Public Access Defibrillation

Is This Making Any Difference? Controversial Issues in Resuscitation from Cardiac Arrest

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KEYWORDS

• Defibrillation • Cardiopulmonary resuscitation • Bystander AED • Automated external defibrillator • Epinephrine

KEY POINTS

- Public access defibrillation is particularly valuable in witnessed cardiac arrests that occur in public locations. There has been considerable growth in bystander and police use of automated external defibrillators (AEDs) over the past 15 years for this subset of all cardiac arrests.
- Although defibrillators are used by bystanders or police in only a very small (but growing) percentage of all cardiac arrests, use among patients with cardiac arrest who survive, and survive with normal or near-normal neurologic function, is substantial.
- There is great promise for increasing the use of bystander defibrillators as communication technology links the patients with shockable arrests to volunteers committed to bringing AED's and applying the device to the patient.
- There are several important strategies that could increase the availability and use of AEDs, such as optimizing their location within public buildings and reducing their size and weight.
- Although the value of early shock in increasing survival from shockable cardiac arrest is well established, there continues to be considerable controversy and little definite evidence as to the value of using epinephrine, antiarrhythmic drugs, hypothermia, or mechanical chest compression devices in resuscitation from cardiac arrest.

INTRODUCTION

In 2002, Weisfeldt and Becker[1] proposed a 3-element model for the best strategy for resuscitation from cardiac arrest. Because this model has to some extent passed the test of time, the model frames this discussion (**Box 1**). Phase I of the model (the first 3–4 minutes after collapse) states that, if the cause of cardiac arrest is shockable rhythm and a defibrillator is available, the patient should be defibrillated first. Also, occasionally, correction of bradycardia or asystole may occur by pacing or repeated chest blows during phase 1.

Phase II is between 4 and 10 minutes after arrest. After 4 minutes, it is important to provide chest compressions to create artificial circulation that provides myocardial blood flow. After 4 minutes, defibrillation without prior circulation frequently leads to irreversible myocardial changes, often called stone heart. Phase III, after

The investigators have no conflicts of interest.

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Card Electrophysiol Clin 9 (2017) 551–557

http://dx.doi.org/10.1016/j.ccep.2017.07.006

Box 1
The 3-phase model of cardiac resuscitation

I. Electrical: 0 to 4 minutes

II. Circulatory: 4 to 10 minutes

III. Metabolic: greater than 10 minutes

Time intervals are from the onset of arrest. During the electrical phase, immediate electrical correction is advised. During the circulatory phase cardiopulmonary resuscitation (chest compressions) are advised before electrical correction. In the metabolic phase, the hope is to identify lifesaving interventions.

Data from Weisfeldt ML, Becker L. Resuscitation after cardiac arrest: a 3-phase time-sensitive model [Commentary]. JAMA 2002;288(23):3035–8.

10 minutes of untreated arrest, is likely to be fatal. Very rarely does a patient with no chest compression or defibrillation survive. It is hoped that at some point an effective metabolic intervention will be identified that might allow survival without severe neurologic injury. No intervention is currently established to provide such benefit in humans. It was hoped that hypothermia might be such an intervention but there is no clear proof of benefit at this time.

LAUNCHING OF BYSTANDER USE OF AUTOMATIC DEFIBRILLATORS: PUBLIC ACCESS DEFIBRILLATION

In the early 1990s, the American Heart Association in a task force report[2] recommended to industry that simple-to-use, reliable, and inexpensive defibrillators be developed for use by lay bystanders. Automatic detection of ventricular tachycardia or fibrillation was essential. Once it was clear that such devices were going to become available, the American Heart Association led an effort with others to publicize, promote, and seek regulatory approval of defibrillation by any willing and adequately trained individual, whether a health care professional or not. Two consensus meetings featuring survivors of defibrillation arrest and attended by health care professionals, representatives of government (including the US Food and Drug Administration [FDA]), and the press were held in Washington, DC, and the results published.[3,4] Public interest was enhanced by the press and automated external defibrillators (AEDs) were approved for use, but not by non–health care professionals. The American Heart Association successfully pursued the inclusion of defibrillation under each state's so-called Good Samaritan statutes. Favorable results from the use of defibrillators by security guards in Las Vegas casinos[5] and aboard American Airlines flights[6] showed both safety and efficacy in the hands of lay individuals with a duty to respond. Proof of benefit in the hands of lay volunteers awaited the FDA allowing the use of AEDs by lay responders and the randomized National Heart Lung and Blood Institute Public Access Defibrillation (PAD) study published in 2004.[7] In that study, 1000 community site volunteers were trained to perform cardiopulmonary resuscitation (CPR) and call 911. At 500 randomly chosen sites, volunteers were also trained in the use of AEDs and the sites were equipped with AEDs. The number of survivors increased from 15 to 30 in control versus AED sites ($P<.03$). Following this publication, sales of AEDs increased exponentially.

EQUIPPING OF POLICE VEHICLES AND TRAINING OF POLICE IN THE USE OF AUTOMATED EXTERNAL DEFIBRILLATORS

Long before the advent of easy-to-use automatic AEDs for public use, Roger White led a successful effort in Rochester, Minnesota, to improve survival from cardiac arrest in that community. Dr White trained police in defibrillation and CPR and summoned both the nearest emergency medical services (EMS) vehicle and the nearest police vehicle to every call that was likely to be related to a patient with cardiac arrest. The results of this effort were reported in serial publications documenting improved survival after successful police defibrillation when the police arrived before EMS.[8]

Following this successful effort, Koster and associates progressively implemented a similar police effort, again with impressive results of improving survival from shockable out-of-hospital arrests from 29.1% to 41.4%.[9] The limited studies analyzing police AED defibrillation in major US cities have had mixed results. The Rochester experience pertains to small to middle-sized communities, whereas the extent of use by police in larger, more densely populated communities may be more variable.

COMMUNITY-BASED STUDIES OF USE AND OUTCOME

Several prospective registries of patients with cardiac arrest have documented improved survival and little evidence of harm from implementing bystander AED use in out-of-hospital cardiac arrests. The Resuscitation Outcomes Consortium (ROC) implemented an extensive prospective registry called EPISTRY (Epidemiology and Registry) under the leadership of Laurie Morrison in 2005, functioning as the backbone for prospective