In-hospital Cardiac Arrest at Cork University Hospital in 2011

Abstract:
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We describe the incidence and outcomes of in-hospital cardiac arrest (IHCA) at Cork University Hospital over a one year time period (2011), prior to the implementation of national early warning scoring (NEWS) systems. There were 43,217 coded CUH admissions in 2011, to 518 in-patient beds. The Hospital In-Patient Enquiry Database was used to identify adults (/>= 18 years) in patient cardiac arrest events which occurred from January 1st 2011 through the 31st of December 2011 were confirmed by the absence of a detectable pulse, unresponsiveness and apnoea (or agonal respirations). A resuscitation attempt is defined as any time on a Saturday or Sunday. A “survivor” is any IHCA patient who survived to hospital discharge, after successful completion of CPR. This definition excluded situations with brief returns of pulse during on-going CPR. We calculate cardiac arrest incidence by dividing the number of patients with IHCA, by the number of patients admitted to the hospital that year, (per 1000 admissions). In patients who experienced multiple arrests, the IHCA number includes only the index arrest.

Results

Resuscitation was defined as the use of chest compressions and rescue breathing. Advanced life support measures include invasive airway management, chest compression, drugs administration or defibrillation, with an automated external defibrillator (AED). An in-hours arrest refers to an IHCA that occurs Monday to Friday between 09:00 and 16:59; an “out-of-hours” arrest refers to an IHCA that occurs Monday to Friday between 17:00 and 08:59, or any time on a Saturday or Sunday. A survivor is any IHCA patient who survived to hospital discharge, after cardiac arrest. Survival rate was determined by dividing the number of survivors, by the total IHCA number.

The Hospital In-Patient Enquiry (HIPE) Reporting Database was used to identify eligible patients. Adult (/>= 18 years) in patient cardiac arrest events which occurred from January 1st 2011 through the 31st of December 2011 were included. Figure 1 illustrates chart inclusion criteria.

Cork University Hospital operates to ACLS (advanced cardiac life support) Guidelines. Physicians are expected to maintain up to date ACLS certification, likewise are Emergency, Intensive Care and Cardiac Care nurses. AEDs can be found on all general wards, as well as in the emergency department (ED), intensive care unit (ICU), cardiac care unit (CCU) and cardiac catheterisation laboratory (cath lab), with all staff trained in their use, irrespective of life support qualification level. Resuscitation equipment is standardised and located on every ward or unit; and within that area, is positioned nearest the highest dependency beds of that area. Cardiac arrest variables which were retrievable and obtained from patient chart included: age; sex; arrest location, time of day, day and month; if the cardiac arrest was witnessed and/or monitored; length of arrest episode; initial rhythm, length of stay prior to arrest were significantly different between survivors and non-survivors. All survivors (n=17) had intact neurological outcome post-event. Our outcomes from IHCA are poorest on hospital wards when compared to other areas of the hospital. Those that survive have excellent function and one-year survival.

Introduction

A cardiac arrest is a sentinel event in healthcare. Cardiopulmonary resuscitation, since the late-1950s, has been a standard of care for these patients. However, the success rate of this treatment protocol remains dismal, and the progress stagnant. Focus on improving cardiac arrest outcomes through an auditing culture has resulted in the development of Utstein-style guidelines for cardiac arrest. This template has provided a scaffold for the United States collaborative cardiac arrest registry, known as Get With The Guidelines Registry (GWTG-R); as well as the more recently developed National Cardiac Arrest Audit (NCAA) initiative among hospitals in the UK and Ireland. Factors surrounding in-hospital cardiac arrest incidence and outcome can highlight general aspects of hospital vigilance, system responsiveness and efficacy. This study describes the incidence and outcomes of in-hospital cardiac arrest at Cork University Hospital, for a one year time period (2011). This establishes a baseline prior to the implementation of national early warning scoring (NEWS) systems, designed to improve clinical vigilance for the deteriorating patient.
Results

HIPE identified 115 coded in-hospital cardiac arrest cases. These charts were retrieved and reviewed (Figure 1). There were 63 cases which met IHCA criteria. There were n=46/63 (73.0%) patients who achieved ROSC, n=21/63 (33.3%) who achieved a ROSC of greater than 20 minutes, and n=17/63 (27.0%) survived to be discharged from hospital alive (Table 1).

Location

Cardiac arrest outcomes differed on the hospital wards compared to other areas of the hospital, with ROSC rates of 12/22 (54.5%) versus 34/41 (82.9%), p=0.03; and survival rates 1/22 (4.5%) versus 16/41 (39.0%), p=0.01, respectively, (see also Table 2). Compared to a witnessing rate of n=55/63 (87.3%) among all IHCA, only n=44/63 (71.4%) of the ward-based cardiac arrests were witnessed. Within the emergency department (ED), n=6/15 (40.0%) cardiac arrests had a primarily cardiac aetiology, whereas only n=3/22 (13.6%) of those which took place on the ward had a primarily cardiac aetiology.

