Nurse-initiated defibrillation: are nurses confident enough?

C K Tai, Giles N Cattermole, Paulina S K Mak, Colin A Graham, Timothy H Rainer

ABSTRACT
Objectives To determine the capability of nurses to identify ventricular fibrillation (VF) and ventricular tachycardia (VT) rhythms on an ECG and carry out subsequent defibrillation on their own as soon as they identify and confirm cardiac arrest.

Methods This was a prospective cohort study to determine the capability of emergency department (ED) nurses to recognise VF or pulseless VT correctly and their willingness to perform defibrillation immediately in an ED of a teaching hospital in Hong Kong. A questionnaire was completed before and after a teaching session focusing on the identification of rhythms in cardiac arrest and defibrillation skills. Correct answers for both ECG interpretation and defibrillation decisions scored one point for each question. The differences in mean scores between the pre-teaching and post-teaching questionnaires of all nurses were calculated.

Results 51 pre-teaching and 43 post-teaching questionnaires were collected. There were no statistically significant changes in ECG scores after teaching. For defibrillation scores, there was an overall improvement in the defibrillation decision (absolute mean difference 0.42, p = 0.014). Performance was also improved by the teaching (absolute mean difference 0.465, p = 0.046), reflected by the combination of both scores. Two-thirds (67%) of nurses became more confident in managing patients with shockable rhythms.

Conclusion Nurses improve in defibrillation decision-making skills and confidence after appropriate brief, focused in-house training.

The survival rate of in-hospital cardiac arrest remains low despite the extensive efforts of different resuscitation councils to improve clinical management of this common condition. The survival-to-discharge rate ranges from 15.3% to 37%.

Nurses are usually the first healthcare staff to identify patients with cardiac arrest. Initial rhythm recognition is crucial to the management of patients with cardiac arrest because time is critical for survival in patients whose cardiac arrest rhythm is ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT).

Early defibrillation is a major key to increase survival, and therefore the use of an automated external device is included in modern standard basic life support (BLS) training. This leads to better survival rates for cardiac arrests outside critical care areas. Boyde and Wotton found that the majority of nurses can effectively manage all components of cardiopulmonary resuscitation (CPR). Ideally, all nurses should also be competent to recognise VF or pulseless VT and perform defibrillation within the first few seconds after collapse, and before any doctor arrives. On the other hand, it is equally important that a nurse should not misinterpret the ECG and give an unnecessary defibrillation shock to the patient.

It has been shown that the training of nurses in advanced cardiac life support (ACLS) is strongly related to improved survival for patients with cardiac arrest. Nurses can recognise shockable rhythms early and carry out defibrillation immediately. In addition, up-to-date training and greater self-confidence can lead to improved performance for medical professionals in resuscitation and subsequently increased survival. Nurses’ confidence and perceived technical and non-technical skills during patient clinical emergencies have been shown to be enhanced following simulation. Such training should be based on in-hospital scenarios and current evidence-based guidelines, including the recognition of sick patients, and should be taught using simulations of a variety of cardiac arrest scenarios. This will ensure that the training reflects the potential situations that nurses may face in practice.

However, there is lack of sufficient data about changes in performance after the implementation of nurse-initiated defibrillation. Some studies support the concept but they have failed to compare the outcomes objectively after implementing this technique.

The aim of the current study was to determine the capability of nurses to identify VF and VT rhythms on an ECG and carry out subsequent defibrillation on their own as soon as they identify and confirm cardiac arrest.

The results may affect the emphasis of nurses’ undergraduate and postgraduate training including ECG interpretation and defibrillation skills, which in turn may impact our current patient management practice.

METHODS
Study design
The study protocol was approved by the ethics committee from the Survey and Behavioural Research Ethics of the Chinese University of Hong Kong. This was a prospective cohort study to determine the capability of emergency department (ED) nurses to recognise VF or pulseless VT correctly and their willingness to perform defibrillation immediately. All nursing staff in the ED of the Prince of Wales Hospital in Shatin including nursing officers, registered nurses and enrolled nurses were invited to attend a 90-min teaching session about ECG interpretation and defibrillation skills. The teaching session was conducted by an assistant professor (GNC) in our department.
Prince of Wales Hospital is the only tertiary centre in the New Territories East Cluster in Hong Kong. There are approximately 375 resuscitation cases monthly including 25 cardiac arrest cases in the year 2009. Although all patients in cardiac arrest will be recognised and resuscitation initiated by nursing staff, the definitive care of all resuscitation cases is currently provided by medical practitioners. All registered nurses in the department undergo regular refresher training in BLS and frequently use it in practice.

Participants were asked to complete a questionnaire (see supplementary appendix 1, available online only) just before the teaching session. The questionnaire consisted of 10 questions; each included an ECG rhythm for identification and the decision for defibrillation. Correct answers for both parts scored one mark for the question and therefore the total marks for the questionnaire were 10. The teaching session focused on the identification of rhythms in cardiac arrest and defibrillation skills. It was followed by a practical session to practice defibrillation, using full monitor/defibrillators (not automated external defibrillators). The accuracy of CPR was also assessed, based on the American Heart Association BLS (2005) guidelines in an attempt to standardise skills. A 50:2 ratio with a compression depth of 1.5 to 2 inches was the aim for all participants.

Participants were invited to repeat the same assessment on the same set of ECG (see supplementary appendix 2, available online only) 1–2 weeks after the teaching session. The teaching sessions were mandatory for the nursing staff, and they were required to attend one of the teaching sessions unless there was a special reason for their absence. Participation in the study was voluntary. The accuracy rate for the recognition of VF and/or VT before and after teaching and the confidence in performing defibrillation was calculated and compared.

