't break the dysrhythmia.

Treatment of Hypotension: For a hypotensive patient, always treat for shock, administer oxygen if indicated, attach the cardiac monitor, get IV access, and prepare to administer a fluid bolus of 20 ml/kg normal saline or lactated ringers isotonic solution. If you suspect potential congestive heart failure or pulmonary edema either detected by X-Ray or by physical exam, you should administer an initial fluid bolus of 10 ml/kg and then reassess the patient before you administer a second dose or consider a vasopressor infusion such as epinephrine or a dopamine drip and titrate to a systolic blood pressure.

Oxygen saturation should be maintained at **94% or greater**, by either administering oxygen via a nasal cannula or non-rebreather mask at the appropriate flow rate. Remember to keep in mind the factors that may suppress or alter pulse oximetry, such as extreme shock, nail polish, and carbon monoxide poisoning.

The 2020 curriculum has also seen the introduction of the Opioid Associated Emergency Algorithm for healthcare providers.

Opioid Overdoses: Currently, the opioid crisis is rampant in New York State; narcan is now available over the counter and free at participating pharmacies, and the city offers free narcan training to the community. Police and lay-persons now carry narcan and have helped reduce the number of deaths from opioid overdoses in our state. New York residents can get access to free Opioid Emergency Kits at no cost with no questions asked. For more information on participating pharmacies and naloxone training, you can call 311 or visit.
https://www1.nyc.gov/site/doh/health/health-topics/naloxone.page

Other types of toxins overdoses:

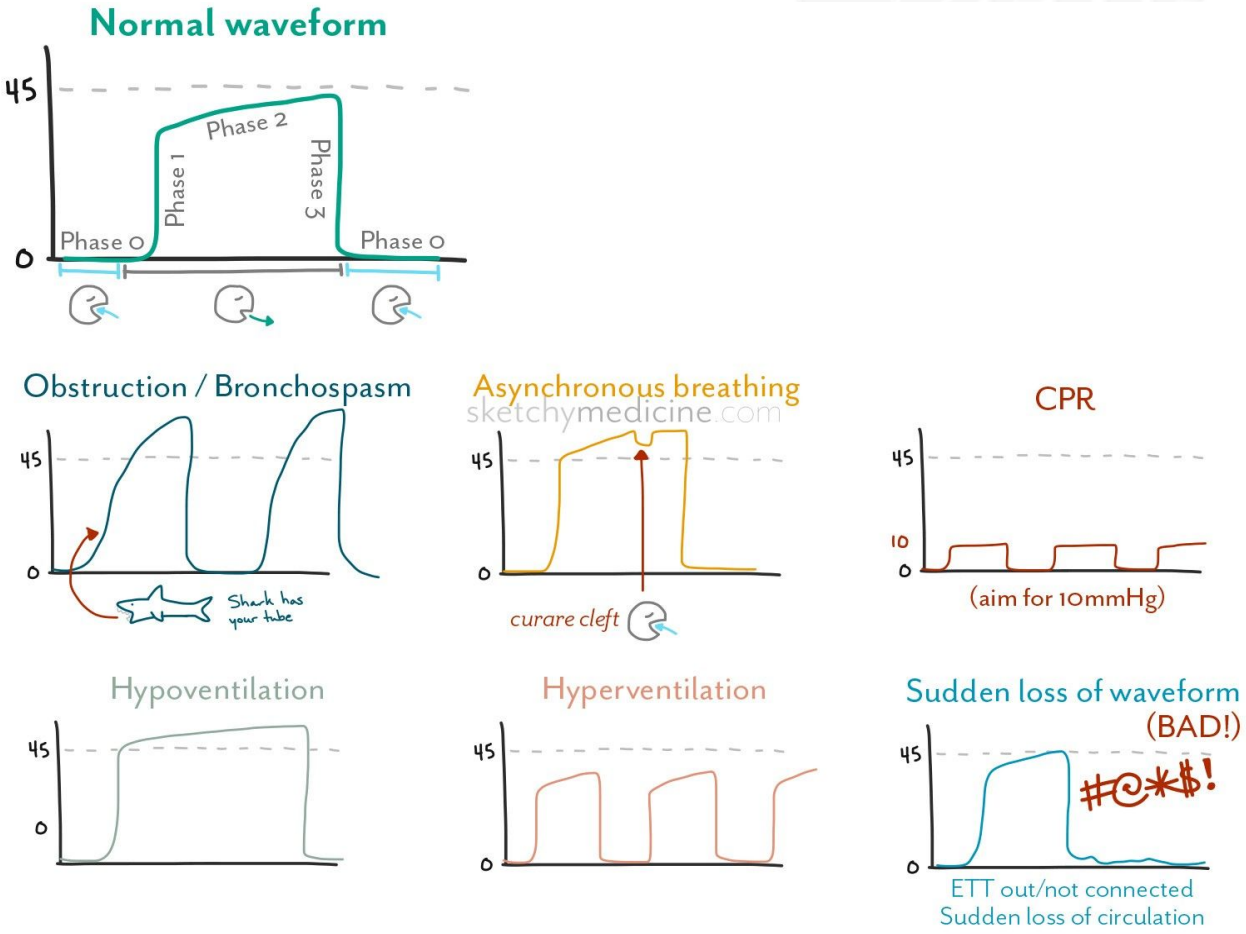
Calcium Channel Blocker Overdose - Antidote Calcium Chloride

Beta Blocker Overdose - Antidote Glucagon

Tricyclic Antidepressant OD - Antidote Sodium Bicarbonate

New studies have shown that the administration of sodium bicarbonate should be done as a IV Drip rather than a fast bolus. Sodium bicarbonate should not be administered in the same IV line as calcium chloride as it will precipitate and form a solid mass.

