

The role of nurses in the resuscitation of in-hospital cardiac arrests

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ABSTRACT

Survival rates for in-hospital cardiac arrests are disappointing. Even though such arrests are often witnessed by a nurse, inadequate training may cause these first responders to have to wait for Advanced Cardiac Life Support trained personnel to arrive to perform defibrillation. The introduction of automated external defibrillator (AED) use by nurses was designed to address this problem, but studies have revealed that AED use is associated with a lower rate of survival after in-hospital cardiac arrest compared with no AED use. Interruption to cardiopulmonary resuscitation during the AED advisory mode is the likely reason for these unexpected results. Hence, courses like the Life Support Course for Nurses, which trains nurses to recognise collapse rhythms and to institute manual defibrillation, are extremely important. Barriers to the practice of advanced life support by nurses and recommendations for the prevention and management of in-hospital cardiac arrest are discussed.

Keywords: in-hospital cardiac arrest, Life Support Course for Nurses, life support instructors, nurse defibrillation, resuscitation officers

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INTRODUCTION

In a prospective observational study of 14,720 in-hospital cardiac arrests,⁽¹⁾ it was found that the collapse rhythm was ventricular fibrillation (VF) in only 25% of instances compared with VF being the predominant rhythm in out-of-hospital cardiac arrests.⁽²⁾ The other significant difference is that the majority of in-hospital cardiac arrests are witnessed events, theoretically making early cardiopulmonary resuscitation (CPR) and defibrillation possible. Thus the rationale for nurse-initiated resuscitation for in-hospital cardiac arrests is clear. Most in-hospital cardiac arrests are witnessed by nurses, and in cases of unwitnessed arrests, the first responders are usually also nurses. It is a basic requirement in most institutions for nurses to be trained in Basic Cardiac Life Support (BCLS). Intensive care unit (ICU) nurses

are usually further trained to the level of Advanced Cardiac Life Support (ACLS). ICU nurses typically initiate CPR and provide defibrillation, while general ward nurses perform CPR until a code-blue team or the ward team arrives to take over advanced level of care with defibrillation, drug therapy and stabilisation of the patient for transfer to the ICU. Despite the broad-based resuscitation training of nurses, the rates of survival to discharge for in-hospital cardiac arrest remain disappointingly low, at 36% for VF or pulseless ventricular tachycardia (VT) and 11% following asystole or pulseless electrical activity (PEA).⁽³⁾ The objective of this review is to consider the various roles nurses could play in cardiac arrest resuscitations, and explain how their role could be enhanced for patient benefit.

POTENTIAL ROLES FOR NURSES IN IN-HOSPITAL RESUSCITATIONS

In a hospital setting, nurses could play one or more of the following roles:

As a member of the resuscitation team

The initial rescuer performing CPR

In public institutions in Singapore, all nursing staff with patient contact duties need to be currently CPR certified. Since certification is for a period of two years, nurses would need to go through the CPR steps in a simulated environment at least once every two years in order to continue to have patient contact rights. How this translates to quality performance of CPR during defibrillation needs to be determined. A landmark study in the USA⁽⁴⁾ had shown that hospital-based staff fall extremely short of desired standards in CPR performance. Correction of these deficiencies can be addressed through reinforced quality CPR training and procedures to provide feedback to staff on the quality of their CPR performance. One cannot presume that all is well or that our nursing staff must be doing their CPR well in our hospitals. After all, a recent study in one of our hospitals⁽⁵⁾ revealed a return of spontaneous circulation (ROSC) rate of 63.8% and a survival to discharge rate of 13.1% for in-hospital cardiac arrests. There is a need to institute a set of indicators⁽⁶⁾ to better understand the quality of CPR performed during in-hospital cardiac resuscitations.

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In the meantime, there is a need to emphasise the importance of performance of good quality CPR by our ward nurses. All wards should be provided with the necessary resources to ensure a better quality of CPR, e.g. a step stool to ensure that the rescuer is vertically above the patient and able to confidently perform good quality chest compressions and a CPR counter to ensure correct rate of compressions and to remind rescuers not to interrupt these unnecessarily. Any person who performs CPR should be providing the best possible quality in the hospital, whether that person is a doctor or nurse. This can only be achieved if the person recognises and is convinced of the importance of good quality chest compressions. Therefore, refresher training with emphasis on quality is crucial.

