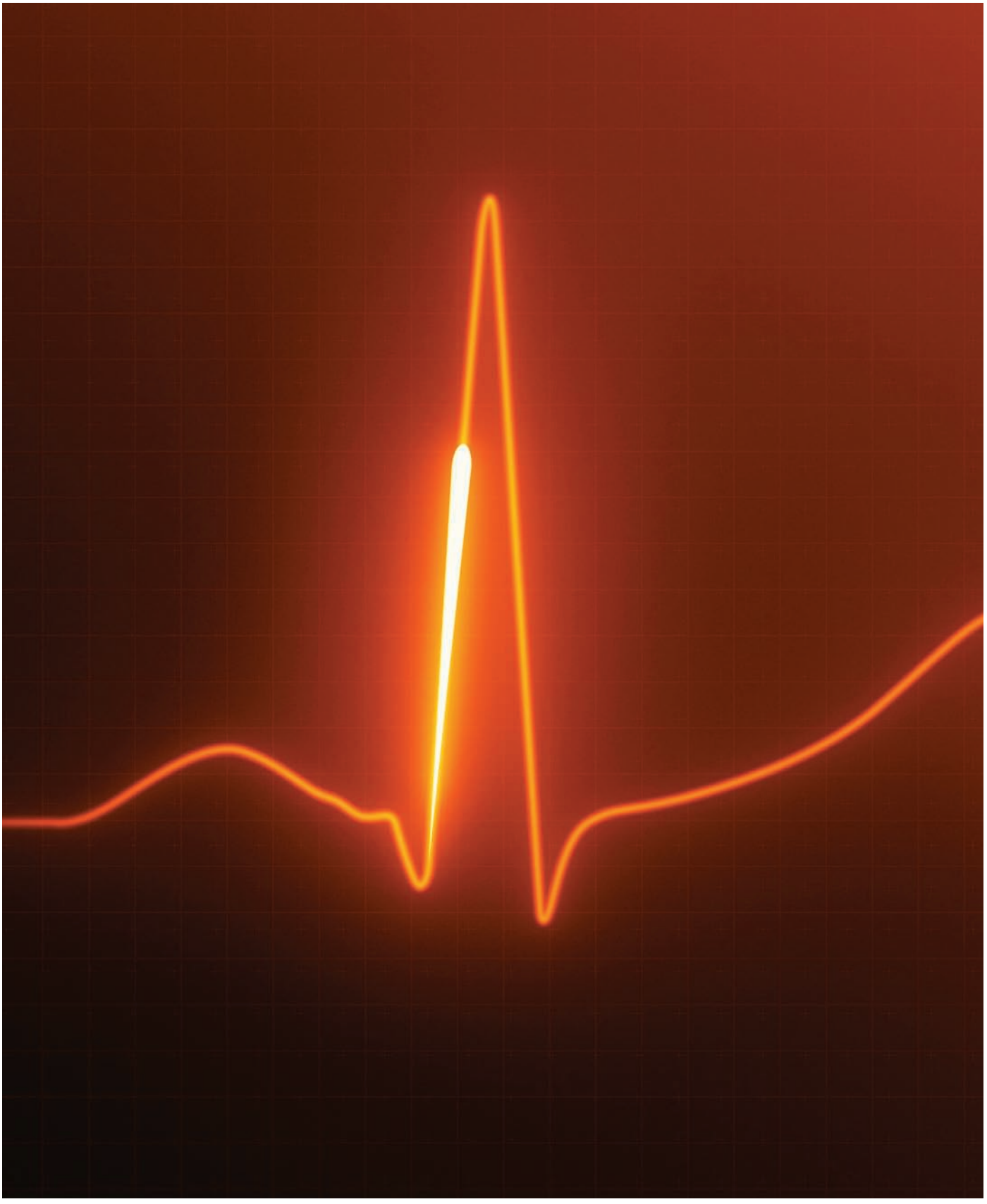

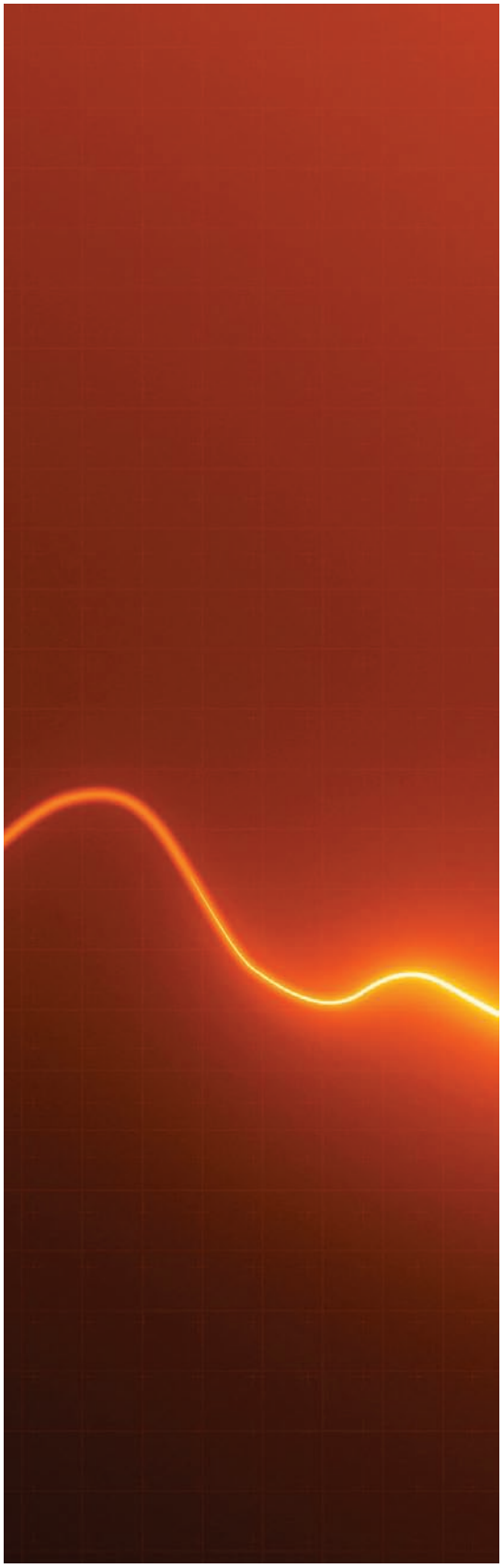

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AHA update: BLS, ACLS, and PALS

BY KAREN JEAN CRAIG-BRANGAN, BS, RN, EMT-P, AND MARY PATRICIA DAY, MSN, RN, CRNA

Abstract: The American Heart Association (AHA) recently released its 2020 guidelines for advanced cardiovascular life support, basic life support, and pediatric advanced life support. This article details these updates, as well as the latest AHA recommendations for CPR and emergency cardiovascular care.

Keywords: ACLS, advanced cardiovascular life support, AHA, American Heart Association, basic life support, BLS, CPR, ECC, emergency cardiovascular care, PALS, pediatric advanced life support

THE AMERICAN Heart Association (AHA) recently released updated guidelines for advanced cardiovascular life support (ACLS), basic life support (BLS), and pediatric advanced life support (PALS) for in- and out-of-hospital responses from both healthcare professionals and nonprofessionals. These were derived from a continuous review of the current research guidelines, including changes in the sequence of care, medication administration, and methods of education. This article discusses these changes, as well as the latest AHA recommendations for CPR and emergency cardiovascular care (ECC).

Adults: BLS

