Arrest in Hospital: A Study of in Hospital Cardiac Arrest Outcomes

Abstract:

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The effect of advances in cardiac arrest management over the last five decades on in-hospital cardiac arrest survival rates has been described. The data were retrospectively reviewed between January 2013 were retrospectively reviewed over the study period 10.4 per 1000 patients per year. The demographics and arrest characteristics of 212 of these events were captured using the Utstein template for in-hospital cardiac arrest. The form captures specific information such as patient demographics (age, sex, etc.) and event variables (date, time of day, location, cause, initial rhythm, timing and types of airway provision and other resuscitation interventions such as provision of life-saving drugs and timing to delivery thereof), and was designed to be completed by cardiac arrest team leaders in real time. Overall the detail of the form comprises some 81 distinct possible data points and contains space for documenting each step of the Advanced Cardiac Life Support Algorithm. The form was designed by the Resuscitation Training Officer with multi-disciplinary input and in consultation with an Emergency Medicine Consultant, an advanced nurse practitioner in chest pain assessment, a consultant Anaesthetist and the Resuscitation Advisory Group of the Hospital.

Data on 212 distinct cardiac arrest events recorded over a 40 month period were retrospectively analysed by means of an audit form based upon the Utstein template for in-hospital cardiac arrest. The form captures specific information such as patient demographics (age, sex, etc.) and event variables (date, time of day, location, cause, initial rhythm, timing and types of airway provision and other resuscitation interventions such as provision of life-saving drugs and timing to delivery thereof), and was designed to be completed by cardiac arrest team leaders in real time. Overall the detail of the form comprises some 81 distinct possible data points and contains space for documenting each step of the Advanced Cardiac Life Support Algorithm. The form was designed by the Resuscitation Training Officer with multi-disciplinary input and in consultation with an Emergency Medicine Consultant, an advanced nurse practitioner in chest pain assessment, a consultant Anaesthetist and the Resuscitation Advisory Group of the Hospital.

All statistical analyses were performed with the use of descriptive statistics in Microsoft Excel. Means, Standard Deviations and 95% Confidence Intervals (CI) were used for continuous variables (age, time to delivery of medications etc), while frequency tables and cross tabulations were applied for categorical variables (location, gender, initial rhythm, whether an event was witnessed or not, etc.) Fischers exact test was used to investigate possible associations between categorical variables and two outcome groups (return of spontaneous circulation vs. death). In cases where the number of categorical variables numbered 3 or more a chi-squared analysis was used in place of Fischers exact test.

Results

Demographics and Arrest Characteristics

Between Jan 2010 and May 2013 the hospital admitted 71,508 patients, of which 2,548 died in hospital. The number of verified cardiac arrests logged during this period was 741, making the frequency of in hospital cardiac arrest during the study period 10.4 per 1000 patients per year. The data were retrospectively reviewed over the study period 10.4 per 1000 patients per year. The demographics and arrest characteristics of 212 of these events were captured using the Utstein template for in-hospital cardiac arrest. The form captures specific information such as patient demographics (age, sex, etc.) and event variables (date, time of day, location, cause, initial rhythm, timing and types of airway provision and other resuscitation interventions such as provision of life-saving drugs and timing to delivery thereof), and was designed to be completed by cardiac arrest team leaders in real time. Overall the detail of the form comprises some 81 distinct possible data points and contains space for documenting each step of the Advanced Cardiac Life Support Algorithm. The form was designed by the Resuscitation Training Officer with multi-disciplinary input and in consultation with an Emergency Medicine Consultant, an advanced nurse practitioner in chest pain assessment, a consultant Anaesthetist and the Resuscitation Advisory Group of the Hospital.

Outcomes

Return of spontaneous circulation was achieved in 98 cardiac arrests in total (46%); Table 2, in 28 patients (85%) with VF/VT and in 36 patients (29.5%) with asystole/PEA. Of the 98 patients who achieved return of spontaneous circulation, follow up data was available for 73 only. Of these 73, 39 survived to discharge while the remainder died in hospital (Table 2). Thus, the survival to discharge rate in this study was 39 out of 212 patients (18.4%).

Cardiac arrest team performance

The mean time to arrival of the cardiac arrest team (CAT) in all patients was 3.05 minutes (95% CI 2.66-3.44; Table 3). The mean time to arrival of the CAT in those who achieved return of spontaneous circulation was 3.1 minutes (95% CI 2.55-3.64), very similar to the mean time in those who did not (2.96 minutes; 95% CI 2.40-3.53). Regarding those patients who had a presenting rhythm of asystole/PEA, the first dose of adrenaline was given within 2 minutes of arrest onset or later (13 patients (31%); P=0.001), whether the initial rhythm was shockable or non-shockable (28 patients (85%) vs. 34 patients (31%); P=0.04).

