

Saving Lives – Creating a Heartsafe Environment

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Introduction

Heart disease, in general, is the biggest killer in the modern world. It is a sobering thought that each year, in particular, Sudden Cardiac Arrest (SCA) causes the death of over 700,000 people in Europe. Many of these deaths occur in the workplace as both workers and customers are vulnerable to this worldwide pandemic. Many of these deaths are avoidable if the appropriate therapy and treatment is available within a few minutes of the onset of SCA. The placement of Automated External Defibrillators (AED) in the workplace can save lives and allow corporate entities to deliver a 'Heartsafe Environment' to workers and customers.



When a patient goes into SCA, his heart stops functioning normally due to the passage of irregular and chaotic passage of cardiac impulses throughout the heart. Unless this is corrected within minutes the patient will die as the heart is incapable of pumping oxygenated blood, necessary for life, around the body.

Research has shown that for every minute defibrillation is delayed survival falls by 7% - 10%¹.

Current survival rates outside of hospital are around 1-5% (or to put it more effectively 95-99% of people suffering an SCA out side hospital will die) which reflects the difficulty in getting early defibrillation to the patient as recommended by the American Heart Association (AHA) and European Resuscitation Council (ERC) whose current guidelines highlight the importance of getting the first defibrillatory shock into the patient in less than five minutes².

Unfortunately, even in the best Emergency Medical System (EMS), it can often take ten minutes or more to reach a patient in SCA and while co-workers are generally first on scene and can be trained in basic life support skills such as Cardio-Pulmonary Resuscitation (CPR), a very useful skill that keeps the heart oxygenated and ready for defibrillation; the only effective therapy for SCA is early defibrillation. Delays of ten minutes or more in treating the patient reduces their chance of survival to almost zero. For many EMS services there are specific problems in getting to the workplace SCA victim quickly. The modern city is plagued by heavy traffic; many work places are high rise buildings where security entrances and elevators have to be tackled before the EMS crew/doctor arrives at the stricken patient's side. Multiple level facilities can cause problems in the time it takes to travel from one level to the next. Some work places have over-ground and underground facilities while others may have huge compounds spread over a very wide area. These issues can all cause delay in getting the patient that important early defibrillatory shock. On-site access to AEDs are literally a life or death matter.

¹ American Heart Association. Heart Disease and Stroke Statistics – 2005 Update. Dallas, Texas: American Heart Association; 2004.

² Guidelines 2000 for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 4: the automated external defibrillator: key link in the chain of survival. The American Heart Association in Collaboration with the International Liaison Committee on Resuscitation. *Circulation*. 2000 Aug 22;102(8 Suppl):I60-76.

