Cardiac Arrest Study
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Expert Group Members

Dr Andy Lockey Consultant in Emergency Medicine, Resuscitation Council UK
Dr David Pitcher Consultant Cardiologist, Resuscitation Council UK
Dr Jerry Nolan Consultant Anaesthetist, Resuscitation Council UK
Dr Linda Twohey Consultant in Anaesthetics and Intensive Care
Mr Ken Spearpoint Consultant Nurse, Resuscitation, Council for Professionals as Resuscitation Officers
Mrs Audrey Brightwell Lay representative
Ms Dot Timms Senior Nurse Resuscitation Service
Professor Mike Pearson Professor of Clinical Evaluation, University of Liverpool

NCEPOD Steering Group:

Professor Tim Hendra Consultant Physician for the Elderly
Mrs Madeline Wang Lay representative

NCEPOD Clinical Co-ordinators:

Dr George Findlay Consultant in Intensive Care Medicine
Dr David Mason Consultant Paediatric Anaesthetist

NCEPOD Non Clinical Staff:

Dr Marisa Mason Chief Executive
Dr. Hannah Shotton Researcher
Mrs Heather Freeth Clinical Researcher
Miss Kathryn Kelly Research Assistant
Dr Neil Smith Clinical Researcher

Scientific Advisors:

Professor Martin Utley Clinical Operational Research Unit (CORU), UCL

Introduction

During the 2005 topic selection procedure, The Royal College of Physicians proposed a study focusing on patients who suffered a cardiac arrest. The aim of this proposal was to detail the variability in selection of patients who undergo attempted resuscitation and to describe the effectiveness of this intervention. In addition it was felt that study should address the issue of appropriateness of attempted resuscitation.

During workup of this study we became aware that NICE would shortly release Clinical Guideline 50 [1] and it was felt that this study should be postponed until changes in practice from NICE CG 50 were embedded. During the 2009 topic selection the study proposal was revisited and it was felt that this would be an ideal time to recommence this work.

Often in recorded data, the term 'cardiac arrest' covers many different cases, with little acknowledgement of the variances in aetiology, cardiac rhythms at the time of resuscitation, or other factors[2]. The use of the Utstein Template[3] for reporting cardiac arrests was introduced in an attempt to bring a measure of standardisation that would allow comparability between data sets. Despite these guidelines there remains the problem that some studies are not comparable due to different definitions of the same event being used. For example survival rates from cardiac arrest can be quoted that use endpoints of immediate survival, survival for 24 hours, hospital survival or even 6 month survival. This lack of standardisation is a challenge to researchers in this field.

Immediate survival rates following attempted cardiopulmonary resuscitation (CPR) for a cardiac arrest in-hospital vary across studies, depending on factors such as sample population, location of study, and type of hospital included in the study. However the rates are roughly 37% – 52% [4-9], with survival falling to around 30% after 24 hours [9, 10]. Survival to discharge rates following attempted CPR for a cardiac arrest are again variable across studies but fall within the range of 11% – 20[4-17], although one study found a survival to discharge rate of 29%[15]. In one study which monitored 12 sites the rate for survival 1-year post-arrest was found to be 15%[18]. In another study, survival rate dropped to 5% at 1-year post-arrest [9].

Various studies have examined factors which may be associated with a higher or lower likelihood of survival to discharge, including age, gender, duration of CPR, location of arrest, and co-morbidities or pre-existing conditions among others. There is evidence to suggest an increase in age is associated with decreased likelihood of survival to discharge, with the change in prognosis occurring somewhere between 68 and 75 years of age[6,7,9,10,16,17,19,20]. However, other

studies have not found an association between age and outcome, or age and probability of survival [4-6,16].

One study found a near-significant difference in survival to discharge rate between genders, with more women surviving than men[5]; another found that being female was associated with a increased rate of immediate survival[7]. Also, duration of attempted CPR has been shown to have an effect on survival rate; a poorer prognosis is associated with CPR continuing longer than 10 – 18 minutes[9,10, 16, 17, 19, 21]. Another study reported a zero survival rate to discharge in patients where CPR lasted longer than 30 minutes [11]. In line with this observation, it was reported that in those in whom CPR lasted longer than 15 minutes there was only a 20% immediate survival rate[6]. Evidence suggests that arrest location may be a significant correlate of survival at 24 hours[9, 10]. In one study, patients with resuscitation occurring in ICU were more likely to survive to discharge[7].