Waveform Capnography is now the standard for verifying and monitoring continuous placement of the endotracheal tube or an advanced airway device, and can be used during cardiac arrest as an indicator of effectiveness of chest compressions. Normal ETCO2 is 35-45mmHG, and is measured by a sensor connected to the ET tube that measures exhaled carbon dioxide. Exhaled carbon dioxide is a by-product of cellular respiration, if there is no increase in the patient's ETCO2 or it remains less than 4mmHG, this is an indicator of the unlikelihood that the patient will achieve return of spontaneous circulation. It can also aid the provider in determining when to terminate resuscitative efforts.



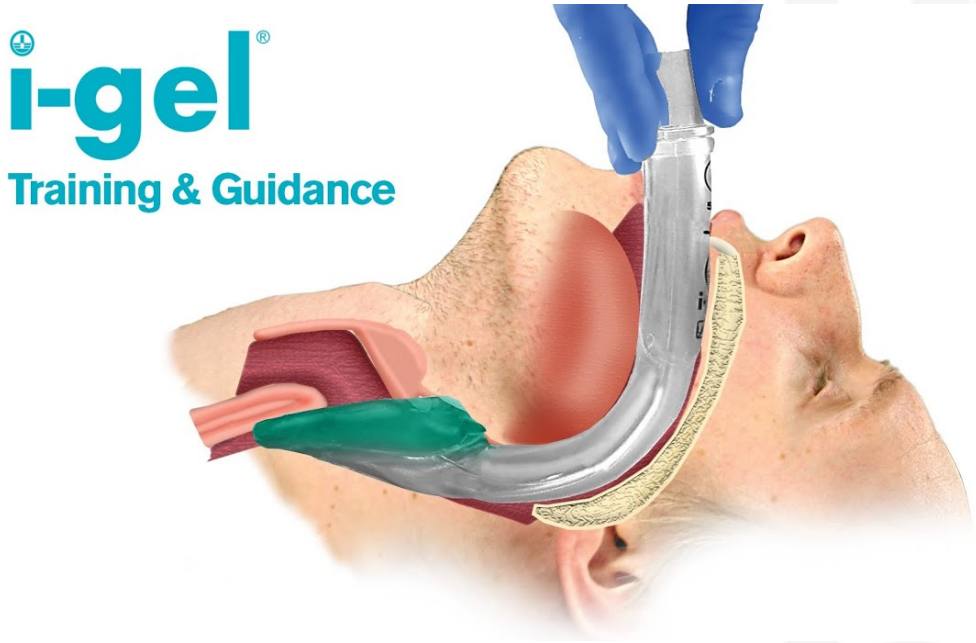
Basic Airway Management: BLS providers should not suction the airway for longer than 10 seconds, as all interruptions in CPR should be limited to no longer than to 10 seconds. Ventilations should be just enough for chest rise and fail, breaths should not be adminsitered too quickly. Chest rise is the best indicator of effective bag mask ventilations. If BLS providers find it difficult to Bag Mask Ventilate the patient, they should reposition the head and attempt to insert an appropriately sized Oropharyngeal Airway or Nasopharyngeal Airway unless contraindicated by patient's condition. When an advanced airway is in place, compressions are continuous with no pause except to defibrillate. BLS and advanced providers should never drop the ambu bag to the side of the patient's face while pausing to defibrillate, as this could cause the advanced airway

to be dislodged. The provider should disconnect the ambu bag from the airway and step back while pausing to defibrillate, then reconnect to continue providing ventilation.

Advanced airway management: Advanced providers should also take care to limit interruption in CPR to 10 seconds, this includes the insertion of an advanced airway device. Providers should note the depth of placement of the advanced airway and document it in the patient's chart, as this depth can be an indicator of tube displacement. You can use the "D.O.P.E" mnemonic to aid in troubleshooting issues with placement of the tube or patient deterioration. D is Displacement, note the depth and check the tube placement each time the patient is moved. O is Obstructions such as mucous plug tube may need to be suctioned, P is Pneumothorax, and E is Equipment failure. In lieu of endotracheal tube, providers can use supraglottic airway devices; they are just as effective as endotracheal tubes, can measure exhaled carbon dioxide, and can be inserted with no visualizations or pause in compressions in less than 10 seconds. Also, keep in mind if basic airway measures are securing the airway, then there is no need to insert an advanced airway.

The "i-gel" - is a form of supraglottic airway that is easy to insert, can measure exhaled carbon dioxide and has access to the stomach via a hole to perform gastric decompression. The Provider can easily insert a nasogastric tube to perform gastric decompression.