After verifying that the scene is safe, call for help and determine whether the patient is unresponsive, check his or her pulse, and confirm absent or abnormal breathing patterns such as agonal or gasping respirations. To minimize delay in initiation of CPR, assess the patient's breathing and perform a carotid pulse check simultaneously, taking at least 5 seconds but no longer than 10. If a pulse is not detected, assume the patient is experiencing a cardiac arrest.[1]

Once cardiac arrest has been identified, the emergency response system should be activated, the code team alerted, and CPR initiated promptly. Start by providing chest compressions and ventilation in cycles with a ratio of 30 compressions to 2 ventilations. For adult patients, compressions should be hard (at least 2 in in depth, not to exceed 2.4 in) and fast (maintaining a rate of 100/min to 120/min). Allow for complete recoil of the chest.[1] If the patient is not breathing but has a pulse, initiate rescue breathing at a rate of 1 breath every 6 seconds or 10 breaths/min. Remember that gasping and/or irregular or agonal respirations are not considered breathing.[2]

Outside of the healthcare setting, lay rescuers are individuals who have not received formal emergency

care training.[3] Lay rescuers should confirm cardiac arrest based on patient unresponsiveness and breathing patterns, such as the absence of breathing and irregular or gasping respirations. To avoid delaying the initiation of CPR, lay rescuers do not perform pulse checks and may provide compression-only CPR.[2]