Length of Stay Prior to Arrest

There were n=24/63 (38.1%) of IHCA patients who had their cardiac arrest on day-one of admission, with, n=11/24 (45.8%), survivors, in that category. Of those IHCA patients who had their cardiac arrest after day-one of their admission, n=6/39 (15.4%) survived. There were two cardiac arrests (n=2/15, 13.3%) that occurred in the ED > 24 hours after registration while the patients were boarded awaiting an inpatient bed. Only n=1/22, 4.5% of ward-based cardiac arrests happened on day-one of admission. Of all IHCA patients who had a cardiac arrest on day-one of admission, n=13/24 (54.1%) were shockable. IHCA patients who had a cardiac arrest after day-one of admission, were only shockable in n=6/39 (15.4%) of cases. Length of stay prior to arrest was significantly different between a shockable and unshockable rhythm (p=0.002), and also between survivors and non-survivors, by logistic regression (p=0.01). The single ward survivor arrested on day 22 of admission. Median days of stay prior to arrest were significantly different between shockable (0 days) and unshockable rhythm (4.5 days), p-value < 0.002; and also between survivors (0 days) and non-survivors, (4.0 days), p-value < 0.01, respectively.
Arrest Characteristics

Of unshockable IHCA, n=8/44 (18.2%) subsequently converted to a shockable rhythm later in the resuscitation, and conversely, n=3/19 (15.8%) of shockable IHCA went on to become unshockable rhythms. Day and month of arrest are influential on survival and ROSC, respectively, however time of arrest was not significantly associated with either. See Figure 2 for outcomes per survival rhythm. Survivors had more arrests on their first day of admission, n=11/17 (64.7%), than non-survivors, n=13/46 (28.3%), p=0.02.

Length of Resuscitation

Resuscitation lasted less than 10 minutes in, n=37/63 (58.7%), of IHCA cases. In those that achieved ROSC, n=30/41 (73.2%), did so within 10 minutes. The median length of resuscitation lasted 5 minutes in survivors, which was significantly shorter than the median of 15 minutes, in patients who did not survive, p-value = 0.015.

Survivor Outcome

All survivors, (n=17), had a CPC score of one, post-arrest. One patient was subsequently lost to follow up. The remainder of survivors, (n=16/17), lived to at least 12 months post-arrest. There were three survivors who experienced a deterioration in their functional independence for activities of daily living.

Discussion

This is the first Irish report of in-hospital arrest data that has been contextualised by the manual review of patient notes. This approach was crucial, as nearly half of our initially defined study denominator subsequently did not satisfy the definition of an in-hospital cardiac arrest per the Utstein criteria, following this chart analysis. Our cardiac arrest incidence and survival rate was shown to be comparable to international standard. Our survivors neurological outcomes approached 100%, and this correlated with excellent functional outcomes. Our cohorts good outcome is somewhat unique in cardiac arrest literature, with a preservation of neurological function in less than 80% of cases, typically. Survival at the ward level was lower than that seen in all other hospital locations (Table 2). The poorer outcomes seen in ward-based IHCA, seem related to prognostic favorability of a shockable rhythm, which we found to be less likely in a long-stay patient’s IHCA. We found that length of resuscitation was significantly shorter among survivors versus non-survivors, which is an established phenomenon. Although our survival rate was excellent, the duration of our resuscitation attempts was shorter (in some cases) than some literature would advise.

The issues of decreased observation, dilution of expertise, and de-escalated patient monitoring seen in ward care are a focus of the newly implemented NEWS system, as monitored and witnessed arrests are more likely to survive. This new approach aims to identify physiologic deteriorations and allow early interventions. This has been shown to alter
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Not all Utstein variables were available for this study, due to documentation limitations. In the case of timing-based variables, such as time-to-defibrillation (in shockable rhythms), whereas a brewing septic milieu is more likely to lead to PEA or asystole 

## References


6. National Cardiac Arrest Audit Homepage

https://www.icaarnc.org/CMS/ArticleDisplay.aspx?ID=acf00d90-5fdb-df11-8854-002264a1a658&root=RESEARCH&categoryID=b6fbea09-61db-df11-8854-002264a1a658


17. Franklin C, Mathew J (1994) Developing strategies to prevent inhospital cardiac arrest: analyzing responses of physicians and nurses in the hours before the event. Critical care medicine 22 (2):244-247