(Example of supraglottic airway)



https://www.youtube.com/watch?v=ae1Yr0fbz98

Additionally, the "5 H's and 5 T's" are hallmark to cardiac arrest care and should be considered sooner rather than later; they represent the reversible causes of a cardiac arrest and are represented in the table below.

H's of ACLS

Causes	Signs	Treatment
Hypovolemia	-Rapid heart rate -Narrow QRS -Blood loss	-Obtain IO/IV Access -Administer fluid/blood -Use fluid challenge
Hypoxia/ Hypoxemia	-Slow heart rate -Cyanosis	-Ensure airway is open -Ventilate -Ensure oxygen supply is adequate
Hydrogen Ion Excess (Acidosis)	-Low amplitude QRS complex	-Atriel blood gas -Provide adequate ventilations -Sodium bicarbonate (metabolic)
Hypokalemia/ Hyperkalemia	-Flattened T waves & a U wave (Hypokalemia) -Peaked T waves & a widened QRS (Hyperkalemia)	-Ventilate (respiratory) -Sodium bicarbonate (metabolic)
Hypothermia	-Shivering -Previous exposure to cold temperatures	-Active warming measures -Temperature should be above 30°C

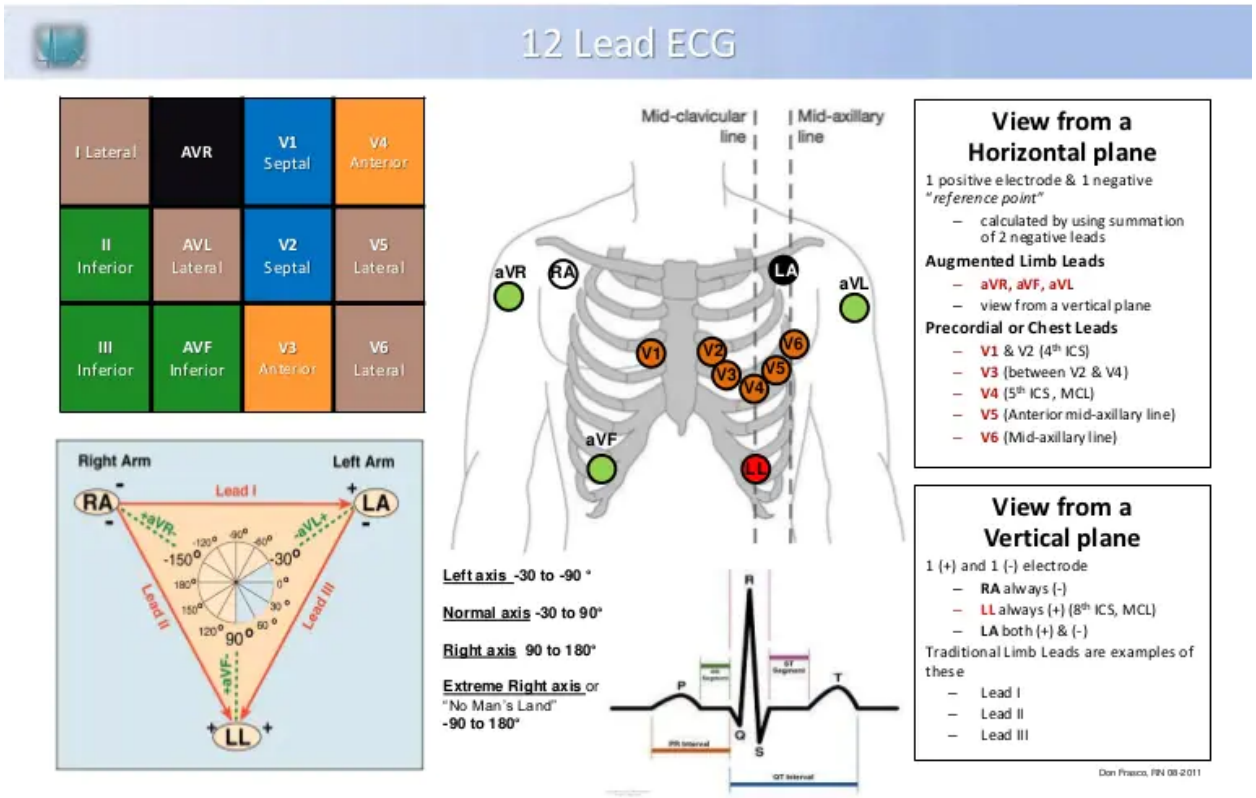
Hypoglycemia | Check and confirm POC Glucose, administer dextrose as indicated.

