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System level changes for improving survival from cardiac arrest

Koichiro Shinozaki, MD, PhD, Lance B. Becker, MD, FAHA

Center for Resuscitation Science, University of Pennsylvania, Philadelphia, PA, USA

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Improving worldwide survival rates from cardiac arrest (CA) is an ambitious goal. This week's Critical Care Medicine (CCM) presents new data from Japan that demonstrates we are making progress. The Japanese data dovetails nicely and provides support for the recent Institute of Medicine (IOM) report on global system level strategies to improve survival from CA.

The first medical publication documenting survival from CA after cardiopulmonary resuscitation (CPR) was reported five decades ago(1). The state of research has come a long way since then. In 2000, the first International Liaison Committee on Resuscitation evidence-based guidelines for CA care were created(2). These CPR guidelines have been distributed via the American Heart Association and the American Red Cross in the United States and worldwide via national resuscitation councils. The Japanese guidelines were released throughout the country in 2010(3).

These guidelines are like a collection of excellent recipes. They can be assembled into a great cookbook, but they are not the same as a good restaurant or a fine dining experience. We know it takes much more, including an experienced cook, high quality food, proficient serving staff, and the right ambiance for everything to come together for a successful outcome.

In June 2015, the IOM released a report entitled "Strategies To Improve Survival From Cardiac Arrest: A Time To Act", that lays out a novel system level approach to improving survival(4). The report advances eight evidence-based system level recommendations that focus on concepts, like the need for a comprehensive national registry, cultural change among providers and the public, enhanced EMS capabilities, adoption of standards for continuous quality improvement, development of a robust research infrastructure, and the creation of a national advocacy organization that can collectively promote the full system level approach (Table 1). Compared to this system-level approach, our traditional CPR guidelines that promote the optimal compression-ventilation ratio, AED use, or a sequence of actions(5, 6), are like a collection of recipes, each of which contribute but are unlikely to

maximally save lives without commitment and implementation from the entire health care system. This is particularly true for a complex condition like CA that requires exacting and time sensitive therapies.

The report by Tagami (7) nicely presents a system level approach. They perform a nationwide retrospective study to examine the care received after the initial resuscitation and the impact of post-resuscitation care on survival rates. The investigators used an inpatient database and identified 3413 adults who both experienced out of hospital cardiac arrest (OHCA) and whose initial rhythms were appropriate for defibrillation. They found increased rates of implementation of therapeutic hypothermia and/or percutaneous coronary intervention (PCI) over time (2008–2012). Using multiple propensity scoring analysis they found significant associations between therapeutic hypothermia and/or PCI and improved 30-day mortality. Interestingly, the implementation rate of post-resuscitation care (therapeutic hypothermia or PCI or both) elevated dramatically from year 2010 to 2011 (29.3% to 41.2%) following the release of the Japanese guidelines. The major limitation of this study is that it is a retrospective analysis of administrative medical encounter data. While the propensity scoring can control for observable post resuscitation factors, the authors were unable to account for many other potentially confounding factors related to the initial resuscitation. Important data on the quality of CPR or the duration of arrest were not available. Nonetheless, this paper highlights the potential knowledge and improved outcomes possible when countries actively collect national data on CA as suggested by the IOM for the US.

There are additional system level questions to be examined. The financial impact of resuscitation care must be considered as societal resources are limited and health care must be allocated efficiently. In Japan, the costs of therapeutic hypothermia for CA patients have been covered since 2006 by the nation's universal public health insurance. Japan also facilitated the implementation of therapeutic hypothermia by providing incentives to physicians who contributed data to the national registry. From 2005 to 2012, the J-PULSE-Hypo study was conducted in 14 Japanese hospitals, the protocols were widely discussed among physicians, and a total of 467 OHCA patients received therapeutic hypothermia in this study(8). After the J-PULSE-Hypo study, the adoption of therapeutic hypothermia was greatly accelerated and was associated with improved survival. However, while the size of the effect from improvements in post-resuscitation care identified approximately 10% decrease, the authors do not report on other important outcomes that would be related to a post-resuscitation bundle, such as long-term neurologically-intact survival(9). The addition of pre-arrest comorbidity and resuscitation data, along with on-going analysis of the longitudinal national database will hopefully be able to identify the full impact of a national system-wide approach to OHCA and post-resuscitation care.

The report is encouraging in providing support that survival rates from OHCA seem to be improving, but a number of important questions remain. Are survival rates improving at the rate that would be possible under a more organized and better resourced system level approach as suggested by the IOM? Could we make more progress if the lines of authority made it clear who is responsible for a community or hospital's survival rate? What is the

optimal system to provide dispatcher assisted CPR to more patients? A national registry of CA will make it possible to examine these and other vital questions.

Deaths from many heart diseases such as coronary heart disease, and stroke have dropped more than 30% in the last decade(10). Many experts believe that a driving force for this improvement has been the investment of millions of dollars in research funding coupled with strong advocacy. But the data from the NIH informs us that as opposed to the significant investments in research for coronary heart disease and stroke, by direct comparison very little research funding has gone into CA. And it is also true that in the US, we have not yet seen large improvements in survival rates. This recent report suggests opportunities to improve survival from CA exist, the recent IOM report demonstrates a strategic pathway to achieve this goal. We agree that now is the “time to act”.

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Table 1.**IOM Recommended Strategies for Improving Cardiac Arrest Survival**

Recommendation 1	Establish a National Cardiac Arrest Registry
Recommendation 2	Foster a Culture of Action Through Public Awareness and Training
Recommendation 3	Enhance the Capabilities and Performance of Emergency Medical Services (EMS) Systems
Recommendation 4	Set National Accreditation Standards Related to Cardiac Arrest for Hospitals and Health Care Systems
Recommendation 5	Adopt Continuous Quality Improvement Programs
Recommendation 6	Accelerate Research on Pathophysiology, New Therapies, and Translation of Science for Cardiac Arrest
Recommendation 7	Accelerate Research on the Evaluation and Adoption of Cardiac Arrest Therapies
Recommendation 8	Create a National Cardiac Arrest Collaborative