

HIGHLIGHTS AT A GLANCE

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1. Algorithms and Visual Aids

- A sixth link, Recovery, was added to the In-Hospital Cardiac Arrest (IHCA) and Out-of-Hospital Cardiac Arrest (OHCA) Chains of Survival.
- The universal Adult Cardiac Arrest Algorithm was modified to emphasize the role of early epinephrine administration for patients with nonshockable rhythms.
- Two new Opioid-Associated Emergency Algorithms have been added for lay rescuers and trained rescuers.
- The Post-Cardiac Arrest Care Algorithm was updated to emphasize the need to prevent hyperoxia, hypoxemia, and hypotension.
- A new diagram has been added to guide and inform neuroprognostication.
- A new Cardiac Arrest in Pregnancy Algorithm has been added to address these special cases.
- A new pediatric Chain of Survival was created for IHCA in infants, children, and adolescents.
- A sixth link, Recovery, was added to the pediatric OHCA Chain of Survival and is included in the new pediatric IHCA Chain of Survival.
- The Pediatric Cardiac Arrest and Pediatric Bradycardia With a Pulse Algorithms have been updated to reflect the latest science.
- The single Pediatric Tachycardia With a Pulse Algorithm now covers both narrow- and wide-complex tachycardias in pediatric patients.
- A new checklist is provided for pediatric post-cardiac arrest care.

2. Systems of Care

Using Mobile Devices to Summon Rescuers

- The use of mobile phone technology by emergency dispatch systems to alert willing bystanders to nearby events that may require CPR or AED use is reasonable.

Data Registries to Improve System Performance

- It is reasonable for organizations that treat cardiac arrest patients to collect processes-of-care data and outcomes.

3. Adult Basic Life Support and CPR quality :

Lay Rescuer CPR

Early Initiation of CPR by Lay Rescuers

- We recommend that laypersons initiate CPR for presumed cardiac arrest because the risk of harm to the patient is low if the patient is not in cardiac arrest.

Debriefings for Rescuers

- Debriefings and referral for follow up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.

Health Care Providers BLS

Real-Time Audiovisual Feedback

- It may be reasonable to use audiovisual feedback devices during CPR for real-time optimization of CPR performance.

Debriefings for Rescuers

- Debriefings and referral for follow up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.

4. Adult Advanced Cardiovascular Life Support

Early Administration of Epinephrine

- With respect to timing, for cardiac arrest with a nonshockable rhythm, it is reasonable to administer epinephrine as soon as feasible.
- With respect to timing, for cardiac arrest with a shockable rhythm, it may be reasonable to administer epinephrine after initial defibrillation attempts have failed.

Real-Time Audiovisual Feedback

- It may be reasonable to use audiovisual feedback devices during CPR for real-time optimization of CPR performance.

Physiologic Monitoring of CPR Quality

- It may be reasonable to use physiologic parameters such as arterial blood pressure or ETCO₂ when feasible to monitor and optimize CPR quality.

Double Sequential Defibrillation Not Supported

- The usefulness of double sequential defibrillation for refractory shockable rhythm has not been established.

IV Access Preferred Over IO

- It is reasonable for providers to first attempt establishing IV access for drug administration in cardiac arrest.
- IO access may be considered if attempts at IV access are unsuccessful or not feasible.

Post-Cardiac Arrest Care and Neuroprognostication

- We recommend that cardiac arrest survivors have multimodal rehabilitation assessment and treatment for physical, neurologic, cardiopulmonary, and cognitive impairments before discharge from the hospital.
- We recommend that cardiac arrest survivors and their caregivers receive comprehensive, multidisciplinary discharge planning, to include medical and rehabilitative treatment recommendations and return to activity/work expectations.
- We recommend structured assessment for anxiety, depression, posttraumatic stress, and fatigue for cardiac arrest survivors and their caregivers.

Debriefings for Rescuers

- Debriefings and referral for follow up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.

Cardiac Arrest in Pregnancy

- Because pregnant patients are more prone to hypoxia, oxygenation and airway management should be prioritized during resuscitation from cardiac arrest in pregnancy.
- Because of potential interference with maternal resuscitation, fetal monitoring should not be undertaken during cardiac arrest in pregnancy.
- We recommend targeted temperature management for pregnant women who remain comatose after resuscitation from cardiac arrest.
- During targeted temperature management of the pregnant patient, it is recommended that the fetus be continuously monitored for bradycardia as a potential complication, and obstetric and neonatal consultation should be sought.

5. Pediatric Basic Life Support

Changes to the Assisted Ventilation Rate: Rescue Breathing

- 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).

Opioid Overdose

- 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.
- 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.
- 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).

Debriefings for Rescuers

- Debriefings and referral for follow up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.

6. Pediatric Advanced Life Support

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

- 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.

Cuffed ETTs

- 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 H₂O).

