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In the Rhythm of Saving Lives

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Sudden cardiac arrest is a condition in which the heart stops suddenly and unexpectedly, and is caused by lifethreatening arrhythmias in the heart's electrical system. Most victims of witnessed sudden cardiac arrest are in ventricular fibrillation (VF), which is an abnormal, chaotic heart rhythm that prevents the heart from pumping blood. The only effective treatment for ventricular fibrillation is defibrillation—the delivery of a shock to the heart that stops VF and allows a normal heart rhythm to resume.

by Gerald M. Dworkin
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On July 13, 2004, a 55-year-old man collapsed in the Medina (Ohio) Aquatic and Fitness Center. The aquatic manager for the city, Darlene Donkin, responded and assessed him to be in cardiac arrest. Although Donkin was a CPR instructor and taught more than 100 classes on the subject, she had never actually performed it in a life-and-death situation prior to this incident.

Donkin administered two rounds of CPR while the automatic external defibrillator, or AED, was brought to the victim's side and the electrodes were attached. The AED assessed him to have a shockable rhythm, then charged itself and instructed the rescue personnel to administer the shock. After one shock, the victim's heart returned to a normal sinus rhythm. The patient had triple bypass surgery the next day and did not suffer any hypoxic brain damage as a result of this incident, mainly because Donkin administered CPR and used an AED in a timely manner.

Sudden cardiac arrest is a condition in which the heart stops suddenly and unexpectedly, and is caused by lifethreatening arrhythmias in the heart's electrical system. Most victims of witnessed sudden cardiac arrest are in ventricular fibrillation (VF), which is an abnormal, chaotic heart rhythm that prevents the heart from pumping blood. The only effective treatment for ventricular fibrillation is defibrillation—the delivery of a shock to the heart that stops VF and allows a normal heart rhythm to resume.

Each year, about 225,000 people suffer out-of-hospital sudden cardiac arrest, of which only 2 percent to 5 percent are successfully resuscitated. These numbers are in stark contrast to the high success rate when defibrillation is performed immediately after the onset of VF. Studies have shown that when a person suffers a sudden cardiac arrest, chances of survival decrease by 7 percent to 10 percent for each minute that passes without defibrillation.

A sudden cardiac arrest is not the same thing as a heart attack, although a person suffering a heart attack is more likely to develop abnormal heart rhythms and sudden cardiac arrest. Sudden cardiac arrest is unpredictable and can happen to anyone, anywhere—even a child, although risk does increase with age. Although pre-existing heart disease is a common cause of cardiac arrest, many victims have never suffered from any heart problems.

The Chain of Survival

In 1991, the American Heart Association (AHA) published “Improving Survival from Sudden Cardiac Arrest: The Chain of Survival Concept.” This paper identified the idea that all communities should adopt the principle of early defibrillation, and that all personnel who are expected, as part of their professional duties, to perform basic CPR, should be equipped with an AED and be trained to operate it.

Since then, the AHA has advocated that health professionals who have a duty to respond to a person in cardiac arrest should have a defibrillator available either immediately or within one to two minutes. The definition of a lifeguard, published by Chronicle Guidance Publications, says that “lifeguards ... prevent incidents, perform rescues and administer first aid and resuscitation to incident victims.”

Therefore, they certainly meet the criteria established above for health professionals with a duty to respond to people in cardiac arrest. The AHA’s “Chain of Survival” depicts the critical actions required to treat life-threatening emergencies, including heart attack, cardiac arrest, stroke and foreign body airway obstruction.

The links within this Chain of Survival include:

1. Early access to the emergency response system;
2. Early CPR to support circulation to the heart and brain until normal heart activity is restored;
3. Early defibrillation to treat cardiac arrest caused by VF; and
4. Early advanced care by EMS and hospital personnel.

However, in order for the patient to have the best chance of surviving an out-of-hospital cardiac arrest, CPR and early defibrillation must be provided within the first four minutes of the cardiac arrest, followed by advanced life support (ALS) within the first eight minutes of the arrest.

CPR: Life-Saving or Life-Sustaining Procedures?

Although the performance of CPR on a cardiac arrest patient prolongs the time that defibrillation can be effective, CPR should not be considered a “life saving” procedure, but rather a “life sustaining” procedure in that it typically will not restore a heartbeat to a cardiac arrest victim. CPR only temporarily sustains the cardiac arrest victim in that gray area between clinical death and biological death, hopefully long enough to obtain defibrillation and care.

Considering this fact, the standard of care for the emergency management of cardiac arrest patients, regardless of the cause, is immediate life support (early access, early CPR and early defibrillation) immediately followed by ALS. If an AED is not immediately available for the response to cardiac arrest victims within your facility, then the claim can be made that your facility has breached the standard of care.

What Is an AED?