CPR quality

During CPR, continuous quantitative waveform capnography can provide an indirect assessment of the patient's cardiac output during chest compressions, measured as end-tidal carbon dioxide ($EtCO_2$). Waveform capnography provides information regarding the quality of CPR. An $EtCO_2$ level greater than 10 mm Hg suggests that high-quality CPR is being provided, while an $EtCO_2$ level less than 10 mm Hg suggests that the quality of CPR should be reassessed. The $EtCO_2$ level also enables healthcare teams to confirm and monitor endotracheal tube placement. With a return of spontaneous circulation (ROSC), the $EtCO_2$ level will abruptly increase to 35 mm Hg to 40 mm Hg.[4]

An $EtCO_2$ level below 10 mm Hg during chest compressions is rarely associated with ROSC. However, the nurse should attempt to improve $EtCO_2$ by improving the quality of CPR. Similarly, intra-arterial diastolic pressures can be used to monitor CPR quality. If monitoring is available and a patient's intra-arterial diastolic pressure is less than 20 mm Hg, which is rarely associated with ROSC during chest compressions, the nurse should attempt to improve the quality of CPR.[4]

The updated AHA guidelines recommend assigning a CPR coach in cardiac arrest response teams. Ongoing CPR coaching can help facility resuscitation teams provide high-quality CPR. The CPR coach's goal is to minimize pauses in compressions during defibrillation, compressor switches, and/or advanced airway placement. They work with healthcare team leaders by coordinating the start of CPR, coaching to improve quality and compression rate, communicating with team members, and providing feedback regarding the ventilation-to-compression ratio and ventilation rate and volume.[1] Additionally, real-time audiovisual feedback devices can offer insight on compression depth, recoil, and rate to encourage optimal and high-quality CPR efforts.[5,6]

The updated AHA guidelines also recommend formal debriefing. Debriefing describes a postevent communication involving two or more participating healthcare professionals. It contributes to improved resuscitative efforts by allowing time to discuss the resuscitation effort and why certain interventions were initiated and helping to identify strategies for improvement in the future.[1,5]

Once cardiac arrest has been identified, the emergency response system should be activated, the code team alerted, and CPR initiated promptly.

Automated external defibrillators

Automated external defibrillators (AEDs), another critical component to patient survival, allow clinicians to assess and intervene during ventricular fibrillation (VF) and pulseless ventricular tachycardia (pVT). When the device arrives, follow these universal steps for operation:[1]

- Open the carrying case and power on the AED.
- Attach the defibrillator pads to the patient's bare chest, avoiding any implanted devices and medication patches.
- Remain clear while the device analyzes rhythm and delivers a shock as needed.
- Starting with compressions, resume CPR if no shock is advised or after one has been delivered. If indicated after 5 cycles or 2 minutes of CPR, the AED will prompt a repeat analysis and shock.
- Continue until the arrival of ACLS-educated healthcare professionals.

Recovery

The adult *chain of survival* describes a sequence of critical interventions. Patient survival becomes less likely when one element in the sequence is skipped.[7] The chain of survival originally consisted of five tasks, or links. The 2020 AHA guidelines added *recovery* as the sixth link applicable to both out-of-hospital cardiac arrests (OHCA) and in-hospital cardiac arrests (IHCA).

Recovery describes the period from the end of acute treatments to rehabilitation and ends once patients are discharged home following cardiac arrest. It also functions to address the needs of patients and their families. This link stresses the need for a system of care to support recovery, including patient assessments; expectation-setting; treatment plans

for depression, anxiety, and/or fatigue; and plans for surveillance and rehabilitation as patients transition home.[2]

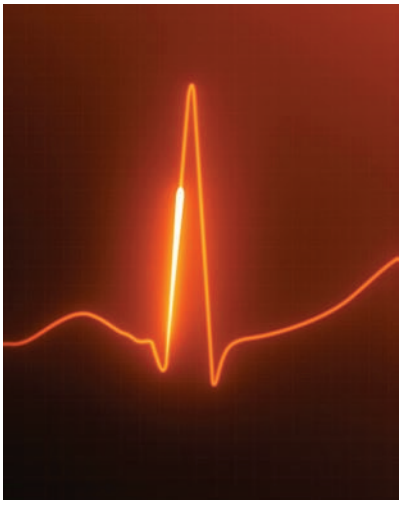
Adults: ACLS

In adults, ACLS care continues to stress high-quality CPR, accurate heart rhythm diagnosis, appropriate use of defibrillation for VF and pVT, I.V. access, and the administration of appropriate medications. Specifically, medication administration via peripheral I.V. access is initially recommended. If this is unsuccessful or not feasible, intraosseous (I.O.) routes may be considered.[8]

