Author/s:
Crosbie, D;Ghosh, A;Van Ekeren, N;Dowling, M;Hayes, B;Cross, A;Jones, D

Title:
Non-beneficial resuscitation during inhospital cardiac arrests in a metropolitan teaching hospital

Date:
2023-05-01

Citation:
Crosbie, D., Ghosh, A., Van Ekeren, N., Dowling, M., Hayes, B., Cross, A. & Jones, D. (2023). Non-beneficial resuscitation during inhospital cardiac arrests in a metropolitan teaching hospital. Internal Medicine Journal, 53 (5), pp.798-802. https://doi.org/10.1111/imj.15638.

Persistent Link:
https://hdl.handle.net/11343/338048

Title:

Non-beneficial resuscitation during in-hospital cardiac arrests in a metropolitan teaching hospital

Authors:

David Crosbie [a], Angaj Ghosh [a], Narkitaa Van Ekeren [a], Monica Dowling [a], Barbara Hayes [b,d], Anthony Cross [a,c], Daryl Jones [e,f]

a. Intensive Care Unit, Northern Health Epping, Melbourne, VIC, Australia
b. Palliative Care Unit, Northern Health Epping, Melbourne, VIC, Australia
c. Department of Critical Care, Melbourne Medical School, University of Melbourne, Melbourne, VIC, Australia
d. Northern Clinical School, University of Melbourne, Melbourne, VIC, Australia
e. Department of Intensive Care, Austin Health, Melbourne, VIC, Australia
f. Department of Epidemiology and Preventative Medicine, Monash University, Melbourne, VIC, Australia

Corresponding Author:

Dr David Crosbie

Northern Health Epping

185 Cooper Street, Epping, Victoria AUSTRALIA 3076

David.crosbie@nh.org.au

Word counts:

Abstract – 200

Paper – 1749

Abstract:

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi:

This article is protected by copyright. All rights reserved.

Purpose:

To describe the prevalence of non-beneficial resuscitation attempts in hospitalised patients and identify interventions that could be used to reduce these events.

Methods:

A retrospective analysis was conducted of all adult IHCAs receiving cardiopulmonary resuscitation (CPR) in a teaching hospital over nine years. Demographics and arrest characteristics were obtained from a prospectively collected database. Non-beneficial CPR was defined as CPR being administered to patients who had a current not for resuscitation (NFR) order in place or who had an NFR order enacted on a previous hospital admission. Further antecedent factors and resuscitation characteristics were collected for these patients.

Results:

There were 257 IHCAs, of which 115 (44.7%) occurred on general wards, with 19.8% of all patients surviving to discharge home. There were 39 (15.2%) instances of non-beneficial CPR of which 28/39 (72%) occurred in unmonitored patients on the ward comprising nearly a quarter (28/115) of all arrests in this patient group. A specialist had reviewed 30/39 (76.9%) of these patients, and 33.3% (13/39) had a medical emergency team (MET) review prior to their arrest.

Conclusions:

Over one in seven resuscitation attempts were non-beneficial. MET reviews and specialist ward rounds provide opportunities to improve the documentation and visibility of NFR status.

Key words:

IHCA, non-beneficial, CPR, NFR, MET, goals of care

Authors:

Crosbie D, Ghosh A, Van Ekeren N, Dowling M, Hayes B, Cross A, Jones D

Introduction:

In-hospital cardiac arrest (IHCA) in Australia is fortunately a rare event (around 1/1000 admissions[1]). Although the implementation of Rapid Response Systems (RRS) over the last 25 years has seen improved survival from IHCAs, the major contributor to better outcomes has been a reduction in IHCA incidence rate[2]. Regrettably, IHCA mortality remains high[3], and one quarter of survivors have a poor functional outcome[1,4] with many suffering long term pain, disability and an inability to return to work. It has been recognised for some time that a considerable proportion of IHCA patients should have been deemed not for resuscitation (NFR) due to their co-morbidities[5]. Moreover, there is increasing concern of the potential for harm of subjecting patients to non-beneficial or unwanted attempts at resuscitation[6].