T's of ACLS

Causes	Signs	Treatment
Tamponade (Cardiac)	-Rapid heart rate -Narrow QRS -JVD -No pulse -Muffled heart sounds	-Pericardiocentesis -Thoracotomy
Toxins	-Prolonged QT interval	-Based on overdose agent -Supportive care
Tension Pneumothorax	-Slow heart rate -Narrow QRS -Unequal breathing -JVD -Tracheal deviation	-Needle decompression -Insertion of a chest tube
Thrombosis (Pulmonary)	-Rapid heart rate -Narrow QRS -Shortness of breath -Decreased oxygen -Chest pain	-Embolectomy -Fibrinolytic therapy -Anticoagulant therapy
Thrombosis (Coronary)	-Abnormal ECG	-Angioplasty -Stent placement -Coronary bypass surgery

12 Lead EKG Review:

Remember SALI, septal, anterior, lateral, and inferior



Septal ⭐v1 - v2 | Left anterior descending artery - septal branch

Anterior ⭐v3 - v4 | Left anterior descending artery - diagonal branch

Lateral⭐I, aVL, v5, v6 | left coronary artery - circumflex

Inferior wall ⭐ II, III, aVf | Right coronary artery

To review One small box on the ecg paper is 0.04 seconds, while one large box is 0.20 secs. (5 boxes) or the large red boxes. A Normal PR Interval should be less than 0.20 seconds (5 boxes) and a normal QRS should be less than 0.03 (3 boxes).

ECG Review (more in-depth)

ECG-Slide-Set.ppt
https://docs.google.com/presentation/d/1VOascirwG-B8j7KliyhkGXcGatfQLtuTVYgPilx6om4/edit?usp=sharing

HeartBlock Review

		ECG Description
Normal sinus rhythm		
1st degree heart block		PR > 0.20 sec All P waves conduct
2nd degree heart block Type I		Progressive prolongation of PR interval until QRS dropped
2nd degree heart block Type II		Constant PR interval
3rd degree heart block		Complete disruption of AV conduction

Treatment for high degree heart blocks is electrical pacing, note that atropine is not effective on high degree heart blocks. If electrical pacing is not available a vasopressor such as epinephrine or dopamine can be administered and titrated to effect.

IO Insertion - IO Insertion in the child/infant should be attempted after one unsuccessful attempt as peripheral IV access. An IO site that should be avoided is the sternum, as this will interfere with chest compressions.

Pediatric Color-Coded Length-Based Resuscitation Tape

Zone	3 kg	4 kg	5 kg	Pink	Red	Purple	Yellow	White	Blue	Orange	Green
ETT uncuffed (mm)	3.5	3.5	3.5	3.5	3.5	4.0	4.5	5.0	5.5	N/A	N/A
ETT cuffed (mm)	3.0	3.0	3.0	3.0	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Lip-tip (cm)	9-9.5	9.5-10	10-10.5	10-10.5	10.5-11	11-12	12.5-13.5	14-15	15.5-16.5	17-18	18.5-19.5
Suction (F)	8	8	8	8	8	8	10	10	10	10	12
L-scope blade	1 straight	1 straight	1 straight	1 straight	1 straight	1-1.5 straight	2 straight/ curved	2 straight/ curved	2 straight/ curved	2-3 straight/ curved	2-3 straight/ curved
Stylet	6 F	6 F	6 F	6 F	6 F	6 F	10 F	10 F	10 F	14 F	14 F
OPA (mm)	50	50	50	50	50	60	60	60	70	80	80
NPA (F)	14	14	14	14	14	18	20	22	24	26	26
Bag-mask device (minimum mL)	450	450	450	450	450	450	450	450-750	750-1000	750-1000	1000
$ETCO_2$ detector	Ped	Ped	Ped	Ped	Ped	Ped	Ped	Adult	Adult	Adult	Adult
LMA	1	1	1	1.5	1.5	2	2	2	2-2.5	2.5	3
Tidal volume (mL)	20-30	24-40	30-50	40-65	50-85	65-105	80-130	100-165	125-210	160-265	200-330
Frequency	20-25/min	20-25/min	20-25/min	20-25/min	20-25/min	15-25/min	15-25/min	15-25/min	12-20/min	12-20/min	12-20/min

Abbreviations: ETT, endotracheal tube; F, French; LMA, laryngeal mask airway; NPA, nasopharyngeal airway; OPA, oropharyngeal airway; Ped, pediatric.
Adapted from Broselow™ Pediatric Emergency Tape. Distributed by Armstrong Medical Industries Inc., Lincolnshire, IL. Copyright 2019 Vital Signs Inc. Courtesy and © Becton, Dickinson and Company. Reprinted with permission.

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.

20-1118 10/20 ISBN 978-1-61669-784-6 Printed in the USA

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

Doses/Details for the 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).

Drug therapy *(continued)*

- **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

Estimating Endotracheal Tube Size

The formula for estimation of proper endotracheal tube size (internal diameter [i.d.]) for children 2 to 10 years of age, based on the child's age:

Uncuffed endotracheal tube size (mm i.d.) = (age in years/4)+4

The formula for estimation of a cuffed endotracheal tube size is as follows:

Cuffed endotracheal tube size (mm i.d.) = (age in years/4)+3.5

Typical cuffed inflation pressure should be <20 to 25 cm H_2O.