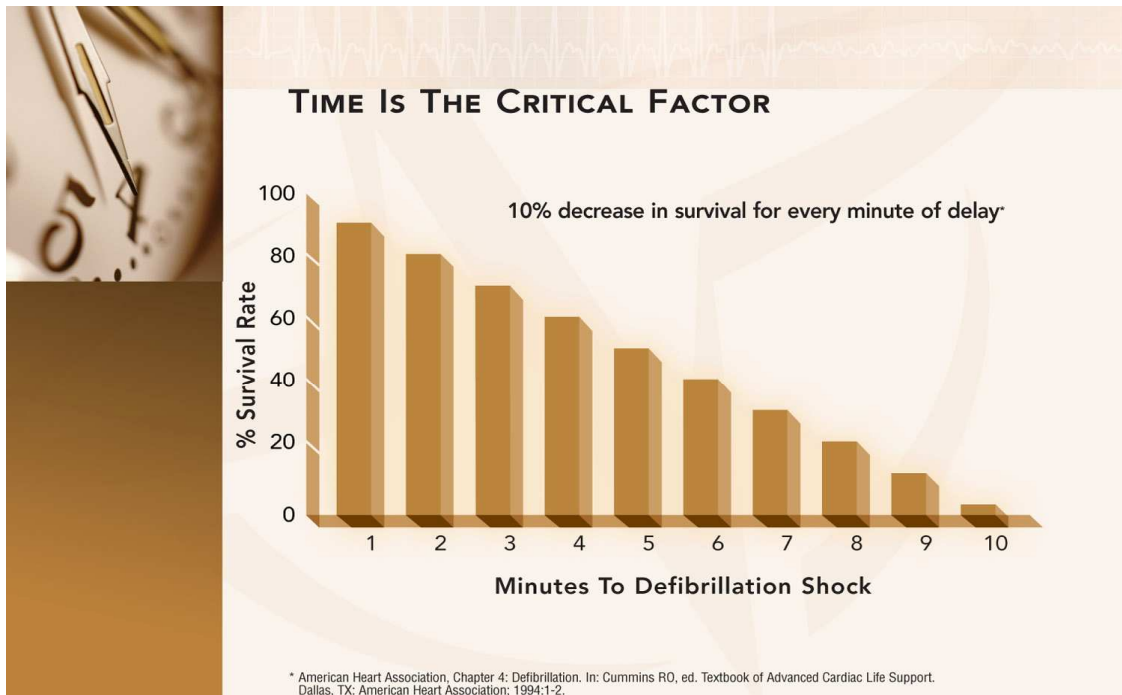


Fig 1 : Time to first shock is critical

What is Defibrillation?

Defibrillation is the controlled application of a direct current electrical charge to the heart. This is achieved using an AED and two adhesive pads, the latter being affixed to the patient's chest. The electrical charge will cause the heart's own natural 'pacemaker' to reassert control of the organ to restore its normal beat and thus ensure that oxygenated blood reaches the patient's brain.

Defibrillation is, however, only one piece of the jigsaw. If we are to give the victim of SCA the absolute best chance of survival then we need to ensure that the continuum of care is available. The 'Chain of Survival' concept³ was introduced as a theoretical treatment chain with four distinct links which, if applied systematically, gives the SCA victim the best chance of survival:

- **Early recognition and Call for help** – getting the EMS unit activated
- **Early CPR** – maintaining the oxygenation of the heart and brain until defibrillation can restore normal heart function.
- **Early defibrillation** – delivering a direct current 'shock' to the heart
- **Advanced care** – airway control and cardio-active drugs delivered by the EMS system upon arrival.

Typically, like any chain, it is only as strong as its weakest link and the weakest link has long been recognised as 'early defibrillation'. This lack of a strong third link has contributed to the current poor survival rates across the international arena as the only place one could find a defibrillator was in the local EMS ambulance which, for the reasons given previously, was often too late on scene to help the SCA victim. Considerable research has shown that witnessed SCA, where early CPR has been initiated, have had the best survival outcomes. Similarly a recent major study in the USA

³ Cummins RO, Ornato JP, Thies WH, Pepe PE. Improving survival from sudden cardiac arrest: the 'chain of survival' concept. A statement for health professionals from the Advanced Cardiac Life Support Subcommittee and the Emergency Cardiac Care Committee American Heart Association. *Circulation* 1991;83:1832±1847

reported a doubling of survival rates where SCA was treated with CPR and AEDs as opposed to CPR alone⁴

As co-workers are the most likely to come across an SCA in the workplace it makes sense that, not only should they be trained in CPR but also in using an AED.



Fig x : The Chain of Survival

AEDs – At the Heart of Saving Lives

AEDs are safe, effective life-saving devices that are specifically designed for non-medical people to use. Developed over several years they are now a familiar feature of the work place and public areas such as rail stations, airports, sports stadia and shopping malls in the USA, UK and across Europe. Where AEDs have been placed survival rates have increased enormously. In one famous study reporting on an AED program in Las Vegas casinos, survival rates are reported at around 74%⁵.

How do AEDs work? How can the non-medical user be re-assured that the device is safe to use both for the patient and the rescuer?

Well, like the AED itself the answer to these questions is simple; the AED contains revolutionary software, including a complex algorithm that means the device is 'fool proof' in detecting the need for the patient to receive a shock or not.

In addition AEDs are designed to be used on unresponsive patients who are not breathing normally and the rescuer simply has to open the lid (which acts as an 'on' switch) and follow the audible and visual voice prompts which instructs the user to place the two pads attached to the AED on the patient's chest.

