

Prehospital Resuscitation

The Good, the Bad, and the Futile

Over the past two decades, the provision of advanced cardiac life support (ACLS) in the prehospital arena has been established and refined in many communities throughout the United States and other industrialized countries. Whereas in the late 1960s no one was given much hope of surviving an out-of-hospital cardiac arrest, today, in cities like Seattle, Milwaukee, and Miami, rates of hospital discharge for cardiac arrest due to ventricular fibrillation hover around 25% to 30%.¹⁻³ This has been accomplished only by applying the lessons learned from research on the subject, which have been incorporated into the "chain of survival" developed by the American Heart Association.⁴ The first link in the chain is establishing systems for rapid public access to emergency medical care (eg, by telephoning 911). The second link is widespread public training in cardiopulmonary resuscitation (CPR) techniques (eg, in Houston, Tex, certification in CPR is a routine part of high school education), which increases the chance of both bystander CPR and ultimate arrest survival. The last two links in the chain are early defibrillation, the cornerstone of any resuscitative effort, and prompt access to ACLS. By promoting and applying each essential element of the chain, emergency medical systems have provided countless people and their families with a second chance at life that would not have otherwise been possible. These sudden-death survivors also represent a new and unique population of patients with their own specific diagnostic and therapeutic challenges. Meeting these has resulted in significant contributions to the understanding of cardiac electrophysiology and the development of antiarrhythmic drugs and devices.

See also pp 1433 and 1457.

So what's the problem with prehospital resuscitation?

While there are many communities with model emergency medical systems and the desirable rates of successful resuscitation that generally follow, they are unfortunately in the minority. Published rates of successful resuscitation from all cardiac rhythms throughout the rest of the country range as low as 2%,⁵ and a telephone survey of New England emergency medical systems in 1991 revealed rates of successful resuscitation between 12% and 20%.⁶ These subpar statistics are the result of three principal factors. First, many rural communities are unable to rapidly access arrest victims due

to the considerable distances involved, thus greatly reducing survival rates.⁷ Second, in many locales for which proximity to the arrest event is not a major obstacle, individual emergency medical system fiefdoms lack organization under a central control, whether it be academic or municipal. This makes for an undesirable mix in the quality of services rendered and makes uniform data collection difficult, thus encumbering assessments of either current efficacy or contemplated improvements in the emergency systems. Finally, much of what is provided to a community is a matter of economics, politics, and priorities. For many towns and cities, rates of successful resuscitation could rival and even surpass those of the "big boys" if the same emphasis and support were given to local efforts to provide rapid care and educate the populace. In communities too small to support full-time ACLS-trained paramedics, automatic external defibrillators are an effective and less-costly alternative.⁸ With approximately 250 000 prehospital cardiac arrests occurring in this country annually, a modest improvement in the national survival rate of 5% would result in an additional 12 500 lives saved per year. This and more could probably be achieved simply by a more resolute application of the American Heart Association recommendations noted above.

Compounding the overall poor national performance is the current practice of transporting victims of unsuccessful field resuscitation—usually at high speeds, jeopardizing both the rescue team and other motorists—to local emergency departments for further, and usually more extensive, resuscitation. In this issue of THE JOURNAL, two large, well-run, prospective studies from established investigators using state-of-the-art emergency medical systems examine this custom.^{9,10} Their conclusions are identical—survival for the victim of cardiac arrest not resuscitated by a determined trial of ACLS at the scene is negligible and not improved by further emergency department efforts. Notable exceptions to this rule are cases of refractory ventricular arrhythmia or those arrests that take place after paramedics have arrived, although survivors in these instances tend to suffer anoxic neurological impairment. These studies provide a resounding confirmation of the findings from previous smaller, retrospective reports.^{6,11-17}

The lack of survival in this population of patients who have undergone prolonged prehospital resuscitation is not surprising given the body of knowledge that exists concerning CPR in humans and in animal models. It has been demonstrated that there are poor returns when resuscitation is extended, regardless of the location of the arrest. Bedell et al¹⁸ examined the course of in-hospital arrest patients and found that an arrest duration longer than 15 minutes was

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associated with a 95% hospital mortality. Analogous findings are seen in the out-of-hospital arrest.^{9,10,19} This is in part because rhythms other than ventricular tachycardia or fibrillation tend to predominate the longer an arrest is in progress, and only occasional survival with these rhythms—electromechanical dissociation and asystole—can be expected.¹ Along with the considerable clinical data regarding the worsening outcomes with prolonged CPR, experiments in various animal models measuring coronary and carotid blood flow during ventricular fibrillation and closed-chest cardiac compression reveal rates that are only fractions of normal values.²⁰⁻²² Modifications in technique improve carotid flow to some extent, but with little augmentation in coronary flow.^{21,22} While methodological difficulties with these investigations are recognized and their extrapolation to humans may be difficult, it is generally accepted that blood flow to vital organs is substantially reduced during CPR, which likely accounts for the dramatically diminished resuscitation rates with protracted arrest. Several authors have postulated that improved hospital survival in patients receiving bystander CPR is due to the maintenance of coronary and carotid blood flow, albeit low, which transiently prolongs the duration of ventricular fibrillation and reduces cerebral anoxic damage.

Why are the two "negative" studies^{9,10} presented in this issue of THE JOURNAL so important? Since more than 70% of patients (approximately 175 000 patients in the United States annually) experiencing prehospital cardiac arrest are unsuccessfully resuscitated, continued transport to hospitals before ceasing resuscitative efforts carries considerable costs, both in terms of health care personnel and economic resources. In one study that examined the use of resources for these patients, the cumulative emergency department time spent performing further, futile resuscitation averaged 2 hours for nurses and 45 minutes for physicians.⁶ In already overcrowded emergency departments, this only causes further, possibly detrimental, delay in caring for other patients. In addition, the fiscal costs are staggering. Bonnin et al¹⁰ estimate annual national charges for the transport and continued futile resuscitative efforts for these patients to be almost \$500 million. Moreover, the cost of hospitalizing those patients who are resuscitated in the emergency department after an unsuccessful field effort, none of whom ultimately survive to hospital discharge, also has been estimated to approach \$500 million annually.²³ All of that time and money is spent for little or no benefit in overall survival; this is difficult to justify any longer when health care costs are coming under such intense scrutiny.

As was done with great success in developing emergency medical systems over the years, it is time to incorporate the lessons learned from research on failed prehospital resuscitation as well. The crystalline realization that the only opportunity to save a prehospital arrest victim is at the scene should lead to the two following obvious conclusions. First, to rely on transport and further hospital care to make up for any inadequacies in an emergency medical system is not only delusional but also dangerous and costly to the community that is supposed to be served. The emphasis should be on

establishing all four links in the chain of survival, without which any efforts to provide resuscitation are inadequate. And second, protocols such as the one proposed by Bonnin et al¹⁰ should be established as criteria for termination of unsuccessful resuscitation at the scene of a prehospital cardiac arrest. This could be done initially in communication with a physician until a level of comfort with this approach is achieved among emergency medical personnel. Appropriate legislation at the state level will likely be required to ease the fear of litigation, which is probably in part responsible for the current practice of continuing unsuccessful resuscitation. In New Jersey, such legislation is in place, and as a result, approximately one fourth of patients are pronounced dead at the scene of arrest, resulting in reduced transport risk and hospital costs.²⁴ But what is ultimately needed is a physician in each locale who is willing to champion these proposals and instigate change, so that the emergency medical system can more often achieve, perhaps even at a reduced cost, its primary directive—to save lives.

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