Pharmacology Review (more in depth)

Pharm-Slide-Set.ppt

https://docs.google.com/presentation/d/14mZJCBL2JZdjYd9Ru5MJtZun9rIhkDuWouTEuSogBNI/edit?usp=sharing

Videos to Review

Physio-Control LUCAS 3 Chest Compression System - Prehospital Use

https://www.youtube.com/watch?v=bIE-sj45DIY

Arrow® EZ-IO® System - Proximal Tibia Site Identification/Insertion (Infant/Child, Animation)

https://www.youtube.com/watch?v=99DVtJSKi6k

Online ECG Simulator

https://www.skillstat.com/tools/ecg-simulator/

The American Heart Association strongly promotes knowledge and proficiency in BLS, ACLS and PALS and has developed instructional materials for this purpose. Use of these materials in an educational course does not represent course sponsorship by the AHA. Any fees charged for such a course, except for a portion of fees needed for AHA materials, do not represent income to the Association.

Prepared by Candice Perez, AAS, NR-P
published Sep 5, 2021

References

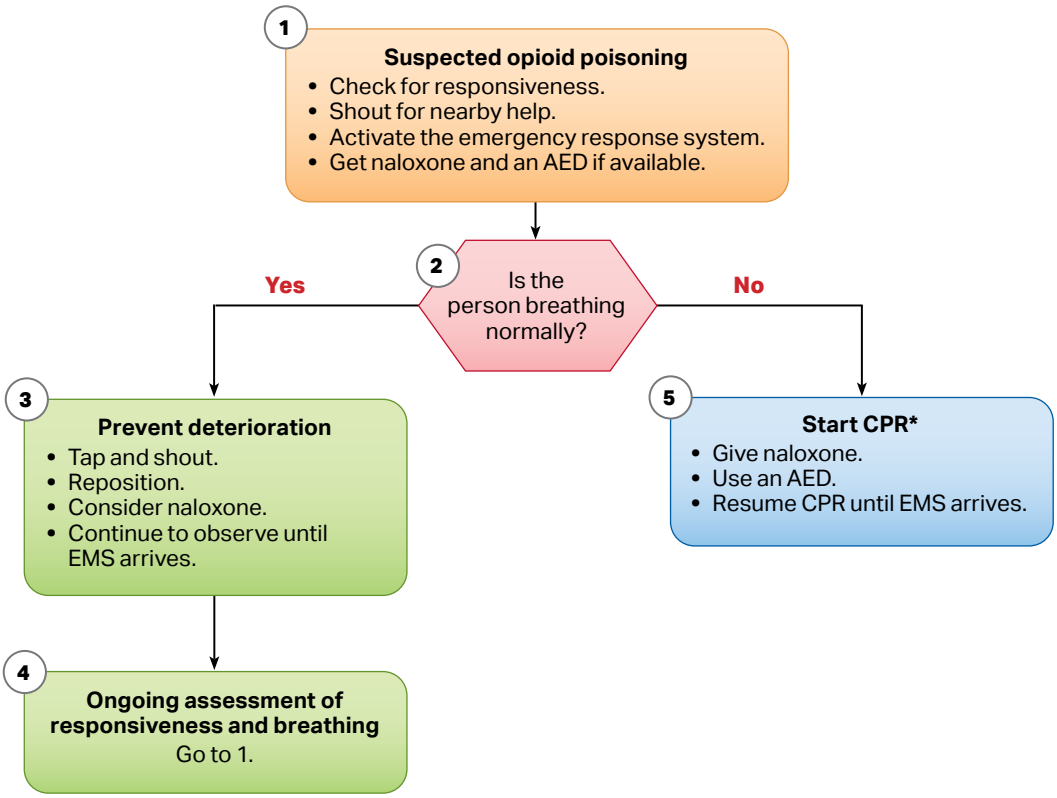
Advanced Cardiovascular Life Support: Provider Manual. American Heart Association, 2020.

Pediatric Advanced Life Support: Provider Manual. American Heart Association, 2020.

Advanced Trauma Life Support: Student Course Manual. American College of Surgeons, 2020.