The 2020 AHA guidelines recommend the administration of I.V./I.O. epinephrine to treat nonshockable cardiac arrest rhythms as soon as possible, and it may also be administered to patients with shockable cardiac arrest rhythms (VF/pVT) after two defibrillation attempts have failed.[9] The guidelines do not recommend the administration of I.V./I.O. vasopressin in place of or in addition to I.V./I.O. epinephrine, however, nor is the routine administration of I.V./I.O. sodium bicarbonate, steroids, or magnesium recommended.[8]

In adults who are experiencing refractory VF or pVT, either 300 mg I.V./I.O. amiodarone with a possible second dose of 150 mg or 1 mg/kg to 1.5 mg/kg I.V./I.O. lidocaine with a possible second dose of 0.5 mg/kg to 0.75 mg/kg may be recommended. These medications may be administered in addition to the identification and appropriate treatment of reversible causes of cardiac arrest, according to the H's (hypovolemia, hypoxemia, hydrogen ion [acidosis], hypothermia, and hyper- and/or hypokalemia) and T's (toxins, cardiac tamponade, tension pneumothorax, and thrombosis [myocardial infarction or pulmonary embolism]).[2,10]

Airway management strategies for these patients may include a bag-mask device or advanced options, such as supraglottic airways (SGAs)



The chain of survival originally consisted of five tasks, but the 2020 AHA guidelines added a sixth: recovery.

or endotracheal tubes (ETTs). For clinicians with limited experience in ETT placement, SGAs should be considered. Waveform capnography is recommended to confirm and continuously monitor ETT placement, in addition to clinical assessment. Once an advanced airway has been placed, ventilations should continue at a rate of 1 breath every 6 seconds or 10 breaths/min.[2]

In adults, symptomatic bradycardia is treated with an initial dose of atropine 1 mg I.V./I.O., which can be repeated every 3 to 5 minutes to a maximum dose of 3 mg. If the patient requires a I.V./I.O. dopamine infusion, the AHA now recommends a rate of 5 to 20 mcg/kg/min. For adults with symptomatic tachycardia with a pulse, the AHA no longer recommends energy doses for synchronized electrical cardioversion; instead, nurses can defer to device-specific recommended energy levels to increase first-shock success rates.[4]

Additionally, the algorithm for adults experiencing acute coronary syndrome (ACS) is now divided into two categories: ST segment elevation myocardial infarction and non-ST segment elevation ACS. The recommended timeline from a patient's initial contact with a healthcare professional to balloon inflation during percutaneous coronary intervention is 90 minutes or less.[4]

ROSC

For adults with ROSC who remain unresponsive, targeted temperature management (TTM) should be initiated promptly. A constant temperature range between 32° C (89.6° F) and 36° C (96.8° F) should be maintained for a minimum of 24 hours. The 2020 AHA guidelines recommend titrating the fraction of inspired oxygen (FiO_2) to achieve an oxygen saturation (SpO_2) between 92% and 98% to prevent hypoxemia in patients who remain comatose.[2]

Special circumstances in adults

When treating pregnant women experiencing cardiac arrest in the latter half of their pregnancy, the 2020 AHA guidelines emphasize high-quality CPR, aortocaval compression relief with left lateral uterine displacement, and the early delivery of the fetus within 5 minutes after the time of arrest.[4]

For adults who are experiencing a cardiac arrest during an opioid emergency, standard interventions such as high-quality CPR should take priority over naloxone administration. The AHA guidelines recommend that both lay and educated rescuers avoid delays in activating EMS while waiting for these patients to respond to naloxone.[2]

Pediatric patients: BLS

The 2020 AHA guidelines for BLS in pediatric patients apply to those between the ages of 1 year to puberty. Infant guidelines apply to those who are younger than 1 year. As with adults, verify that the scene is safe,

determine patient responsiveness, and assess breathing and pulse. Assessments for breathing and pulse should be conducted simultaneously to avoid delays in the initiation of high-quality CPR, taking at least 5 seconds but no longer than 10. Brachial pulse checks are recommended for infants, while carotid or femoral pulse checks are recommended in children. As with adults, children who are gasping and/or experiencing irregular or agonal respirations are not breathing.[1]