Managing defibrillation

It is well documented that early defibrillation leads to optimum outcomes,⁽⁷⁾ and as most defibrillator machines may be readily switched from manual to automated external defibrillator (AED) mode with shock advisory, AED use is now regarded as a core skill for general ward nurses.⁽⁸⁻¹⁰⁾ Some hospitals combine BCLS and AED training into a single entity. Widespread training of nurses to use the AED would allow them to institute early defibrillation regardless of their level of training. It was postulated that this strategy would lead to earlier defibrillation of pulseless VT or VF, better rates of ROSC and improved rates of survival to discharge. On the other hand, it is hypothesised that AED use should not impact ROSC rates or survival to discharge of patients with asystole or PEA arrest.

However, Chan et al⁽¹¹⁾ demonstrated that AED use was associated with a lower rate of survival after in-hospital cardiac arrest compared with no AED use (16.3% vs. 19.3%; $p = 0.001$). Among cardiac arrest due to non-shockable rhythms, AED use was associated with lower survival (10.4% vs. 15.4%; $p = 0.001$). In contrast, for cardiac arrest due to shockable rhythms, AED use was not associated with improved survival (38.4% vs. 39.8%; $p = 0.99$). These patterns were consistently observed in both monitored and non-monitored hospital units where AEDs were used. Forcina et al⁽¹²⁾ reported similar findings. These unexpected findings were attributed to more frequent interruptions to CPR during AED use. During the advisory mode, AEDs instruct rescuers to stop CPR during rhythm analysis and while charging to deliver a shock. In one study of out-of-hospital cardiac arrests, chest compressions were only actively administered during 40% of the resuscitation time owing to interruptions by AED commands and other

resuscitation tasks.⁽¹³⁾ Due to these findings, rescuers are often advised to switch from advisory mode to manual defibrillator immediately upon arrival of ACLS-trained staff. Until AED technology improves, there may be a need to elevate the skills of general ward nurses to recognise shockable rhythms and deliver defibrillation. The need to closely interface AED use with almost uninterrupted CPR for best effect must be emphasised, and our nurses need to be brought up in such a culture.

Managing airway and ventilation

While ACLS is beyond the scope of most general ward nurses, a life support course that bridges the gap between BCLS and ACLS and equips nurses with knowledge and practical resuscitation skills is needed. The Life Support Course for Nurses (LSCN) was created in 1999 under the auspices of the National Resuscitation Council of Singapore. It teaches nurses advanced airway skills such as laryngeal mask ventilation, endotracheal intubation, rhythm recognition, defibrillation and simplified drug therapy. Around the world, similar courses have also been implemented.^(9,10,14,15) All nurses need to be familiar with insertion of an oral airway and effective use of a bag-mask ventilator.

Managing lines, drugs and tubes

Once it is ensured that one person is managing the chest compressions and another the ventilations, the other components of a good resuscitation come into play. Intravenous lines need to be placed for drug and fluid delivery, and sometimes, tubes such as bladder catheter and intra-arterial lines can enhance circulatory management. Even if nursing staff do not place these lines, they have an important role in managing the catheters, administering or helping to administer drugs and infusions as well as ensuring that these are maintained. It is important that at least one person is dedicated to these functions.

As the staff in charge of resuscitation documentation

It is common practice in most areas of the hospital to document the details of the resuscitation only at the end. This often results in approximation of number of doses of drugs delivered, timing of shocks and their magnitude, and the order of resuscitation. This does not allow a fully accurate picture of the resuscitation to be captured for subsequent evaluation and audit for continuous improvement. Accurate documentation is critical in resuscitations if we hope to learn from each patient and make future improvements. A few perspectives are relevant to documentation.