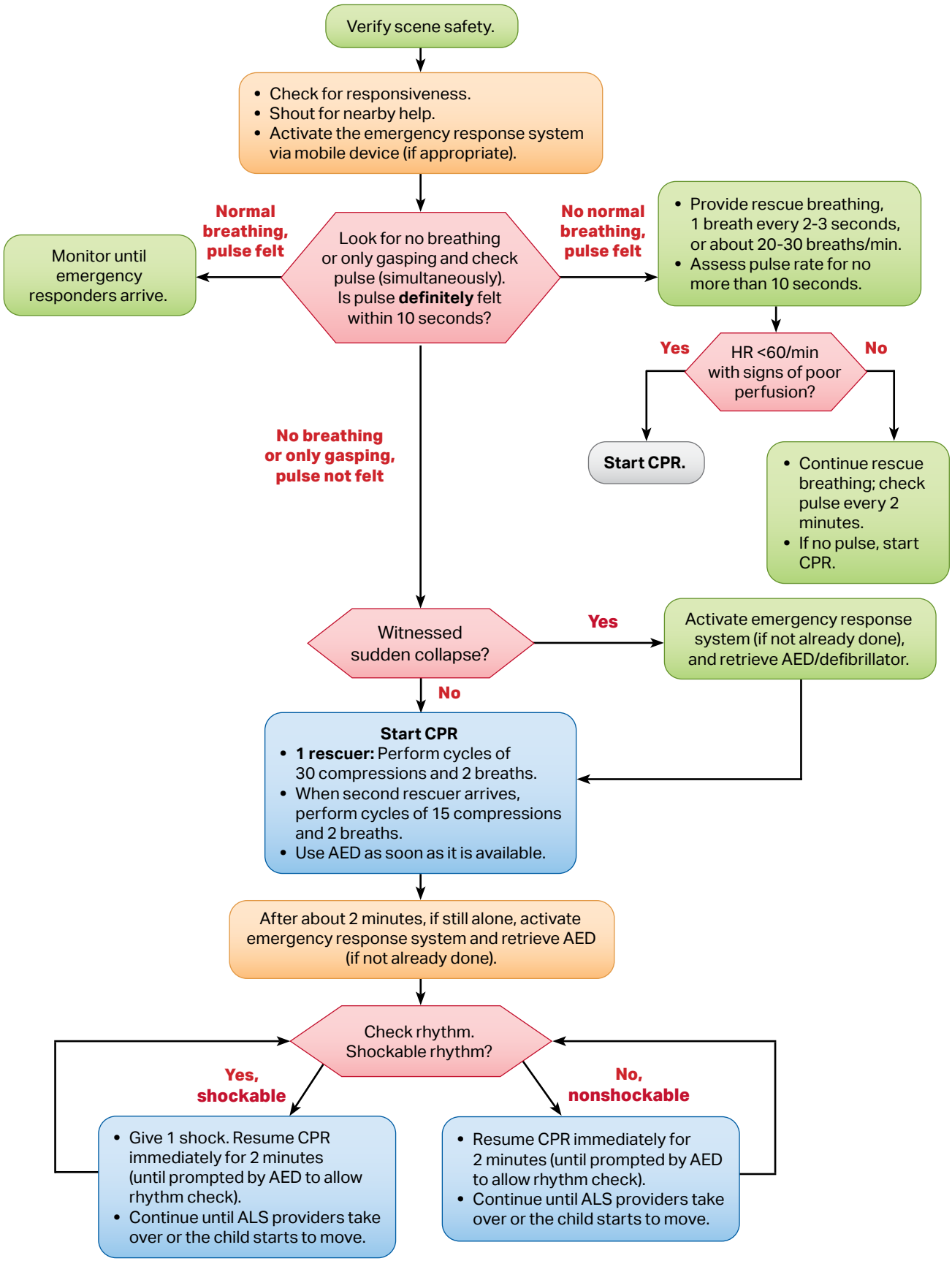
"American Heart Association." *Www.heart.org*, www.heart.org/.

