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AHA/ACC SCIENTIFIC STATEMENT

Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 12: Emergency Action Plans, Resuscitation, Cardiopulmonary Resuscitation, and Automated External Defibrillators

A Scientific Statement From the American Heart Association and American College of Cardiology

Mark S. Link, MD, FACC, *Chair**

Robert J. Myerburg, MD, FACC*
N.A. Mark Estes III, MD, FACC*

The ability to resuscitate cardiac arrest victims is a critical component of health-related topics in the athlete population. Even with screening, there will remain people who experience sudden cardiac arrest. An effective resuscitation strategy requires multiple elements, including planning for an event, appropriate team members who can provide cardiopulmonary resuscitation (CPR), rapid availability of automated external defibrillators (AEDs) and other appropriate equipment, and calls for emergency medical services (EMS). The chain of survival as articulated by the American Heart Association (AHA) calls for immediate recognition of cardiac arrest and activation of EMS, early CPR, rapid defibrillation, effective advanced life support, and integrated post-cardiac arrest care (1,2). Inadequacy in any one of these facets will reduce the chances of survival.

*On behalf of the American Heart Association Electrocardiography and Arrhythmias Committee of the Council on Clinical Cardiology, Council on Cardiovascular Disease in the Young, Council on Cardiovascular and Stroke Nursing, Council on Functional Genomics and Translational Biology, and the American College of Cardiology.

The American Heart Association and the American College of Cardiology make every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest. The Preamble and other Task Force reports for these proceedings are available online at www.onlinejacc.org (J Am Coll Cardiol 2015;66:2343-9; 2350-5; 2356-61; 2362-71; 2372-84; 2385-92; 2393-7; 2398-405; 2406-11; 2412-23; 2424-8; 2429-33; 2439-43; 2444-6; and 2447-50).

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BASICS OF AEDs

AEDs are portable devices capable of detecting and terminating ventricular tachycardia and fibrillation. All require human input to place the pads and turn on the device. Some are fully automated in that they will analyze the rhythm and provide a shock if the arrhythmia is deemed shockable. However, most are semiautomated in that they require continued human input, including activation to analyze the rhythm, and then if the arrhythmia is deemed shockable, further activation to shock. Ease of use has been demonstrated for both automated and semiautomated AEDs. AEDs are manufactured by many companies, with subtle differences in sensing algorithms and shock energy.

The sensitivity and specificity of AEDs are excellent and likely better than human analysis of arrhythmias (3). In arrhythmia libraries, the sensitivity of most devices approaches 100%, as does the specificity (3). Whether one manufacturer's algorithms are more accurate than others is not clear. Some devices will correct for CPR artifact, analyze the quality of the CPR, or both. Nearly all current AEDs incorporate biphasic waveforms; however, the specifics of the waveform and the energy vary among manufacturers. In addition, some AEDs use escalating energies, whereas others have fixed energy output. Whether one type of waveform or energy level is better than another is not clear; however, the ability to terminate ventricular fibrillation is generally excellent.

AEDs may be used in children; however, the AHA recommends the use of pediatric dose attenuator systems and pediatric pads, if available, for people aged 1 to 8 years (3). AEDs require routine maintenance; battery life and system integrity require at least monthly checks, and pads have a limited shelf-life span of ≈2 years. Thus, AEDs should be part of an emergency action plan and should not be placed in isolation.

INITIAL RESPONSE TO SUSPECTED CARDIAC ARREST IN THE SPORTS ENVIRONMENT

The AHA guidelines regarding response to out-of-hospital cardiac arrest generally apply to the circumstances in which athlete-related cardiac arrests occur (4–6). These include immediate assessment of level of consciousness and cardiovascular status of the athlete who has collapsed unexpectedly, as well as institution of chain-of-survival actions when cardiac arrest is identified. Because sport-related cardiac arrest has a higher probability of being witnessed by appropriately trained bystander staff than does cardiac arrest that occurs in the general population, a beneficial outcome is more likely if delays in recognition and responses are avoided. Although benign forms of syncope and near syncope may occur in these settings, it is important to recognize that the onset of cardiac arrest may be heralded by a brief period of drifting in and out of consciousness because of unstable rhythms before a full arrest. It should not be assumed that such patterns are benign.

An important additional factor in many sport-related incidents is the distinction between primary cardiac arrest and cardiac arrest caused by chest wall trauma (commotio cordis). It is critical to determine quickly whether impaired consciousness is associated with loss of pulse and respiration and to institute appropriate resuscitative therapy immediately. The responder must also distinguish loss of pulse caused by an extreme vagal response from a true cardiac arrest. Vagal responses are usually transient and may be associated with marked bradycardia and reduction of blood pressure; respirations typically continue. It is also important, but often difficult, to make the sometimes subtle distinctions between involuntary seizure-like movements associated with cardiac arrest and epilepsy-related seizures. Distinguishing between true spontaneous respirations and gasping respirations is also important, the latter being a part of cardiac arrest physiology (7), which supports the recognition of true cardiac arrest.

BASIC LIFE SUPPORT AND AED DEPLOYMENT FOR THE ATHLETE IN CARDIAC ARREST

If the pulse and spontaneous respirations are absent, it should be assumed that a cardiac arrest is present, and the initial steps in resuscitation should be effected immediately. If an AED is immediately available, it should be deployed simultaneous with the act of contacting emergency rescue personnel (4). In some sports settings, primarily during competitive events with large attendance, a rescue vehicle may be stationed at the scene, but that is less likely during practices or sports events in small facilities. Nonetheless, AEDs are being deployed increasingly in public venues, including schools, universities, and various sports and exercise facilities. Both campus security personnel and EMS should be contacted immediately. It is recommended that the devices be deployed in a manner that results in a maximum access time of 5 minutes to any site on a school campus or sporting venue (8–10).