Implementing Utstein-style reporting

Hospitals in Singapore generally do not use standard reporting systems for their resuscitations. As a result, we do not have a unified understanding of the common challenges different institutions face in the conduct of resuscitations. A common reporting system⁽⁶⁾ has been developed for in-hospital cardiac arrests, which is being used increasingly in a number of countries. Any documentation system requires diligence in order to ensure completeness and usefulness. This requires attention to completing all aspects of documentation as accurately as possible. Nursing staff are known for their diligence in documentation of procedures. They should take charge of completing the reporting form for in-hospital cardiac arrests in the Utstein style. This will allow us to begin a standard form of documentation that will give a more complete picture as to how we manage our patients as well as a common language to discuss our resuscitative practices.

Prompting team members of critical actions required

It is important to ensure that all aspects of a resuscitative sequence have been adequately examined in the management of a cardiac arrest patient. The use of checklists to guide resuscitations can add a new dimension to ensuring completeness of the resuscitation attempt. With the use of such checklists, the resuscitation nurse leader may prompt resuscitation team members of the various areas they need to consider as they proceed with their resuscitation. Such checks can also be useful from a subsequent debrief perspective and will help to ensure that in time, all members of the resuscitation team will become better versed with all aspects of the resuscitation sequence.

Ensuring all follow-up actions are completed

Following the completion of a resuscitation, there is a need to ensure that all resuscitation records are captured, including timings of interventions and drug administration, printout of defibrillation sequences from the defibrillator and printout from the CPR feedback device. This must be carried out as a bundled checklist. Our nurses can fulfil this function by ensuring that all these documents are available during the resuscitation debrief.

As a hospital resuscitation officer

Many hospitals in the UK have appointed resuscitation officers to take charge of the implementation of resuscitation guidelines, ensure that all staff are trained appropriately, maintain training standards, monitor quality

of resuscitations and report regularly to the hospitals' resuscitation committees or governance boards on the quality of resuscitation conducted in the hospital. Some of these officers are nurses who have spent years involved in various aspects of resuscitation training, are very familiar with life support practices and understand the need for high resuscitation standards. McGowan et al⁽¹⁶⁾ reported that the appointment of a resuscitation training officer is associated with improved survival from in-hospital VF or VT arrest. Nurses could contribute tremendously in this role.

As a resuscitation instructor

Many nurses teach life support in our various hospitals. They contribute tremendously to helping the various grades of healthcare workers learn the skills of CPR. Most life support training centres face shortages of instructors, which often affect their ability to train more persons in the critical skills of life saving. Nurses are in a privileged position in society, being trained healthcare workers with the ability to pass on to members of the community the basic life saving skills of CPR and the use of an AED.

There is a need to consider training every nurse to the level of a CPR or CPR+AED instructor and requesting our nurses to continue as instructors for at least five years, teaching in life support courses at least twice annually. Not only will this demonstrate their commitment to saving lives in the community, but being an instructor also sharpens the skills for the procedure they are teaching. Instructing regularly will ensure that our nurses are not only knowledgeable and up to date with the various aspects of CPR, but it will also ensure that they are able to provide the highest standard of CPR any rescuer can provide. This way, they serve as role models for the burgeoning army of citizen first responders in the country. They will be able to teach in the various areas of the country where such instruction is required. In addition, they may volunteer their services in the various constituencies, especially in those close to where they live or work. This will address a real need in the country.

BARRIERS TO NURSE-INITIATED RESUSCITATION

Passing a course like LSCN only fulfils the first three stages of Miller's pyramid of competency⁽¹⁷⁾ (Fig. 1), where the trainee progresses from 'knows', 'knows how' to 'shows how'. Such early competency only describes what an individual is *able to do* in clinical practice, while what an individual *actually does*, the highest level in Miller's pyramid, is often the most challenging transition to make, and fraught with many barriers.