The pediatric BLS guidelines also recommend a compression-airway-breathing sequence. Lay and educated rescuers should press hard during compressions, reaching approximately one-third the depth of the patient's chest (about 1.5 in for infants and 2 in for children). If alone, single rescuers should call for help via emergency response or activate the emergency response system and alert the code team after 2 minutes of CPR and resume compressions. For infants, use either two thumbs with encircling hands or the two-finger technique.[1]

For infant compressions with two or more rescuers, however, two thumbs with encircling hands is the preferred technique. For child compressions, the rescuer may use the heel of one hand or the heels of both hands, depending on the child's size. Press fast and maintain a rate of 100 to 120 compressions/min, allowing for complete recoil of the chest.[1] The AHA recommends switching rescuers every 2 minutes or five cycles to avoid fatigue and minimize interruptions while performing compressions.[5] Maintain a compression/ventilation ratio of 30 compressions to 2 ventilations for one rescuer or 15 compressions to 2 ventilations for two rescuers.[11]

An AED should be used as soon as available. AED models vary.[11,12] Designed for both pediatric and adult patients, pediatric-capable

For adults who are experiencing a cardiac arrest during an opioid emergency, standard interventions should take priority over naloxone administration.

AEDs deliver a reduced shock when pediatric pads are used. Pediatric dose attenuators reduce the shock by two-thirds. Check the AED unit for a switch or a key that, when activated, will deliver a shock in a pediatric dose. Pediatric AED pads are typically used in infants and children under age 8 years. If they are unavailable, adult pads can be used. These deliver a higher energy dose, but it is better than no shock at all. When using pediatric pads, follow the manufacturer directions for placement. When using adult pads on pediatric patients, make sure they do not touch or overlap. One consideration for infants is anterior-posterior pad placement.[12]

For infants, manual defibrillators are preferred because they have more capabilities than AEDs and can deliver lower energy levels. If a manual defibrillator is unavailable, use an AED with a pediatric dose attenuator. If neither is available, use an AED without a pediatric dose attenuator.[12]

If the pediatric patient has a pulse but is not breathing, the 2020 AHA guidelines recommend one breath every 2 to 3 seconds or 20 to 30 breaths/min.[5,11] Lay rescuers do not check for a pulse, however, and they may opt to provide only continuous chest compressions if they are unable or unwilling to provide breaths.[11]

Recovery

As for adults, the 2020 AHA guidelines have added a sixth link in the IHCA and OHCA pediatric chain of survival: recovery. This link lasts from the end of acute treatment through rehabilitation until the patient has been discharged home. Recovery stresses the need for a system of care to support patients and their families.[2] Once discharged, patients who have experienced a cardiac arrest may have physical, emotional, and cognitive challenges that require ongoing interventions. These include addressing any underlying causes of cardiac arrest, cardiac rehabilitation, neurologic recovery, and continued psychological support for patients and families.[5]

PALS

The 2020 AHA-recommended PALS guidelines apply to infants, children, and adolescents up to age 18; newborns are excluded. PALS involves additional components of care, including cardiac rhythm diagnosis, electrical therapy when appropriate, and I.V./I.O. access and medication administration. Specifically, the AHA recommends maintaining a ventilation rate of one breath every 2 to 3 seconds or 20 to 30 breaths/min following advanced airway placement; placing a cuffed ETT with attention to size, position, and cuff pressure; administering epinephrine as soon as possible for pediatric patients experiencing cardiac arrest with nonshockable rhythms; utilizing arterial diastolic BP to monitor CPR quality if an arterial catheter has been placed;

and avoiding routine use of cricoid pressure during intubation.[9] Sodium bicarbonate and calcium are not recommended for routine use, but these may be appropriate in specific circumstances such as managing electrolyte imbalances or drug toxicities.[11]