Opioid-Associated Emergency for Lay Responders Algorithm

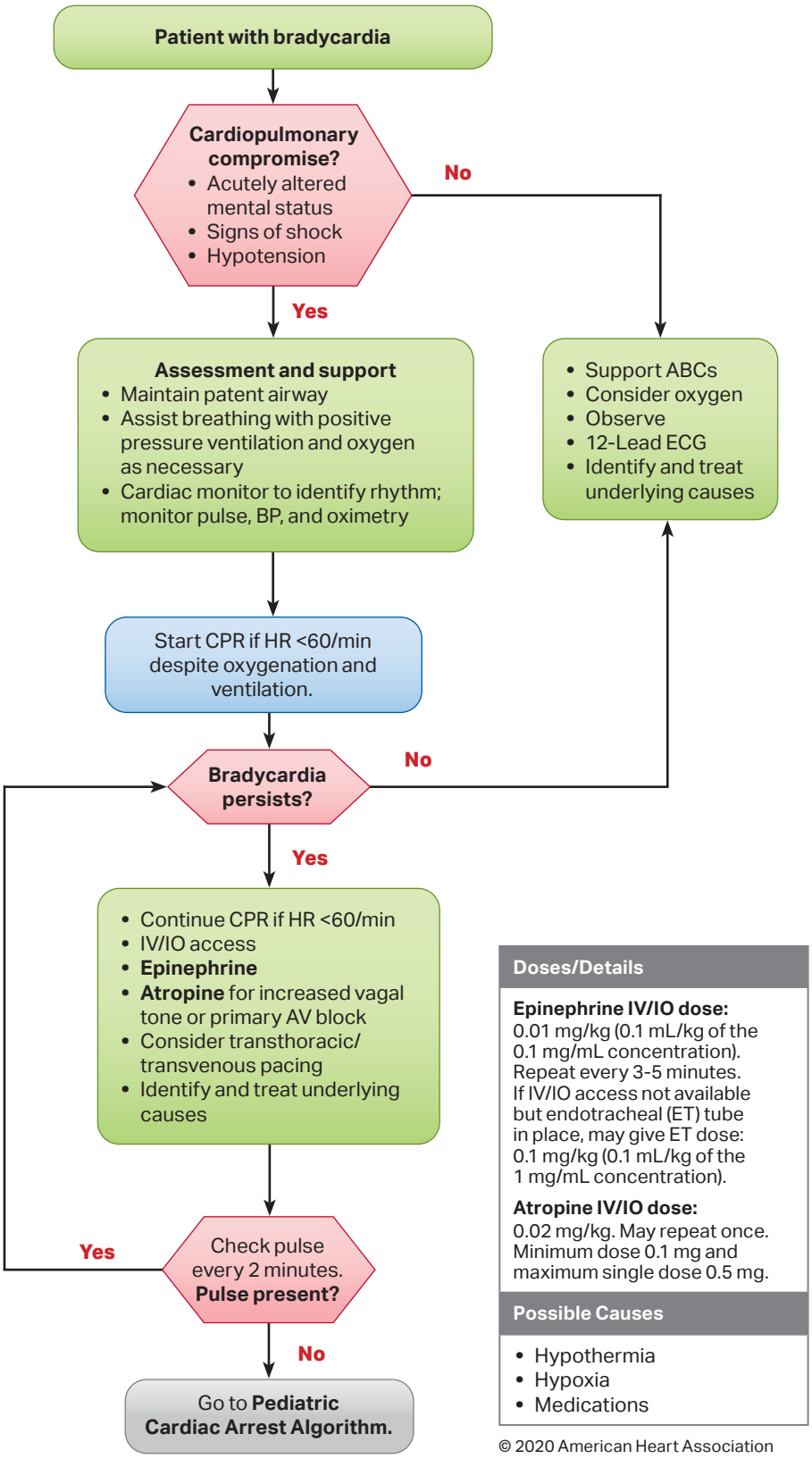


*For adult and adolescent victims, responders should perform compressions and rescue breaths for opioid-associated emergencies if they are trained and perform Hands-Only CPR if not trained to perform rescue breaths. For infants and children, CPR should include compressions with rescue breaths.

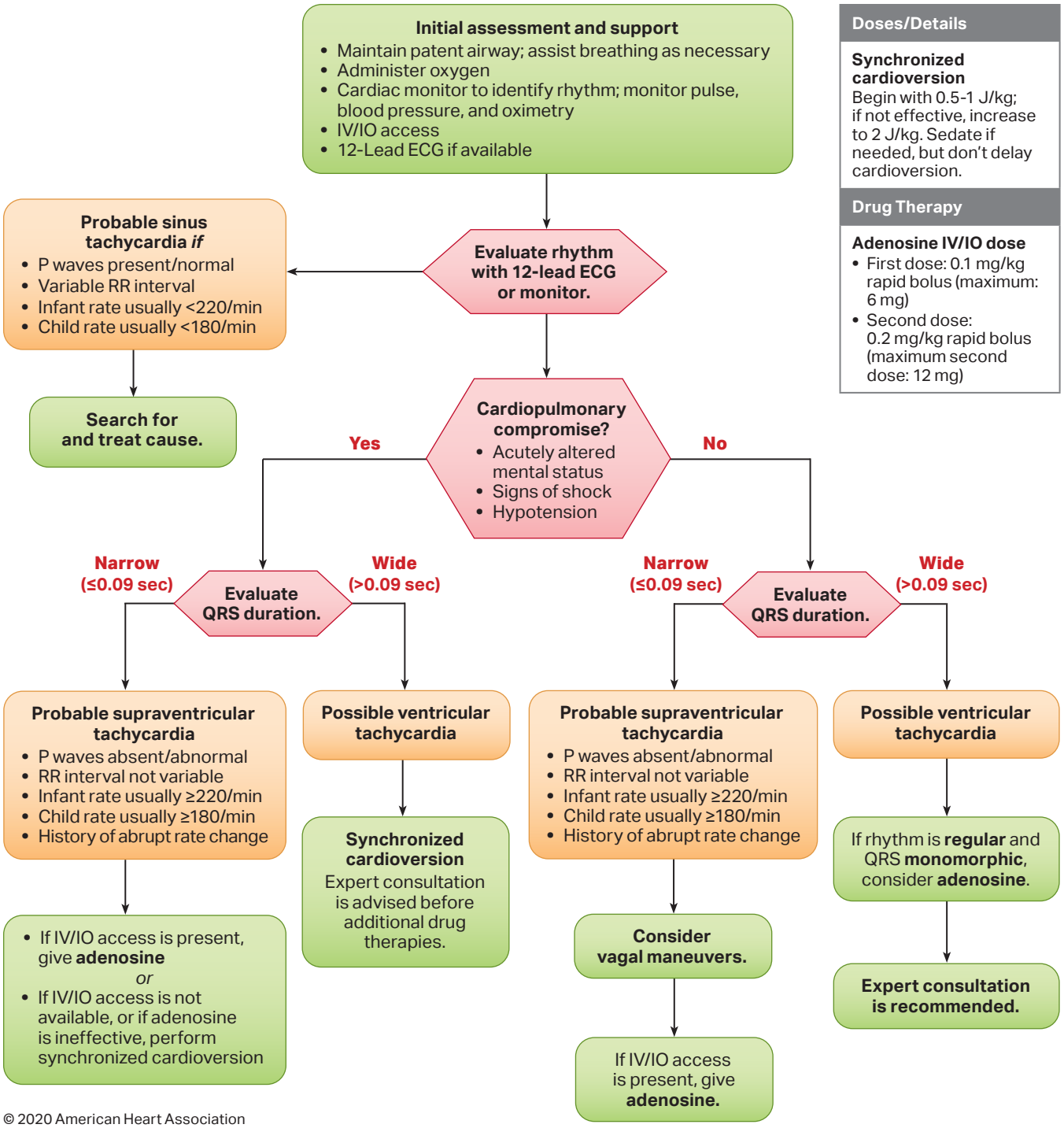
Pediatric Basic Life Support Algorithm for Healthcare Providers—Single Rescuer