Cricoid Pressure During Intubation

- Routine use of cricoid pressure is not recommended during endotracheal intubation of pediatric patients.

Emphasis on Early Epinephrine Administration

- 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.

Invasive Blood Pressure Monitoring to Assess CPR Quality

- 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.

Detecting and Treating Seizures After ROSC

- When resources are available, continuous electroencephalography monitoring is recommended for the detection of seizures following cardiac arrest in patients with persistent encephalopathy.
- It is recommended to treat clinical seizures following cardiac arrest.
- It is reasonable to treat nonconvulsive status epilepticus following cardiac arrest in consultation with experts.

Evaluation and Support for Cardiac Arrest Survivors

- It is recommended that pediatric cardiac arrest survivors be evaluated for rehabilitation services.
- It is reasonable to refer pediatric cardiac arrest survivors for ongoing neurologic evaluation for at least the first year after cardiac arrest.

Fluid Boluses

- In patients with septic shock, it is reasonable to administer fluid in 10 mL/kg or 20 mL/kg aliquots with frequent reassessment.

Choice of Vasopressor

- In infants and children with fluid-refractory septic shock, it is reasonable to use either epinephrine or norepinephrine as an initial vasoactive infusion.
- In infants and children with fluid-refractory septic shock, if epinephrine or norepinephrine are unavailable, dopamine may be considered.

Corticosteroid Administration

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

Hemorrhagic Shock

- 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.

Opioid Overdose

- 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.
- 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.
- 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).

Myocarditis

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

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

- 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.

- 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 (DO₂).
- ECLS after stage I Norwood palliation can be useful to treat low systemic DO₂.
- 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.
- For neonates prior to stage I repair with pulmonary overcirculation and symptomatic low systemic cardiac output and DO₂, it is reasonable to target a Paco₂ 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.

Single Ventricle: Recommendations for the Treatment of Postoperative Stage II (Bidirectional Glenn/Hemi-Fontan) and Stage III (Fontan) Palliation Patients

- For patients in a prearrest state with superior cavopulmonary anastomosis physiology and severe hypoxemia due to inadequate pulmonary blood flow (Q_p), ventilatory strategies that target a mild respiratory acidosis and a minimum mean airway pressure without atelectasis can be useful to increase cerebral and systemic arterial oxygenation.
- ECLS in patients with superior cavopulmonary anastomosis or Fontan circulation may be considered to treat low DO₂ from reversible causes or as a bridge to a ventricular assist device or surgical revision.

Pulmonary Hypertension

- Inhaled nitric oxide or prostacyclin should be used as the initial therapy to treat pulmonary hypertensive crises or acute right-sided heart failure secondary to increased pulmonary vascular resistance.
- Provide careful respiratory management and monitoring to avoid hypoxia and acidosis in the postoperative care of the child with pulmonary hypertension.
- For pediatric patients who are at high risk for pulmonary hypertensive crises, provide adequate analgesics, sedatives, and neuromuscular blocking agents.

- For the initial treatment of pulmonary hypertensive crises, oxygen administration and induction of alkalosis through hyperventilation or alkali administration can be useful while pulmonary-specific vasodilators are administered.
- For children who develop refractory pulmonary hypertension, including signs of low cardiac output or profound respiratory failure despite optimal medical therapy, ECLS may be considered.

Debriefings for Rescuers

- Debriefings and referral for follow up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.

7. Neonatal Resuscitation

Anticipation of Resuscitation Need

- Every birth should be attended by at least 1 person who can perform the initial steps of newborn resuscitation and initiate PPV and whose only responsibility is the care of the newborn.

Temperature Management for Newly Born Infants

- Placing healthy newborn infants who do not require resuscitation skin-to-skin after birth can be effective in improving breastfeeding, temperature control, and blood glucose stability.

Clearing the Airway When Meconium Is Present

- For nonvigorous newborns (presenting with apnea or ineffective breathing effort) delivered through MSAF, routine laryngoscopy with or without tracheal suctioning is not recommended.
- For nonvigorous newborns delivered through MSAF who have evidence of airway obstruction during PPV, intubation and tracheal suction can be beneficial.

Vascular Access

- For babies requiring vascular access at the time of delivery, the umbilical vein is the recommended route. If IV access is not feasible, it may be reasonable to use the IO route.

Termination of Resuscitation

- In newly born babies receiving resuscitation, if there is no heart rate and all the steps of resuscitation have been performed, cessation of resuscitation efforts should be discussed with the healthcare team and the family. A reasonable time frame for this change in goals of care is around 20 minutes after birth.

Human and System Performance

- For participants who have been trained in neonatal resuscitation, individual or team booster training should occur more frequently than every 2 years at a frequency that supports retention of knowledge, skills, and behaviours.