Significant associations with outcomes

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Significant associations with outcomes
Regarding the two primary outcomes (Return of spontaneous circulation vs. death from cardiac arrest) Fishers exact test revealed a significant association between whether a cardiac arrest was witnessed, whether the presenting rhythm was ventricular tachycardia (VT), whether the patient was an in-hospital cardiac arrest, whether the first dose of adrenaline was administered within two minutes of arrest onset (Table 4). With regard to survival to discharge, significant associations were observed between whether the patient's age was less than 65 years or not, and whether the presenting rhythm was shockable or not (Table 4).

Discussion

This study has reported the use of an audit form based upon the Utstein reporting style for documenting the patient characteristics and event variables of 212 in-hospital cardiac arrests over a 26 month period. Whilst 741 verified cardiac arrests were logged during the study period, only 212 forms were completed, giving an uptake rate of just 28.6% for the audit form. This uptake probably reflects the inherently fast-paced and high pressure situation of a cardiac arrest, which makes it difficult for a cardiac arrest team leader to prioritise the completion of an audit form in real time. The low uptake is a key limitation in this type of study, and reflects the need to refine the audit form for easier completion in the future.

The overall rate of return of spontaneous circulation (46%) observed in this study is similar to that seen in other recent studies. In contrast to some previous studies, however, no significant associations between the rates of return of spontaneous circulation and gender or age were identified. This may reflect a population difference, or simply may be due to the lower number of patients documented in this study. Age was shown to be an important determinant in whether a patient will survive to discharge following cardiac arrest, with significantly more patients aged 65 years or less achieving discharge when compared to those older than 65 years (28% vs 14%; P = 0.029; Table 4). Patients were less likely to achieve return of spontaneous circulation if their arrest occurred on the ward when compared to the ICU (38% vs. 56%; P = 0.032; Table 4). This may reflect more intensive monitoring, such as telemetry, in the ICU environment, or may be due to more readily available IV access facilitating speedier delivery of adrenaline. Of note the mean time to administration of adrenaline in those patients suffering cardiac arrest on the ward was 8.2 mins, in contrast to 2.5 mins for those patients in the ICU (data not shown).

Also observed was a significant association between return of spontaneous circulation and witnessed cardiac arrests when compared to non-witnessed arrests (52% vs 30%; P = 0.029). This observation has been seen in other studies to date, and highlights the inherent danger in isolating patients at high risk of cardiac arrest in single rooms or small wards. In contrast to some previous studies, however, no significant associations between the rates of return of spontaneous circulation and gender or age were identified. This may represent a population difference, or simply may be due to the lower number of patients documented in this study. Age was shown to be an important determinant in whether a patient will survive to discharge following cardiac arrest, with significantly more patients aged 65 years or less achieving discharge when compared to those older than 65 years (28% vs 14%; P = 0.029; Table 4). Patients were less likely to achieve return of spontaneous circulation if their arrest occurred on the ward when compared to the ICU (38% vs. 56%; P = 0.032; Table 4). This may reflect more intensive monitoring, such as telemetry, in the ICU environment, or may be due to more readily available IV access facilitating speedier delivery of adrenaline. Of note the mean time to administration of adrenaline in those patients suffering cardiac arrest on the ward was 8.2 mins, in contrast to 2.5 mins for those patients in the ICU (data not shown).

There are many possible reasons for this difference. Firstly, it may simply reflect a high level of co-morbidities in this group of patients, with asystolic heart failure representing the end stage of multiple disease processes in hospitalised patients. Secondly, it may reflect the limitations of current treatments for non-shockable cardiac arrest rhythms. In the absence of defibrillation, the responder is limited to the use of chest compressions, airway provision and administration of anti-arrhythmic drugs such as adrenaline. Thirdly, it may reflect a need to shorten the time interval to administration of the first dose of adrenaline in asystole/PEA. The present study identified a significant association between the percentage of patients who achieved return of spontaneous circulation and the percentage that received the first dose of adrenaline within two minutes of arrest onset (28% vs. 56%; P = 0.029; Table 4). With regard to survival to discharge, data were available for only 73 of the 98 patients who achieved return of spontaneous circulation. Of these 73 patients, 12 survived to discharge, giving a survival to discharge rate of 16.4%. Multiple studies have also shown that survival to discharge rates currently range from 2% to 29%, with the average in larger studies being 18%.

Patients suffering in-hospital cardiac arrest are more likely to achieve return of spontaneous circulation if their arrest is witnessed and the initial arrest rhythm is shockable. However, the majority of patients suffering in-hospital cardiac arrest in this study presented with a non-shockable rhythm and these patients are more likely to achieve return of spontaneous circulation if the first dose of adrenaline is administered within two minutes of arrest onset.

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References