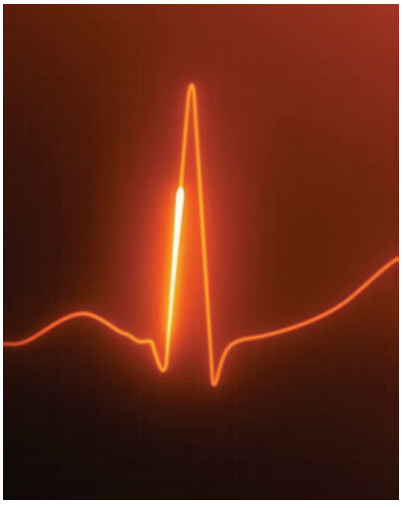
ROSC

ROSC efforts for pediatric patients should focus on ventilation and oxygenation, titrating Fio_2 to a target Spo_2 of 94% to 99% and the partial pressure of carbon dioxide ($PaCo_2$) targeted to the individual patient. A normal $PaCo_2$ level is between 35 mm Hg and 45 mm Hg. Hypocapnia refers to a $PaCo_2$ level below 35 mm Hg; hypercapnia refers to a $PaCo_2$ level above 45 mm Hg. Ventilatory strategies should be targeted to the individual physiologic needs of patients and are influenced by their disease process or diagnosis. Clinicians will adjust ventilator settings to achieve the desired $PaCo_2$ range.[12]

Nurses can maintain BP by administering I.V./I.O. fluids or vasopressors as prescribed. For pediatric patients who are comatose, those between the ages of 24 hours and 18 years may require TTM at 32° C (89.6° F) to 34° C (93.2° F) for the first 48 hours, followed by TTM at 36° C (96.8° F) to 37.5° C (99.5° F) for 3 to 5 days, continuous EEG monitoring, and treatment for convulsive and nonconvulsive seizures as necessary.[11]

Pediatric patients: Special circumstances

According to the 2020 AHA guidelines, pediatric patients with a definite pulse who are experiencing a suspected opioid overdose and respiratory arrest, as evidenced by the absence of normal breathing and/or agonal or gasping respirations, should receive BLS and/or PALS care and I.M. or intranasal naloxone.[9] For those in septic shock, an initial fluid bolus volume



PALS includes cardiac rhythm diagnosis, electrical therapy when appropriate, and I.V./I.O. access and medication administration.

between 10 mL/kg and 20 mL/kg is recommended with isotonic crystalloids or colloids, accompanied by frequent reassessments for patient response to fluid boluses such as "increased blood pressure (toward normal), decreased heart rate (toward normal), reduced respiratory rate (toward normal), increased urine output and improved mental status."[11,12] I.V./I.O. infusions of epinephrine or norepinephrine are recommended for patients experiencing fluid refractory shock.[11]

Education programs

Besides the 2020 BLS, ACLS, and PALS guidelines, the AHA also includes recommendations for effective educational programs for both healthcare professionals and lay rescuers. For healthcare professionals, these include several design approaches, such as:[6]

- deliberate practice, which describes goal-driven learning with performance feedback and repetition
- mastery learning, which continues the lessons of deliberate practice with testing
- booster training, which refers to brief, focused sessions to repeat content that has been presented in an initial learning course
- spaced learning in which multiple short educational sessions review previous content or introduce new content
- in situ education, which describes simulation exercises that are conducted in clinical environments
- gamified learning, which utilizes board games, computer games, and/or leaderboards to discuss serious topics
- computer-generated virtual reality learning, which offers simulated experiences in a fabricated pseudo-clinical setting.

Another option is massed learning, or a single training event that can last hours or days. When this is utilized, the 2020 AHA guidelines recommend that educators implement booster training as well. Similarly, educators should consider spaced learning courses in place of massed learning.

For lay rescuers, the AHA recommends self-learning, instructor-led education, and hands-on training. These educational courses can include middle and high school students, as well as family caregivers who are responsible for high-risk patients, and feature compression-only CPR as an alternative to conventional approaches.[6]

Ongoing research for improved outcomes

Once again, continuous research efforts have contributed to changes in the AHA guidelines for patient care, including the addition of recovery as a sixth link in the IHCA and OHCA adult and pediatric chains of survival, ventilatory rate changes in rescue breathing, recommendations for medication administration, Spo_2

range goals for patients experiencing ROSC, and changes in the management of cardiac dysrhythmias and ACS. The AHA also offers recommendations for future educational restructuring to increase the focus on retention and proficiency. ■

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Karen Jean Craig-Brangan is the owner, president, and CEO of EMS Educational Services, Inc. in Cheltenham, Pa., as well as an American Heart Association Training Center manager at Temple University Health System in Philadelphia, Pa., and Mary Patricia Day is a certified registered nurse anesthetist at Temple University Hospital in Philadelphia, Pa.

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