An AED is a small, lightweight device that is designed to assess a person’s heart rhythm and then administer an electric shock to restore a normal rhythm in victims of cardiac arrest. A microprocessor inside the defibrillator analyzes the victim’s heart rhythm through adhesive electrodes; determines whether defibrillation is needed based on whether the victim has a “shockable rhythm;” advises the operator whether a shock is needed; and then charges itself for the administration of that electric shock. When the operator responds to the prompt to give a shock, an electric current is delivered through the victim’s chest wall to the heart.

Defibrillator effectiveness depends on two factors: 1) the electrodes being firmly and correctly connected to

the patient; and 2) the defibrillation current being conducted through the patient's heart. The electrodes require a dry surface to adhere to the patient's chest. This can be accomplished quickly by wiping the patient's chest with a towel prior to applying the electrodes.

To ensure the defibrillation current is conducted through the patient, if it is possible to quickly and safely move the patient, he should be placed onto a backboard and out of the way of any puddles of water. Before defibrillating the patient, the defibrillator operator must ensure that no part of his or her body or any bystander is touching the patient. Prior to pushing the shock/treatment button on the AED, the primary rescuer should scan the immediate rescue scene and should both verbalize and visually confirm, "I'm clear, you're clear, everyone is clear" prior to shocking the patient. AEDs used in and around swimming pools, beaches, waterparks and other aquatic facilities will be exposed to elements not typically found in office buildings and other locations.

Before purchasing an AED for use within an aquatic environment, ask the manufacturer whether the device has undergone a drop test and splash test, and compare the results of these tests with other AED manufacturers. It should be noted that the drop test and splash test ratings have absolutely no impact on the functionality of the device. It is simply a measurement of that specific AED's durability and water resistance.

Regardless of the drop test and splash test ratings, it is recommended that any AED being used near water should be stored in a watertight case. Most AED manufacturers offer these cases as an option when purchasing the device.

Legislation Mandates AED Deployment

Several states have recently passed legislation in recognition of the life-saving potential AEDs offer against sudden cardiac arrest. These states specifically mandate the deployment of AEDs in various public places and facilities, and contribute to the establishment of the standard of care within communities.

In New York, the state amended its general public buildings law to now require all state buildings and institutions to deploy at least one AED on the premises. The bill noted that a senate investigation committee probe concluded that "the greater acquisition, deployment and use of automated external defibrillators in New York can save thousands of people from otherwise certain death from heart attacks."

In May 2003, New York also became the first state in the nation to mandate AEDs in schools. The law requires schools, vocational and extension facilities, and charter schools to keep at least one AED on premises, and to have at least one available at school-sponsored athletic events, on campus or off.

In Pennsylvania, funds are provided for one AED per school district throughout the state. In Rhode Island, the state mandated all health clubs registered with its Department of the Attorney General to have at least one AED on the premises and be easily accessible to the staff, members and guests. The law also stipulates that at least one employee properly trained in the use of AEDs be on hand at all times.

In Louisiana, a new state law requires all physical fitness facilities, including clubs, studios, health spas, weight control centers, clinics and athletic or sport clubs to keep an AED accessible on site. The state law

also requires all institutions of higher education that compete in intercollegiate athletics to have an AED in the athletic department.

The Cardiac Arrest Survival Act, which became federal law in November 2001, requires the installation of AEDs in all federal buildings and encourages state and local governments, the private sector and other entities to implement their own AED programs based on the federal model.

With so many states passing legislation mandating facilities to have an AED on premises, why not have one? Aquatic facility managers and operators often give excuses such as, “All the police cars have AEDs on board,” or “The rescue squad is down the street.” However, one must always consider the dispatch mechanisms within the community, the community resources (i.e. basic life support and advance life support capabilities), and the response times for police, fire and EMS.

The average response time from dispatch to scene arrival across the U.S. is about 10 minutes. Once the EMS personnel arrive on the scene, it may even take several minutes before they are able to make contact with the patient.

Roger White, a Mayo Clinic researcher and medical director for the early defibrillation program in Rochester, Minn., measured how much time passes between a 911 call and the instant a shock is delivered to a cardiac arrest patient. His data showed that victims shocked within six minutes almost always lived, while those shocked after six minutes almost always die.

Currently, 95 percent of sudden cardiac arrest victims die before reaching the hospital due to the length of time it takes for emergency personnel to arrive on the scene. Dr. Joseph Ornato of Virginia Commonwealth University in Richmond states, “The bottom line is we believe defibrillators in public facilities will double survival, if there are trained teams to use them.”

The National Center for Early Defibrillation’s Web site (www.early-defib.org) provides a wealth of information, including a list of state EMS offices. A number of funding opportunities for the deployment of AEDs may be available through the state EMS offices. Contact your local office to determine the level of funding that may be available to you.

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