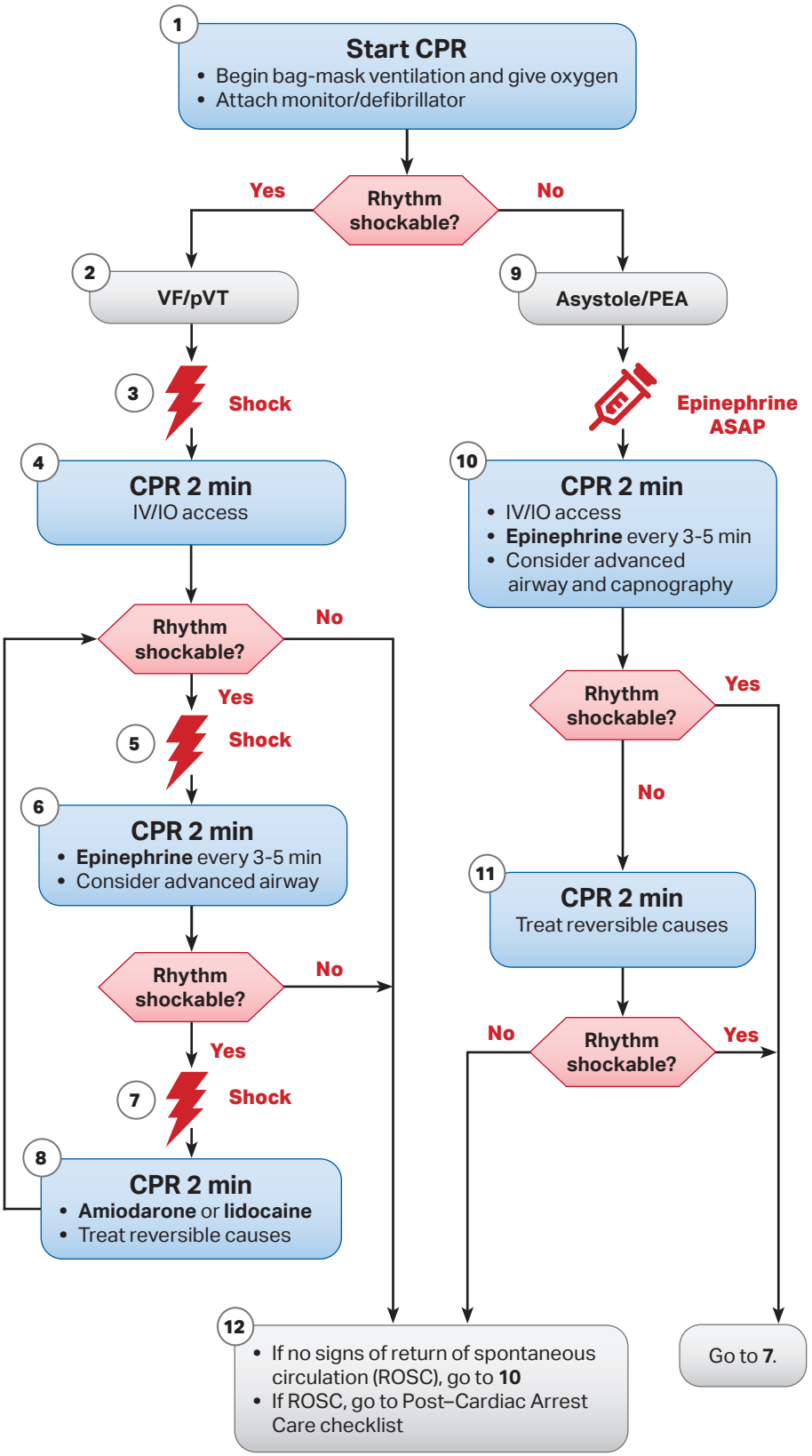
Pediatric Bradycardia With a Pulse Algorithm



Pediatric Tachycardia With a Pulse Algorithm



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

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.	☐

IN ASSOCIATION WITH:

EMS Training LLC

NOVEMBER 15-18, 2021
0800 - 1700 EST

IA MED

FLIGHT MEDICAL PROVIDER™ COURSE

EMS TRAINING LLC

CUSTOM-BUILT VIRTUAL LIVESTREAM COURSE
HTTPS://EMSTRAININGNY.COM/COURSE/FLIGHT-MEDICAL-PROVIDER/

100 ACCREDITED CEUS
Recertify state licenses and NREMT/IBSC/BCEN

SCAN QR CODE TO LEARN MORE & REGISTER TODAY!

FP-C®/CFRN®/CCP-C®
Test preparation designed to help you pass the first time!

EXCELL YOUR CAREER
Earn more, fast track your promotion, and get hired!

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

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>