Once attached the AED utilizes very complex software to analyze the patient's heart rhythm and decides very quickly whether the patient requires a shock or not. If the patient requires a shock the device will automatically charge itself and invite the user to press the 'flashing shock button'

⁴ Public-Access Defibrillation and Survival after Out-of-Hospital Cardiac Arrest The Public Access Defibrillation Trial Investigators *The New England Journal of Medicine*; August 12, 2004 vol. 351 no. 7

⁵ Valenzuela TD, Roe DJ, Nichol G, Clark LL, Spaite DW, Hardman RG. Outcomes of rapid defibrillation by security officers after cardiac arrest in casinos. *N Engl J Med* 2000;343:1206-9.



This action will then deliver an electrical shock to the patient's heart at a level determined by a calculation of his trans-thoracic impedance (the amount of resistance to electrical impulses across the chest). Should the AED detect the patient has a normal heart rhythm or another type of non-shockable rhythm then it will direct the user to the appropriate Basic Life Support procedures. It is impossible to deliver a shock to a patient who does not require one.

The AED has a very high sensitivity and specificity rating which makes this an ideal emergency tool for the non-medical user.

Choosing the Right AED

The American analyst firm, Frost & Sullivan has estimated that by the year 2009, the worldwide AED market will be worth in excess of US\$1 billion⁶. Consequently many companies are now producing AEDs in order to capitalise on this rapidly developing market. However purchasers need to beware of exactly what they are buying as not all AEDs are the same. For example, all cars will get the driver from A to B however some marques do it more effectively, safely and efficiently. Similarly, all AEDs will deliver a shock but it is how they reach the point of shock delivery and how clinically effective that shock is when it is delivered that is important.

When buying an AED it is important to consider three main characteristics:

- **Rescue-Ready reliability** – will it work reliably every time it is needed? Most AEDs have some form of testing system however it is necessary to ensure that all 3 critical components of the AED; the battery, defibrillation pads and the device itself are automatically self-tested on a daily, weekly and monthly basis to ensure reliability.
- **Ease of use** – is the device easy to use in a stressful rescue situation? Ideally the AED should have pre-connected defibrillation pads which are interchangeable and can be placed in either of the two normal positions on the chest thus simplifying the number of steps for the non-medical rescuer to implement. In addition a single-button operation means that the rescuer is able to perform life saving defibrillation very quickly.
- **Technology** - having up to date cutting edge technology is absolutely paramount in a life-saving device such as an AED. The AED needs to measure the patient's individual impedance and be capable of delivering an escalating, variable energy shock customized to the individual patient. This allows the most efficacious therapy to be delivered to the patient suffering SCA.



Implementation and Training

It is important to define the correct number of AEDs required for an individual workplace environment. For example, placing one AED in a 15 storey building will not allow the corporation to reach an SCA within the AHA guideline of 5 minutes as discussed previously. Given that SCA is a random event that can occur at anytime, anywhere to anybody, a site survey should be carried out in order to determine the optimum number of AEDs required and their optimum placement. The next stage is to determine a simple but effective emergency response program that will define who will respond to an incident. Some corporations will direct specific first aid trained responders to be the first line AED responder while in others several people in a department or on a floor will be trained to deliver CPR/AED training. Because the technique in carrying out CPR and using an AED is so simple a training course consisting of a four to six hour program is sufficient for most responders. Refresher training is very important and should be carried out once every twelve months.

Both the AHA and the ERC have an excellent AED training programmes ideally suited for lay persons. Although not required by law, utilising the advice of a medical practitioner to help advise on setting up the program is recommended to ensure that the AED program is as robust as possible. It is also advisable to implement a data recording system so that after use the AED can be downloaded and proper clinical audit carried out. Finally make sure that everyone within the company is educated about the availability of AEDs, where they are placed and know how to summon help quickly when someone collapses.

If we are to make in-roads into reducing this world-wide pandemic we need to implement a strong culture of emergency response within corporations and thus provide a Heartsafe environment that protects our most valuable assets – our people – from sudden cardiac death.

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