Numerous publications and surveys have identified consistent barriers to the practice of advanced skills like defibrillation. These include lack of confidence, fear of incurring litigation and harming the patient or themselves, perceived difficulty in interpreting electrocardiograph rhythms, entrenched 'supportive' role of nurses in resuscitation and the lack of practising privilege by the policy makers.^(15,19,20) Strategies that have been suggested to overcome these barriers include making defibrillation a prevalent and accepted core nursing procedure.⁽²⁰⁾ To address this reticence and effect a cultural change, nurses need to re-examine their role in resuscitation more closely and demonstrate that nurse-led resuscitation does lead to improved patient survival.

When given front-line roles in resuscitation, nurses have been shown to be capable leaders. Giligan et al⁽²¹⁾ reported that advanced life support (ALS)-trained emergency nurses performed as well as ALS-trained and non ALS-trained emergency junior doctors in a simulated cardiac arrest situation. The nurses had better applied knowledge of the potentially reversible causes of cardiac arrest. It was suggested that in the absence of a senior or middle-grade emergency doctor, it might be appropriate for ALS-trained nursing staff to act as the resuscitation leader, rather than the junior doctor.

RECOMMENDATIONS

Prevention of cardiac arrest is key, and factors contributing to poor outcomes, such as a lack of monitoring of vital parameters or recognition of early warning signs (e.g. deterioration of these parameters) by nursing staff, variable quality of CPR due to rescuer fatigue and cardiac arrests occurring during periods of low staffing,⁽²²⁾ after hours and over weekends, can all be identified and rectified. There is a need for systems to be in place to effect these. A multi-pronged approach to address these factors must include staff education in order to detect deterioration and implementation of criteria for escalation of care. Some hospitals have medical emergency teams (METs) that respond to any patient who is acutely unwell. Their role is to correct the patient's deranged physiology and prevent cardiac arrest. CPR-feedback devices can identify deterioration in rescuer performance and signal a need to change rescuer. Mechanical CPR devices provide consistent high-quality CPR and have the added advantage of freeing up personnel to attend to other aspects of the resuscitation. High-fidelity simulation team-based training enhances cooperation and communication between doctors and nurses who are responding to a cardiac arrest. Post-event debrief and video review of the team's performance are powerful educational tools, providing rescuers insight into

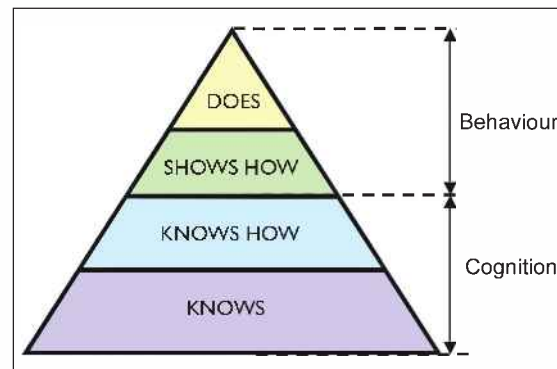


Fig. 1 Miller's pyramid of competency.

their performance and identifying areas for improvement. This practice should also be extended beyond the training arena so as to allow staff to debrief and reflect on the team's performance after an actual resuscitation.

AED engineering must address the problem of CPR interruption during the advisory mode. Improvements must be made to AED algorithms to allow CPR to continue during rhythm analysis and while the AED is charging. Nursing staff should also be cognisant of minimising CPR interruptions during airway or vascular access interventions.

CONCLUSION

Until AED technology improves, general ward nurses, often the first responders to in-hospital cardiac arrests, need to improve their resuscitation skills in order to recognise collapse rhythms and institute manual defibrillation. LSCN is a course designed to equip nurses with these skills. In tandem with such training, nurse administrators and the hospital leadership should sanction the practice of these resuscitation skills by nurses while systematically addressing the barriers described previously. Only then can we hope to make an impact on improving the survival rates of in-hospital cardiac arrest.