Investigators have reported small case series[7,8] of patients receiving cardiopulmonary resuscitation (CPR) despite a valid NFR order. In this study we sought to describe the frequency and characteristics of patients who received non-beneficial CPR amongst all IHCAs over a nine year period in our institution. The aim was to identify potentially modifiable factors associated with these events to guide future intervention to reduce such non-beneficial resuscitation attempts.

Methods:

Design

The study was a retrospective analysis of prospectively collected patient data. It was approved by the Northern Health Research Office as a Quality and Service Improvement Project (ALR 87.2020).

Setting

The study was conducted at Northern Health Epping (NHE), a metropolitan, university-affiliated teaching hospital in Melbourne, Australia. The hospital has over 400 beds with approximately 30 000 multiday admissions per annum. A full range of adult medical and surgical services are available with the exception of cardiac and neurosurgery.

Data sources

NHE implemented a RRS in 1998 which has the Medical Emergency Team (MET) as the efferent limb and uses defined calling criteria that have been described in detail previously[9]. In addition the MET responds to any code blue call, which is activated for a suspected or confirmed cardiac or respiratory arrest or a threatened airway. The MET comprises an intensive care fellow (registrar) or specialist (during business hours), an intensive care nurse and an internal medicine fellow. Details of all MET and code blue calls are recorded by the MET in a standard format and entered into a secure database. Additional patient data was obtained from the hospital's electronic medical record.

Inclusion criteria

This study included all adult in-patients who had an IHCA and received CPR by the code blue team, as recorded in the hospital's database, from 1 January 2012 until 31 December 2020. For patients suffering multiple IHCAs only the first arrest was analysed.

Exclusion criteria

Patients who had an out of hospital cardiac arrest were excluded, as were those who did not receive CPR during the code blue call or only required defibrillation (for example for arrhythmias during cardiac angiography).

Data collected

For each IHCA data was collected on demographics (age, gender, admission source, body system associated with admission diagnosis, admitting unit, prior NFR order), peri-arrest factors (day of arrest occurrence, time of day, weekend/public holiday, pre-arrest MET calls, location, monitoring)

and actual arrest details (witnessed vs non-witnessed, initial rhythm, return of spontaneous circulation [ROSC], intensive care [ICU] admission, hospital mortality, discharge destination).

Non-beneficial CPR

We defined non-beneficial CPR as occurring in patients who received CPR despite an existing NFR order, or an NFR order on a previous admission. For these patients we collected further information on frailty[10], comorbidities[11], length of stay, number of previous admissions, frequency of antecedent MET call review for non-cardiac arrest events, frequency and timing of preceding specialist review, resuscitation duration and other interventions.

Arrest location

For the purposes of our analysis we defined patient groups based on hospital location at the time of the arrest. Unmonitored ward patients were on a standard hospital ward nursed at a 1:4 nursing ratio during the day with a 1:8 ratio overnight. Monitored ward patients included any patient on a telemetry ward as well as patients in the coronary care unit (CCU) where the nursing ratio would have been higher (1:2 or 1:3). High care environment patients were in ICU, the cardiac catheter laboratory, the operating theatre or the emergency department.

Statistical analysis

Descriptive data is presented as raw numbers and percentages. Normally distributed data is expressed as means with 95% confidence intervals, and non-normally distributed data as medians with interquartile ranges (IQR). Distributed data was compared with the Mann-Whitney U test. A two-sided p value of < 0.05 was used to indicate statistical significance. Statistical analysis was performed using Stata 14 (StataCorp. 2015, College Station, Texas).

Results:

Overall cohort arrest characteristics and outcomes

Over a nine year period 257 IHCAs fulfilling the inclusion criteria were analysed, of which 115 (44.7%) were unmonitored ward patients, 37 (14.4%) were monitored on the ward and 105 (40.9%) were in high care environments. During this period there was a total of 281 641 overnight and multi-day admissions, which gives an overall arrest rate of 0.9 per 1000 admissions overall and 0.4 per 1000 admissions for unmonitored ward patients. Table 1 shows arrest characteristics of the overall cohort separated by arrest location. The median patient age was 69 (IQR 57-78) years and 63% were male. Shockable rhythms were detected in 19.4% of the patients overall and 19.8% were discharged to home. The rates of shockable rhythms, ROSC and survival were lower for unmonitored ward patients, and nearly half of unmonitored ward arrests were not witnessed (Table 1).