Debriefings for Rescuers

- Debriefings and referral for follow up for emotional support for lay rescuers, EMS providers, and hospital-based healthcare workers after a cardiac arrest event may be beneficial.

8. Education

Deliberate Practice and Mastery Learning

- Incorporating a deliberate practice and mastery learning model into basic or advanced life support courses may be considered for improving skill acquisition and performance.

Booster Training and Spaced Learning

- It is recommended to implement booster sessions when utilizing a massed-learning approach for resuscitation training.
- It is reasonable to use a spaced-learning approach in place of a massed-learning approach for resuscitation training.

Lay Rescuer Training

- A combination of self-instruction and instructor-led teaching with hands-on training is recommended as an alternative to instructor-led courses for lay rescuers. If instructor-led training is not available, self-directed training is recommended for lay rescuers.
- It is recommended to train middle (Jr. High) school- and high school-age children in how to perform high-quality CPR.

In Situ Education

- It is reasonable to conduct in situ simulation-based resuscitation training in addition to traditional training.
- It may be reasonable to conduct in situ simulation-based resuscitation training in place of traditional training.

Gamified Learning and Virtual Reality

- The use of gamified learning and virtual reality may be considered for basic or advanced life support training for lay rescuers and/or healthcare providers.

Opioid Overdose Training for Lay Rescuers

- It is reasonable for lay rescuers to receive training in responding to opioid overdose, including provision of naloxone.

Disparities in Education

- It is recommended to target and tailor layperson CPR training to specific racial and ethnic populations and neighborhoods in the United States and Canada.
- It is reasonable to address barriers to bystander CPR for female victims through educational training and public awareness efforts.

EMS Practitioner Experience and Exposure to Out-of-Hospital Cardiac Arrest

- It is reasonable for EMS systems to monitor clinical personnel's exposure to resuscitation to ensure treating teams have members competent in managing cardiac arrest cases. Competence of teams may be supported through staffing or training strategies.

ACLS Course Participation

- It is reasonable for healthcare professionals to take an adult ACLS course or equivalent training.

Willingness to Perform Bystander CPR

- It is reasonable to increase bystander willingness to perform CPR through CPR training, mass CPR training, CPR awareness initiatives, and promotion of Hands-Only CPR.

9. First Aid

Stroke Recognition

- To recognize a possible stroke, first aid providers can use the signs of weakness in the face (eg, droop), arm or grip on one side of the body, or speech disturbance and should activate emergency services as quickly as possible if any of these signs are present.

Aspirin for Adults With Nontraumatic Chest Pain

- While awaiting the arrival of emergency medical services, first aid providers may encourage alert adults experiencing nontraumatic chest pain to chew and swallow aspirin unless the person experiencing pain has a known aspirin allergy or has been advised by a healthcare provider not to take aspirin.

Control of Life-Threatening Bleeding

- A manufactured tourniquet should be used as first-line therapy for life-threatening extremity bleeding and should be placed as soon as possible after the injury.
- If a manufactured tourniquet is not immediately available, or if a properly applied manufactured tourniquet fails to stop bleeding, direct manual pressure, with the use of a hemostatic dressing if available, should be used to treat life-threatening extremity bleeding.

- For individuals with life-threatening external bleeding, direct manual pressure should be applied to achieve initial bleeding cessation for wounds not amenable to a manufactured tourniquet or when a manufactured tourniquet is not immediately available.
- If a hemostatic dressing is available, it can be useful as adjunctive therapy to direct manual pressure for the treatment of life-threatening external bleeding.

Cooling Techniques for Exertional Hyperthermia and Heatstroke

- For adults and children with exertional hyperthermia or heatstroke, first aid providers should move the individual from the hot environment, remove excess clothing, limit exertion, and activate emergency services.
- For adults with exertional hyperthermia or heatstroke, it is reasonable to initiate immediate active cooling by using whole-body (neck down) cool- to cold-water immersion techniques (1°C to 26°C [33.8°F to 78.8°F]), when safe, until a core body temperature of less than 39°C (102.2°F) is reached or neurological symptoms resolve.
- For adults with exertional hyperthermia or heatstroke, it may be reasonable to initiate other forms of active cooling, including commercial ice packs, cold showers, ice sheets and towels, cooling vests and jackets, evaporative, fanning, or a combination of techniques when water immersion is not available.
- For children with exertional hyperthermia or heatstroke, it may be reasonable to initiate immediate active cooling by using whole-body (neck down) cool- to cold-water immersion techniques (1°C to 26°C [33.8°F to 78.8°F]), when safe, until a core body temperature of less than 39°C (102.2°F) is reached or neurological symptoms resolve.
- For children with exertional hyperthermia or heatstroke, it may be reasonable to initiate other forms of active cooling, including commercial ice packs, cold showers, ice sheets and towels, cooling vests and jackets, evaporative, fanning, or a combination when water immersion is not available.



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