Evidence is mixed on the impact of co-morbidities on likelihood of survival to discharge. It has been found that neither the admitting diagnosis nor the main co-morbidity were predictive of outcome[4]. However, the presence of pneumonia[7, 11, 22], hypotension[11, 22], renal failure[11], cancer[7, 11, 22, 23], AIDS[7], haematocrit > 35%[7], sepsis[7, 22, 23], dementia[7], serum creatinine level > 130 μmol/L (1.5mg/dL) [7, 11, 22], cerebro-vascular accident[22] and congestive heart failure[22]have all been associated with a decreased likelihood of survival to discharge. Patients with coronary artery disease are more likely to survive to discharge[7], and a non-cardiac primary diagnosis has been shown to be a significant correlate of survival at 24 hours[10]. One discussion paper argues that patients with the best chance of survival have minimal co-morbidities[19], among other factors.
It has been suggested that management of critically ill patients could be improved, resulting in fewer arrests, and therefore fewer failed resuscitation attempts[24]. Studies have shown up to 84% of patients display physiological changes and deteriorations in the 24 hours preceding an arrest[24, 25]; yet many of these changes, although identified, are not correctly treated, despite over half of them being potentially correctable[25]. Patients who arrest on general wards most commonly have tachypnoea[25, 26], hypotension[3, 26], a fall in the Glasgow Coma Scale[3] and metabolic dysfunctions[25] immediately prior to their arrests.
Several studies have suggested that the formation and intervention of a medical emergency team may improve outcome and reduce the incidence of cardiac arrests[27, 28]. This fits nicely with the knowledge that many patients can be identified prior to cardiac arrest due to the presence of antecedent factors. It is also intuitive as interventions to prevent deterioration to the point of cardiac arrest can then be made. However this research is difficult to interpret as many of the apparent improvements in outcome may relate to differences in severity of illness and more widespread use of DNAR orders after introduction of MET. In addition the latest trial in this area[29] failed to show any significant outcome benefit. Despite a clear benefit of MET the concept has been widely embraced

with many Royal Colleges and Professional Societies recommending this development[30], [31, 32], [33]. Longitudinal research found that the creation of a formal resuscitation team changed immediate survival rate from 30% to 58%. Pre- and post-creation survival rates were similar for ventricular tachycardia/ventricular fibrillation (50% compared with 57%), but significantly improved for pulse-less electrical activity (PEA)/asystole (18% compared with 84%). Overall survival to discharge improved from 6% to 18%[28]. This finding is supported by The Resuscitation Council (UK) who state ‘healthcare institutions admitting acutely ill patients should have a resuscitation team, or it’s equivalent, available at all times’, and recommend giving further guidance concerning the members of staff who should be involved in such a team[34].
A homebound lifestyle[11] and African-American race[7] have been significantly associated with in-hospital mortality. Higher survival rates have been associated with the primary arrhythmia being VT or VF than asystole or PEA[5, 6, 9, 17]. Non-asystolic dysrhythmia has been shown to be significantly correlated with survival rates at 24 hours[10]. However, research has found that the primary arrhythmia in around 15% of cardiac arrests recorded is VF/VT, while 20% is asystole, and 65% is PEA[8, 16]. Other factors which were associated with an improved survival-to-discharge rate included the cardiac arrest being witnessed[5, 9], prompt defibrillation[19], and fewer procedures and medications used during CPR (including no intubation or insertion of a pacemaker)[10,19]. Research has found that patients most likely to survive to discharge are monitored patients with VT or VF, at a rate of around 30 – 34%[19].

The quality of the CPR administered during cardiac arrest can also have an impact on survival. The timing of the CPR relative to defibrillation and the depth of chest compressions have been shown to affect the success of the resuscitation attempt [35-37].

All patients are entitled to be considered for CPR; however it is essential to identify those patients for whom CPR would be inappropriate. Resuscitative measures should be undertaken where appropriate, where no explicit advance directive has been made[38]. The decision may be made to issue a Do Not Attempt Resuscitate (DNAR) order for a patient; however this is an ethically, clinically and emotionally complex decision to make, and the Resuscitation Council (UK), have provided clear guidelines for the formulation of Local Policy with regards to DNAR orders[38].

Public Perception of survival following CPR
Public perception of success rates of CPR have also been examined, and have been shown to be significantly overestimated Estimated survival to discharge rate has been found in the region of 50%, compared with the actual survival to discharge rate of up to 20%[39]. Public opinion also showed that success rate is influenced by a number of factors, including type of arrest[5] and speed of response[40].

