The need for Singapore resuscitation research and guidelines

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Over the last 50 years of resuscitation practice since the introduction of modern day cardiopulmonary resuscitation (CPR),[1] the bulk of the research that has influenced the details of the practice has been conducted in the Western hemisphere where the size, anthropometric and ethnic characteristics of the patients are significantly different from the general population of Asia and Singapore. That ethnic differences do matter in the areas of characterisation and outcomes of cardiovascular disease has been well documented for both Asian and Caucasian populations.[2-5] Such differences have been noted in the risk factor profiles of these different populations.[6,7] Some variations have also been noted among acute myocardial infarction patients in the multiple ethnic groups in Singapore.[8]

These differences are not confined to the physical, ethnic anthropometric and biochemical differences in these populations. Social and infrastructural factors that play a major part in the clinical outcomes of cardiac arrest patients have also shown significant differences between Asian countries and those of the west. These factors are important from the perspective of management of a time-critical illness such as cardiac arrest.[9] In a number of communities in Arizona, USA, the ambulance response times[10,11] have decreased significantly to within five minutes, so that bystanders performing compression-only CPR are able to keep the circulation going for just those few minutes till the arrival of the emergency ambulance crew. Increasing the proportion of bystanders performing compression-only CPR has, in these instances, resulted in improved survival rates. On the other hand, the Iwami study in Japan[12] demonstrated that performance of compression-only CPR in Asian populations for longer than 15 minutes prior to ambulance arrival resulted in worse outcomes than if a combination of standard compressions and ventilations were performed. This has significant implications for other Asian countries such as Singapore, where our prehospital times prior to arrival of the ambulance are long, with an average of 25 minutes.[13] In such instances, compression-only CPR will result in worse outcomes than standard 30:2 CPR. This line of reasoning has been explored in the paper, 'Chest-compression only CPR or good quality 30:2 CPR'[14] in this issue of the journal.

Cardiac arrest management in the community may be divided into three phases. The first is known as the 'first responder' phase. First responders are members of the public. With the time-critical nature of the illness, first responders are in the best place to initiate life-saving CPR. However, the low bystander CPR rates in Singapore do not augur well for improved cardiac arrest survival. Leong reviews the evidence on bystander CPR rates[15] and discusses the value of increasing such rates. Research also shows that the quality of CPR delivered has a direct impact on a victim's chances of survival.[16] In fact, with every minute without CPR following sudden cardiac arrest, the probability of survival is reduced by 7%–10%. When bystander CPR is delivered, the patient stands a better chance, as the probability for survival reduces to 3%–4% per minute. Overall, bystander CPR increases survival by 2–3 times than if no bystander CPR were provided.[17-19] When rescuers deliver quality CPR, research indicates that survival rates can increase by four times, compared to when poor CPR were performed.[16,20-22]

To maximise survival with good quality CPR, there is a need to establish local standards and guidelines. These have been clearly defined by Lim[23] and the Basic Life Support Committee of the National Resuscitation Council (NRC). Local customisation for easier implementation has included standardisation of the chest compression counting procedure and continued emphasis on the need for bystanders to be trained in both chest compressions and mouth-to-mouth ventilations. The challenge lies in the widespread application of these guidelines to the first responder community, and plans that have been drawn up for implementation in Singapore over the years by the NRC are described by Anantharaman.[24] The application of quality measurement principles to out-of-hospital cardiac arrest management will likewise be a major challenge. Ong[25] provides a glimpse of some aspects of quality management that may be considered in the future.