Patients receiving non-beneficial CPR

The study identified 39 (15.2%) patients who received CPR despite having either a current NFR order (14 patients) or an NFR order on a previous admission (25 patients). The majority (28/39 [71.8%]) of these events occurred in unmonitored wards, where nearly one quarter of arrested patients (28/115) received CPR despite a current or previous NFR order. As illustrated in Table 2 the demographics, comorbidities and arrest characteristics were similar regardless of whether the NFR order was documented in the current or previous admission, and all patients could be classified as frail. Amongst the patients receiving non-beneficial CPR, 13/39 (33.3%) had a non-arrest related MET call prior to their IHCA and 10/13 (76.9%) received a MET review within less than 24 hours of the arrest. More than three quarters (30/39 [76.9%]) were seen by a specialist before their arrest, with the median time to specialist review of 0.5 days (IQR 0, 1). Most of the patients received medical interventions (vasoactive drugs, defibrillation or intubation) in addition to CPR (Table 2), and the longest resuscitation attempt was 51 minutes. Of the 39 patients with an existing or prior NFR designation, 3 (7.7%) were discharged to home. In 12 of the 14 patients who received CPR in the presence of an existing NFR order, CPR was ceased when the NFR form was located. For the patients

who had a NFR order on a previous admission, 18/25 (72%) did not have any documentation of resuscitation status prior to their CPR attempt.

Discussion

Summary of major findings

Over a nine year period at this institution more than one in seven patients suffering an IHCA appeared to have received non-beneficial CPR. Several factors were identified that could be modified or enhanced to avoid non-beneficial CPR attempts. Over three quarters of patients were seen by a senior doctor before they arrested, and a third had a MET call prior to the event. For the patients who received CPR in the presence of a current NFR order, nearly all cases occurred because of delays in locating the NFR documentation.

Comparison with previous studies

To the best of our knowledge this study is the first in Australia to describe the characteristics of hospital inpatients receiving non-beneficial CPR in the context of all cardiac arrests in an institution over a long time period. The overall arrest characteristics and outcome of the cohort are similar to those of other described Australian studies[1,12], with an incident rate at the lower end of the reported range in the literature[3]. The hospital survival of our cohort was lower than that reported by other investigators [1,13], possibly due to the majority of arrests occurring on the ward and being unmonitored. In addition, we included outcomes for those who received non-beneficial CPR. If such patients were excluded, hospital survival was 33% (72/218).

There is limited international literature on patients receiving non-beneficial CPR[7,8,14], while two Australian studies[13,15] have identified the proportion of patients receiving CPR despite having a NFR order during a previous admission. Our study has expanded on this work by providing further details on antecedent factors associated with non-beneficial CPR. Of concern we also found that the majority of patients received invasive medical interventions in addition to the resuscitation.

Implications of findings

This study has shown that up to a quarter of CPR attempts on ward patients could be non-beneficial CPR, suggesting a failing in end of life discussions and formulation of resuscitation plans. Over 70% of these patients had a MET call or were seen by a senior doctor less than a day before the cardiac arrest. This is of particular concern in light of the increasing recognition of the harms of inappropriate CPR attempts. As described by Field et al[16] "performing an invasive and unsuccessful resuscitation procedure towards the end of a person's natural life can lead to a loss of dignity and potentially prolong suffering". There are also potential medico-legal ramifications for health practitioners in our region, whereby performing an intervention against a patient's pre-specified wishes is regarded as unprofessional conduct[17]. Such events may also lead to distress in the attending clinical staff[18].

Future research

This study has shown that non-beneficial CPR attempts are frequent and there are several potentially modifiable factors that could reduce their occurrence. Enhanced visibility of NFR status would be an obvious area to target, and improvement beyond paper-based forms for bedside clinicians is clearly needed. Resuscitation orders need to be explicitly discussed and communicated at MET reviews, with reinforcement at nursing handovers and daily multi-disciplinary huddles. The implementation of such measures is being considered at this institution in the future, with the introduction of an Electronic Medical Record (EMR) with the potential for automatic displays of resuscitation plans. This patient dataset will be a useful comparator to assess the utility of any intervention at reducing the incidence of non-beneficial resuscitation.