REFERENCES

1. Peberdy MA, Kaye W, Ornato JP, et al. Cardiopulmonary resuscitation of adults in the hospital: A report of 14 720 cardiac arrests from the National Registry of Cardiopulmonary Resuscitation. *Resuscitation* 2003; 58:297-308.
2. Bayes de Luna A, Coumel P, Leclercq JF. Ambulatory sudden cardiac death: mechanisms of production of fatal arrhythmia on the basis of data from 157 cases. *Am Heart J* 1989; 117:151-9.
3. Nadkarni VM, Larkin GL, Peberdy MA, et al. First documented rhythm and clinical outcome from in-hospital cardiac arrest among children and adults. *JAMA* 2006; 295:50-7.
4. Abella, BS, Alvarado, JP, Myklebust H, et al. Quality of cardiopulmonary resuscitation during in-hospital cardiac arrest. *JAMA* 2005; 293:305-10.
5. Leong BSH, Lim EL, Chan YH, et al. Evidence-based quality review and improvement of In-Hospital Cardiac Arrest response - NUH Cardiac Arrest Registry. Poster, NHG Congress 2009. Unpublished.

6. Cummins RO, Chamberlain D, Hazinski MF, et al. Recommended guidelines for reviewing, reporting, and conducting research on in-hospital resuscitation: the in-hospital "Utstein style". American Heart Association. *Circulation* 1997; 95:2213-39.
7. Larsen MP, Eisenberg MS, Cummins RO, Hallstrom AP. Predicting survival from out-of-hospital cardiac arrest: a graphic model. *Ann Emerg Med* 1993; 22:1652-8.
8. Warwick JP, Mackie K, Spencer I. Towards early defibrillation--a nurse training programme in the use of automated external defibrillators. *Resuscitation* 1995; 30:231-5.
9. Stewart JA. Focused nurse-defibrillation training: a simple and cost-effective strategy to improve survival from in-hospital cardiac arrest. *Scand J Trauma Resusc Emerg Med* 2010; 18:42.
10. Kaye W, Mancini ME, Giuliano KK, et al. Strengthening the in-hospital chain of survival with rapid defibrillation by first responders using automated external defibrillators: training and retention issues. *Ann Emerg Med* 1995; 25:163-8.
11. Chan PS, Krumholz HM, Spertus JA, et al. Automated external defibrillators and survival after in-hospital cardiac arrest. *JAMA* 2010; 304:2129-36.
12. Forcina MS, Farhat AY, O'Neil WW, Haines DE. Cardiac arrest survival after implementation of automated external defibrillator technology in the in-hospital setting. *Crit Care Med* 2009; 37:1229-36.
13. Valenzuela TD, Kern KB, Clark LL, et al. Interruptions of chest compressions during emergency medical systems resuscitation. *Circulation* 2005; 112:1259-65.
14. Shelton RJ, Allinson A, Johnson T, Smales C, Kaye GC. Four years experience of a nurse-led elective cardioversion service within a district general hospital setting. *Europace* 2006; 8:81-5.
15. O'Higgins F, Ward M, Nolan J. Advanced life support skills undertaken by nurses--UK survey. *Resuscitation* 2001; 50:45-9.
16. McGowan J, Graham CA, Gordon MW. Appointment of a Resuscitation Training Officer is associated with improved survival from in-hospital ventricular fibrillation/ventricular tachycardia cardiac arrest. *Resuscitation* 1999; 41:169-73.
17. Miller GE. The assessment of clinical skills/competence/performance. *Acad Med* 1990; S63-7.
18. Lee IS, Low LP. Nurses' role in the early defibrillation of cardiac patients: implications for nursing in Hong Kong. *Contemp Nurse* 2010; 35:88-94.
19. Dwyer T, Williams LM, Mummery K. Nurse-initiated defibrillation? Reality or rhetoric. *Nurs Crit Care* 2007; 12:270-7.
20. Coady EM. A strategy for nurse defibrillation in general wards. *Resuscitation* 1999; 42:183-6.
21. Gilligan P, Bhattacharjee C, Knight G, et al. To lead or not to lead? Prospective controlled study of study of emergency nurses' provision of advanced life support team leadership. *Emerg Med J* 2005; 22:628-32.
22. Peberdy MA, Ornato JP, Larkin GL, et al. Survival from in-hospital cardiac arrest during nights and weekends. *JAMA* 2008; 299:785-92.

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