Statistical analysis

Nurses were grouped into two groups for data analysis: group one comprised nursing officers and advanced practice nurses, whereas group two consisted of registered nurses and enrolled nurses.

Correct answers for both ECG interpretation and defibrillation decisions scored one point for each question (maximum score of 10 for each part). The sum of the two scores was calculated and halved so that the scores had a maximum of 10 to allow comparison with the original scores. The combined score reflects their ability to give appropriate treatment to patients in cardiac arrest with a shockable rhythm. The differences in mean scores between pre-teaching and post-teaching questionnaires of all nurses were calculated. The paired-samples t test was used to analyse the pre-teaching and post-teaching score of each nurse.

The mean time in years from completion of the ACLS course to the current study was recorded and the means of the two groups were compared using a two-sample t test.

RESULTS

Fifty-one nurses attended the teaching session and all 51 pre-teaching questionnaires were collected (figure 1). Not surprisingly, the nurses in group 1 had more experience of working in the ED. Those in group 2 had less experience, which was more evenly distributed (table 1). Overall, 14 (27.4%) nurses had not completed an ACLS course. The mean number of years after completing an ACLS course was 8.3 (SD 4.2; range 1–14 years). Group 1 had a mean of 9.9 years since completing an ACLS course and group 2 had a mean of 6.5 years since completing an ACLS course, which was a statistically significant difference (p=0.0019, two-sample t test). A total of 43 post-teaching questionnaires was collected with nine from group 1 and the remainder from group 2. Two nurses from group 1 and six nurses from group 2 did not complete the post-teaching questionnaire because they were on vacation at that time or had left the department.

For ECG scores, there were no statistically significant changes in either group after teaching. For defibrillation scores, there was an overall improvement in the defibrillation decision (absolute mean difference 0.42, p=0.014). This is largely due to the improvement in group 2. When looking at the combined scores, performance was also improved by the teaching (absolute mean difference 0.465, p=0.046) (table 2).

Besides the objective data analysis, the nurses reported to have benefited from the teaching. Two-thirds (67%) of nurses

<table>
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<th>Nurses’ ED working experience (n=51)</th>
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<td>ACLS course taken</td>
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ACLS, advanced cardiac life support; ED, emergency department.
become more confident in managing patients with shockable rhythms.

**DISCUSSION**

Nurses are vitally important in patient care. They are usually the first responder to any physiological changes in hospital patients. In VF and pulseless VT, time is the most crucial factor for survival. The shorter the time from arrest to defibrillation, the better the survival rate will be. A delay in defibrillation time of 1 min can greatly decrease the chances of survival.10 24 25

Traditionally in Hong Kong and elsewhere, doctors play an important role in managing patients with cardiac arrest, especially during defibrillation. However, the survival rate is higher if defibrillation is done at an early stage by nurses before the arrival of a resuscitation team. Dwyer et al21 stated that nurses are confident enough to initiate defibrillation if they are permitted to do so. However, most of the studies lack local data to support this practice in Hong Kong. The presence of at least one person with ACLS training has been shown to increase both short-term and long-term survival following cardiac arrest.26 However, Smith et al27 and Madden28 stated that there is a dramatic decline in ACLS and BLS skills retention for nurses within the certification period, and ACLS skills degrade more quickly. Re-education of resuscitation can affect nurses’ knowledge and skills,29 and such training should be provided as often as possible to prevent skills deterioration between updates.17 Therefore, regular concise refreshing training may be beneficial. The fact that more senior nurses (group 1) had a longer interval between ACLS training and this study evaluation may help to explain the difference in scores observed between groups 1 and 2, but these differences were not statistically significant. Nevertheless, this suggests that regular ACLS training is of benefit to all levels of staff, not just ‘junior’ nursing staff.

The results of our study are encouraging. Apart from better decision making, the nurses became more confident when facing cardiac arrests due to VF or pulseless VT. Efforts should be made to have regular training for frontline nurses to keep them well equipped to face these clinical challenges. Nurses should be authorised to defibrillate independently without direct medical supervision. The resuscitation committee in this hospital has started to emphasise the involvement of nurses in resuscitation. Meanwhile, resuscitation still predominantly relies on doctors, but nurse-initiated defibrillation is under consideration and may be launched in the near future. Policies will clearly vary from hospital to hospital, but our experience of this short training programme suggests that nurses are capable of achieving high knowledge scores in this important area of practice. Furthermore, nurse-initiated resuscitation should be subject to a centralised case review process to provide feedback to staff involved in resuscitation and for clinical audit.

Our study mainly focuses on ED nurses who are relatively familiar with cardiac arrests. Nevertheless, there is still room for some improvement both in ECG interpretation and defibrillation decision making. This study could be extended in the future to nurses in different specialities for comparison.

In conclusion, we found that nurses improve in defibrillation decision-making skills and confidence after appropriate brief, focused in-house training.

**Competing interests**

None.

**Ethics approval**

This study was conducted with the approval of the Survey and Behavioural Research Ethics Committee of the Chinese University of Hong Kong.

**Provenance and peer review**

Not commissioned; externally peer reviewed.

**REFERENCES**

27. Herrera M, López F, González H, et al. [Results of the first year of experience of the cardiopulmonary resuscitation program “Juan Ramón Jiménez” Hospital [Huelva] [In Spanish]]. Med Intensiva 2010;34:170–81.
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