

# Resuscitation Research in Emergency Medicine

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Sudden cardiac death is a worldwide public health problem with overwhelmingly poor outcomes. Improvements in outcome have been relatively refractory to otherwise impressive advances in the provision of emergency and intensive care medicine. Incremental progress has been demonstrated for some interventions such as community automated external defibrillator programs, timely provision of chest compressions, therapeutic hypothermia, and multidisciplinary coordinated approaches to care. Clearly, some outcomes can be improved through the provision of high quality, specific interventions [1,2]. However, the sudden cardiac death patient remains complex and poorly understood in terms of pathophysiology and optimal management. This is highlighted by the fact that there has been no significant change to the cardiac arrest pharmacopoeia in the modern era of advanced cardiac life support [3].

The key to improving outcomes of patients sustaining cardiac arrest in research is not very difficult. However, there are unique challenges that are specific to resuscitation research. First, cardiac arrest is a relatively rare, sudden, and unpredictable event. Study of this phenomenon and potentially beneficial interventions require large population-based studies. As such, study design, subject recruitment, and data management are very challenging.

Second, there is significant heterogeneity within the overall cohort of sudden cardiac death patients as evidenced by research demonstrating varying outcomes by cardiac arrest subgroups. Such variables include the etiology of the cardiac arrest event, the type of arrest rhythm, the duration of cardiac arrest, and co-morbidities, all of which are difficult to identify during the course of the arrest event. For example, there is evidence that compression-only cardiopulmonary resuscitation may not be ideal for all cardiac arrest patients. Instead, some subgroups may benefit from post cardiac arrest percutaneous coronary intervention, and patients with ventricular fibrillation cardiac arrest may respond better to therapeutic hypothermia than those with other arrhythmias [4-6].

Third, there are considerable regulatory obstacles and key ethical requirements for resuscitation research, especially with regard to multicenter studies [7]. Multiple regulatory standards must be complied with, including those from the office for Human Research Protections, Institutional Review Boards, and the Food and Drug Administration. Standard informed consent is not possible in many circumstances related to resuscitation research, yet it is fundamental to the protection of human research subjects, and any exception must be carefully approached. Community consultation and public disclosure are essential, as is an option to opt out of such research, as well as post-enrolment notification and consent.

Despite these obstacles, there are several remarkable collaborative research efforts directed at advancing care of the cardiac arrest patient. In the United States and Canada the Resuscitation Outcomes Consortium is a prospectively collected population-based registry of out-of-hospital cardiac arrest from regions with a collective population of approximately 23,000,000 [8]. It serves as a clinical trials network that provides infrastructure and support for cardiopulmonary arrest research. The All-Japan Utstein Registry of the Fire and Disaster Management Agency maintains a database of all cardiac arrest patients in Japan. This database serves as a robust database for research that advances care of the cardiac arrest patient and, like the Resuscitations

Outcomes Consortium, has resulted in numerous key resuscitation research publications. Examples of research from these consortiums includes work on public access defibrillation, out-of-hospital resuscitation variability, real-time feedback during cardiopulmonary resuscitation, automated external defibrillator use in the home, and public access defibrillation, among many others [9-14]. Lastly, Lin et al. describe the development of a novel approach to resuscitation research by developing a data dictionary as part of a web-based data collection form for the study of post-cardiac arrest therapeutic hypothermia at 43 Ontario hospitals [15]. This approach provides centralized control over data and data management, consistent standardized definitions, and improved data validity and reliability. Such an approach may be the ideal tool for studying interventions and outcomes in large numbers of cardiac arrest patients from geographically diverse regions.

There are many obstacles to advancing care of the cardiac arrest patient. However, we should not lack a robust evidence base to guide our care and around which to develop health care policy. Resuscitation research requires population-based collaborative efforts to identify those interventions that will save lives and decrease morbidity. We in emergency medicine should strive to participate in existing collaborative resuscitation research opportunities and seek to establish new cooperative research relationships with investigators both locally and internationally. Easy access to powerful data management tools, the ability to collaborate in real time around the world, and the advent of open access publishing of research make these exciting times for the future of resuscitation science and the future of emergency medicine research.

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