While the AED is being brought to the victim's side and deployed, compression of the chest should be started by bystanders. According to the most recent

guidelines, compression alone ("hands-only CPR") should be started at a rate of 100 to 120 compressions per minute without interruption for rescue breaths (1). Trained professional providers should include rescue breathing. As soon as the defibrillator is attached and powered up, the rhythm is analyzed. A single shock should be delivered if the device senses a shockable rhythm (11). If the initial rhythm is nonshockable (i.e., asystole or pulseless electrical activity), CPR should be continued. If an initial shock fails to restore a spontaneous rhythm with return of spontaneous circulation, compressions should be resumed for 2 minutes before another shock is attempted. The previous concept of delivering 2 or 3 consecutive shocks before resuming CPR is no longer advised, and no more than 1 shock at a time is given, with 2 minutes of chest compressions between each shock. Once emergency rescue personnel are on the scene, advanced life support activities will be implemented as needed. These may include intubation with respiratory management and pharmacological interventions.

The likelihood of survival with good neurological status is directly related to the time between onset of cardiac arrest, implementation of CPR, and return of spontaneous circulation. In the adequately prepared athletic environment, including both trained staff and appropriate equipment, with the onset of the event witnessed, it is a reasonable goal to begin CPR within 60 to 90 seconds and deliver an initial shock to an athlete with a shockable rhythm in <3 minutes.

EMERGENCY RESPONSE PLANS

Comprehensive emergency response plans are as important as the individual aspects of CPR and AEDs (6). The initial recognition of an arrest and immediate CPR must cascade into activation of the emergency response plan, which includes early access to a defibrillator and placement of calls to the local EMS (for example, 9-1-1 in most of the United States). An emergency response plan includes preparation for cardiac arrests, including anticipation of events, placement of AEDs and training of people to use them, access to emergency services, and simulations of real-life events. Included in emergency response plans are monthly AED checks for integrity and battery life.

Similar to treatment of other out-of-hospital cardiac arrest patients, therapeutic hypothermia (also referred to as targeted temperature management) should be started as soon as possible in the victim who is comatose after successful return of spontaneous circulation. Emergency response plans should consider transfer to facilities that are capable of therapeutic hypothermia (12,13).

EMERGENCY RESPONSE: LEGAL CONSIDERATIONS

There are multiple legal and regulatory considerations that minimize legal risks of AED ownership, use, or medical oversight (14). To address liability concerns, state and federal Good Samaritan legislation currently protects responders using AEDs (15,16). Good Samaritan legislation statutes provide immunity from claims of negligence for volunteers aiding others with CPR and AED use. The Federal Cardiac Arrest Survival Act (CASA) was enacted in 2000 with provisions to encourage AED use in federal buildings and to create immunity for AED users (15). CASA provides conditional immunity from legal liability for harm resulting from use or attempted use of an AED by lay responders. All 50 states have Good Samaritan laws that vary in scope and conditions but that supplement the basic protections from liability afforded by federal regulations (17). The state AED program requirements generally include the provisions of Good Samaritan immunity, medical oversight, agency notification, policies, quality assurance measures, training, AED maintenance, and postevent reporting. The AHA has developed a policy statement with the objective of guiding policymakers and other stakeholders in writing new legislation or revising existing legislation to remove potential barriers to implementation of emergency response programs that include AEDs (18). Those considering starting an AED program should consult and adhere to state regulations to minimize potential risks associated with AED ownership, oversight, or use. Healthcare professionals should be aware of the clinical benefits of AEDs and the limited liability associated with their use. They should also consider the potential liability that could arise from failure to use AEDs as a matter of prudent public protection.

Recommendations

1. **Schools and other organizations hosting athletic events or providing training facilities for organized competitive athletic programs should have an emergency action plan that incorporates basic life support and AED use within a broader plan to activate EMS (6,10) *(Class I; Level of Evidence B)*.**
2. **Coaches and athletic trainers should be trained to recognize cardiac arrests and to implement timely and AHA guideline-directed CPR (100 to 120 beats per minute and compression depth of 2 inches) along with AED deployment (4,6) *(Class I; Level of Evidence B)*.**
3. **AEDs should be available to all cardiac arrest victims within 5 minutes, in all settings, including competition, training, and practice (9,10) *(Class I; Level of Evidence B)*.**
4. **Advanced post-cardiac arrest care, including targeted temperature management, should be available at sites to which patients are taken by EMS (19,20) *(Class I; Level of Evidence A)*.**

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Writing Group Disclosures

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Mark S. Link	Tufts Medical Center	None	None	None	None	None	None	None
N.A. Mark Estes III	Tufts Medical Center	None	None	None	None	None	Medtronic*; St. Jude Medical†	None
Robert J. Myerburg	University of Miami	None	None	None	None	None	None	None

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*Modest.
†Significant.

Reviewer Disclosures

Reviewer	Employment	Research Grant	Other Research Support	Speakers Bureau/ Honoraria	Expert Witness	Ownership Interest	Consultant/ Advisory Board	Other
Robert M. Campbell	Children's Healthcare of Atlanta	None	None	None	None	None	None	None
Frederick G. Kushner	West Jefferson Heart Clinic of Louisiana	None	None	None	None	None	None	None
Silvana M. Lawrence	Baylor College of Medicine	None	None	None	None	None	None	Vice President, Science and Research, Championship Hearts Foundation*
Wanchun Tang	University of Southern California	None	None	None	None	None	None	None
Roger White	Mayo Clinic	None	None	None	None	None	None	None
Dongmei Wu	Mount Sinai Medical Center	None	None	None	None	None	None	None

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*Modest.

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