The second phase of cardiac arrest management involves the second responders; the emergency ambulance crew. Additional efforts will be required in order to reduce the ambulance response times by more strategic positioning of available ambulances, converting more of the private ambulances in the country to assume emergency work through crew training and professional

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oversight, and by providing these second responders with resources to ensure greater efficiency of resuscitation during the approximately 20–25 minutes when they are caring for the patient. Efforts in this area include the early use of mechanical CPR devices to ensure a consistent level of chest compressions and adequate mechanical ventilations. Previous international experience with these is discussed by Leong.[26] In the not-too-distant future, it is possible that selected first responders may acquire such mechanical CPR devices for more effective CPR in the first few minutes of cardiac arrest till the arrival of an automated external defibrillator (AED) or the emergency ambulance crew. Second responders also carry AEDs. Although such devices are beginning to make their presence felt in the first responder environment, they are still used mainly by the ambulance crew. Guidelines for defibrillation have to consider the potential for rescuer fatigue when ambulance crew perform bystander CPR. The local guidelines intentionally try to minimise the impact of fatigue by allowing AED rhythm analysis at every one-minute interval rather than blindly following international protocols and accepting prolonged periods of poor quality CPR, which tends to occur after more than one minute of manual chest compressions. The updates to the local defibrillation guidelines have been described by Lee.[27] However, with the implementation of mechanical CPR devices in ambulances, rescuer fatigue may be less of an issue in this area, and guideline modifications to allow for longer periods of continuous chest compressions with interposed ventilations and longer duration of chest compressions before AED rhythm analysis will need to be considered.

The third phase of the community's cardiac arrest management cycle is in hospitals. Our third responders include Emergency Department staff and their colleagues working in the various intensive care units, cardiovascular laboratories and support departments. These third responders take over the patient from the ambulance crew, and would be applying the principles of advanced life support in their management of the patient. The updated guidelines for cardiac arrest are described by Anantharaman and Gunasegaran[28] in this issue. The local guidelines have varied significantly from those of other countries in areas where local experience has allowed better management of patients with specific cardiac rhythm disorders such as supraventricular tachycardias.[29,30] Third responders would now also need to consider the use of post-cardiac arrest procedures such as controlled hypothermia[31] and the creation of a post-resuscitation bundle[32] to decrease the number of lives lost after initial return of spontaneous circulation. Over the years, there has been little consideration for standardising the system for managing the quality of resuscitations carried out in our hospitals. The experience of Leong and Chua[33] illustrates the need for a standardised system for monitoring the quality of in-hospital resuscitations, identifying areas of weakness and evaluating the impact of various initiatives so as to strengthen the chain of survival within the hospital environment. The NRC will work with hospitals to set up and regularise the system of resuscitation quality monitoring and management.

Singapore, as well as much of the world, has a long way to go to optimise survivals of cardiac arrest occurring in the community. Being a small country, we should be in a better position to pool resources and set standards of care and quality in all three phases of the community's cardiac arrest management cycle. There is, however, a need to better understand the epidemiology and characteristics of cardiac arrest in the country and to determine the best method of implementing various interventions and skills in the three phases of cardiac arrest management in our environment. To this end, a strong cardiac arrest research base is required. This is gradually evolving with the conduct of the Cardiac Arrest and Research Epidemiology trials and the recently completed high-energy vs. low-energy biphasic defibrillation study over the last few years, the trials on rescuer fatigue during CPR as well as the currently ongoing out-of-hospital mechanical CPR trial. Dedicated and systematic research in the various phases of cardiac arrest management requires commitment of resources, which are currently scarce and subject to competition with other proposals for the research dollar. What needs to be appreciated is that survivors of cardiac arrest have an average further life span of 6.7 years. This, by itself, should be adequate grounds to support a sustained programme to address the multiple interventions that could help to improve survival. Singaporean clinicians have also taken leading positions in initiatives such as the Pan Asian Resuscitation Outcomes Study. The basis for all such studies and projects must be a structured data management system to capture relevant information on cardiac arrests whether they occur in an out-of-hospital or in-hospital environment. Such a system can reside with the availability of a Cardiac Arrest Registry.[34] This will ensure that the lessons learnt from various local trials will not only be retained, but also add to the scientific evidence that will become the basis for international guidelines serving the traditionally well-endowed communities of the west, which have been the seats of resuscitation research. It will also ensure that guidelines implemented locally are relevant and applicable to both the local and other similar Asian environments.

The NRC will take a global perspective of cardiac arrest management and work toward addressing areas that need improvement in all its three phases.

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