Limitations of our study

The analysis was conducted retrospectively which carries a risk of missing data, however the data was documented prospectively by trained operators contemporaneously to each event. Our study

was single centre in nature, although our hospital has features of many other metropolitan teaching hospitals. In critical care areas it is possible that the true arrest rate is higher than reported as not all arrests lead to an activation of the code blue response.

Conclusions:

Although there is a low incidence of IHCA in our institution, one in seven patients received non-beneficial CPR. These events might be prevented by improved visibility, availability and awareness of NFR orders, and improving NFR documentation for patients expected to have a poor outcome from CPR. This could be achieved during MET reviews or specialist ward rounds as well as nursing handover.

Conflicts of Interest:

None

Acknowledgements:

The NHE ICU liaison nursing staff for their dedicated data collection over the years.

Funding statement:

This research did not receive funding from any sources.

References:

1. Pound G, Jones D, Eastwood GM, Paul E, Hodgson CL. Survival and functional outcome at hospital discharge following in-hospital cardiac arrest (IHCA): A prospective multicentre observation study. *Resuscitation* 2020; 155: 48054
2. Chen J, Ou L, Hillman KM et al. Cardiopulmonary arrest and mortality trends, and their association with rapid response system expansion. *Med J Aust* 2014; 201: 167-170
3. Fennessy G, Hilton A, Radford S, Bellomo R, Jones D. The epidemiology of in-hospital cardiac arrests in Australia and New Zealand. *Int Med J* 2016; 46: 1172-81

4. Thompson LE, Chan PS, Tang F, et al. Long-term survival trends of medicare patients after in-hospital cardiac arrest: insights from get with the guidelines-resuscitation. *Resuscitation* 2018; 123: 58-64
5. Vetro J, Natarajan DK, Mercer I et al. Antecedents to cardiac arrests in a hospital equipped with a medical emergency team. *Crit Care Resus* 2011; 13: 162-166
6. Johnson CE, Chong JC, Wilkinson A, Hayes B, Tait S, Waldron N. Goals of patient care system change with video-based education increases rates of advanced cardiopulmonary resuscitation decision-making and discussions in hospitalise rehabilitation patients. *Int Med J* 2017; 47: 798-806
7. Baxter L, Hancox J, King B, Powell A, Tolley T. STOP! Patients receiving CPR despite valid DNACPR documentation. *Eur J Palliative Care* 2018; 25:125-7
8. Wong J, Duane PG, Ingraham NE. A case series of patients who were do not resuscitate but underwent cardiopulmonary resuscitation. *Resuscitation* 2020; 146: 145-146
9. Casamento AJ, Dunlop C, Jones DA, Duke G. Improving the documentation of medical emergency team reviews. *Crit Care Resusc*. 2008 Mar;10(1):29. PMID: 18304014.
10. Rockwood K, Song X, MacKnight C et al. A global clinical measure of fitness and frailty in elderly people. *CMAJ* 2005; 173:489-95
11. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic co-morbidity in longitudinal studies: Development and validation. J Chronic Dis. 1987; 40(5):373-83.
12. Doherty Z, Fletcher J, Fuzzard K, Kippen R, Knott C, O'Sullivan B. Short and long-term survival following an in-hospital cardiac arrest in a regional hospital cohort. *Resuscitation* 2019; 143: 134-141
13. Jones D, Mercer I, Heland M et al. In-hospital cardiac arrest epidemiology in a mature rapid response system. *Br J of Hosp Med* 2017; 78 (3): 1-7

14. Findlay GP, Shotton HR. Time to intervene? A review of patients who underwent cardiopulmonary resuscitation as a result of an in-hospital cardiorespiratory arrest. London *NCEPOD* 2012.
15. Bingham G, Bilgrami I, Sandford M et al. Avoiding adult in-hospital cardiac arrest: A retrospective cohort study to determine preventability. *Aust Crit Care* 2018 Jul; 31(4):219-225
16. Field RA, Fritz Z, Baker A, Grove A, Perkins GD. Systematic review of interventions to improve appropriate use and outcomes associated with do-not-attempt-cardiopulmonary-resuscitation decisions. *Resuscitation* 2014; 85: 1418-31
17. Medical Treatment Planning & Decisions Act 2016, Parliament of Victoria
18. Hayes B. Clinical model for ethical cardiopulmonary resuscitation decision-making. *Int Med J* 2013; 43: 77-83

Table 1: Characteristics of 257 in-hospital cardiac arrests in a teaching hospital according to location

Location	Unmonitored ward	Monitored ward	High care area	overall
Number	115	37	105	257

Witnessed, *n* (%)	65 (56.5%)	36 (97.3%)	105 (100%)	206 (80.1%)
Shockable, *n* (%)	9 (7.8%)	12 (32.4%)	29 (27.6%)	50 (19.4%)
ROSC, *n* (%)	42 (36.5%)	27 (72.9%)	65 (63.8%)	134 (52.1%)
Hospital survival - Overall, *n* (%) - If got ROSC, *n* (%) - Shockable, *n* (%) - Non-shockable, *n* (%)	 17 (14.8%) 17 (40.4%) 3 (33%) 14 (13%)	 19 (51%) 19 (70.4%) 10 (83%) 9 (36%)	 43 (41%) 43 (50%) 19 (65.5%) 23 (31.1%)	 79 (30.7%) 79 (59%) 32 (65%) 46 (22.3%)
Discharge home, *n* (%)	11 (9.6%)	14 (38%)	26 (24.8%)	51 (19.8%)

Table 2: Characteristics of 39 patients receiving non-beneficial CPR

	NFR order in current admission	NFR order in past admission	Total	p-value
Patients (n)	14	25	39	
Male n (%)	10 (71%)	11 (44%)	21 (54%)	0.09
Age (y) median, IQR	74.5 (71-80)	81 (69-86)	80 (71-84)	0.326
Admitting diagnosis n (%) - Cardiorespiratory - Other	 9 (64%) 5 (36%)	 12 (48%) 13 (52%)	 21 (54%) 18 (46%)	 0.328
Comorbidities (median, IQR)	2, 2-3	2, 2-3	2, 2-3	0.987
Previous admissions (median, IQR)	4, 2-7	5, 3-8	4, 3-8	0.153
Admitting unit n (%) - Medical	 11 (79%)	 17 (68%)	 28 (72%)	 0.482

- Other	3 (21%)	8 (32%)	11 (28%)	
Clinical Frailty Score (median, IQR)	6 (4,6)	4 (3,5)	5 (4,6)	0.015
Length of stay (median, IQR)	4.5, 2-11	3, 2-7	4, 2-9	0.565
MET call prior to arrest n (%)	7 (50%)	9 (36%)	16 (41%)	0.4
Time of arrest -In hours (0800-1700) -Out of hours (1701-0759)	 8 (57%) 6 (43%)	 14 (56%) 11 (44%)	 25 (64%) 14 (36%)	0.95
Weekend/public holiday (%)	7 (50%)	5 (20%)	12 (31%)	0.54
Witnessed (%)	10 (71%)	16 (64%)	26 (67%)	0.64
Monitored (%)	4(29%)	5(20%)	9(23%)	0.54
Shockable (%)	2 (14%)	4 (16%)	6 (15%)	0.25
Location (n) - Ward - Other	 13 (93%) 1 (7%)	 22 (88%) 3 (12%)	 35 (90%) 4 (10%)	0.632
ROSC (%)	4(29%)	11 (44%)	15 (39%)	0.34
Hospital mortality (%)	13 (93%)	19 (76%)	32 (82%)	0.194
Discharged home (%)	0	3 (12%)	3 (7.7%)	0.174
Length of CPR (mins) (median, IQR)	2 (1,4)	9 (5,14)	5 (2,13)	0.0017
Received interventions other than compressions (%)	5 (36%)	17 (68%)	22(56%)	0.054