As discussed previously, it has been well documented that even when the CPR is performed by a trained medical professional, people experiencing cardiac arrest have only a 10-20% chance of surviving to the point of hospital discharge[41, 42]. However the lay public consistently over-estimates the potential for survival, and this is documented to be due to (among other sources) television shows that focus on medical emergencies, and depict a successful outcome following CPR[41]. Previous research has consistently shown television and other media to show higher rates of survival than in real-life[41,43]; and also to be misrepresentative in terms of the demographics of the sample being portrayed[43, 44], and in the nature of the cause[43]. This may impact on decision-making around the administration of CPR. Where appropriate, decisions should be made jointly between patient and physician; in order to make such decisions both need to be aware of potential risks and benefits, and must utilise this knowledge in the choices they make[43].

It has been recognised that patients, their relatives and often the people caring for them such as doctors and nurses[45], frequently have an unrealistically optimistic impression of the effectiveness of resuscitation; this may be as a result of gathering evidence from various sources including television, and in turn this perception may have a strong effect on their own decisions as to whether to opt for CPR in the event of their own critical illness. Public knowledge is becoming increasingly varied, and is gathered from a number of sources, including life support training programmes, journalism and the television[44]. Several studies have cited television as the most popular source of information about resuscitation[41, 43, 45, 46]. In order for people to make 'accurate' informed decisions, the media should accurately portray events and outcomes surrounding CPR.

The aim of this part of the study is to examine both the public and medical professionals' perceptions and expectations of CPR. A separate protocol will be drawn up for this part of the study, once the methodology has been finalised.

Aims and Objectives

Overall Aim:

To describe variability and identify remediable factors in the process of care of adult patients who receive resuscitation in an in-hospital setting, including factors which may affect the decision to initiate the resuscitation attempt, the outcome and the quality of care following the resuscitation attempt; as well as to determine antecedents in the preceding 48 hours, and possible opportunities for intervention.

Objectives

Based on the issues raised by the expert group, the objectives of this study are to collect information on the following:

1. Describe the organisational structures and governance in place to provide resuscitation including training and the uptake of training by members of staff.

2. Describe the structures in place to identify patients who might suffer arrest, and so identify opportunities to intervene.

3. Review outcome following resuscitation.

4. Review DNAR / DNACPR policy in patients who have undergone arrest and describe the appropriateness of resuscitation in regard to the patient on whom the attempt is made.

5. Describe the process of resuscitation attempt, and so differentiate between the organisational structures in place to provide resuscitation, and what actually happens.

6. Determine quality of care in the 48 hours prior to cardiac arrest.

7. Determine the quality of care in the post- resuscitation period.

8. Determine public perceptions and expectations of resuscitation.

9. Determine professional attitudes towards, and perceptions of, resuscitation.

Methodology

Population

All adult patients who undergo a cardiac arrest, triggering either a call to the resuscitation team (or equivalent) via 2222 (or the completion of an audit form subsequent to the resuscitation attempt), that led to the delivery of chest compressions or defibrillation during the 14 day study period: 1st -14th November inclusive.

Exclusions

All patients on Intensive Care Units will be excluded from this study. Patients who arrested before reaching the Emergency Medicine department will also be excluded.
Children under the age of 16 will also be excluded.

Sample Size

Published figures for the mortality rates of patients who undergo resuscitation within a hospital setting are variable. As not all hospitals are able to electronically identify and extract data on patients who had a resuscitation attempted, the expected sample size may be difficult to determine quickly and accurately. A rough estimate based on numbers from the pilot study would give a maximum sample of 3500 returns for the prospective part of the study.

Time Frame

The duration of data collection will be 2 weeks in Autumn 2010: 1st-14th November inclusive.

Data Collection

The management and care of patients on whom resuscitation was attempted, will be examined in detail.
Data collection will take part in two stages. Firstly, basic data will be collected at the time the patient is resuscitated, to allow prompt identification of patients undergoing Cardiac arrest and resuscitation attempt during a given time period. These forms will be completed by the resuscitation lead (or most appropriate person) involved in the resuscitation attempt. This method will ensure that data are collected accurately with regard to the make up of the resuscitation team and details of events that occur at the time of the resuscitation attempt, that are often not clear from the casenotes and difficult to obtain clearly retrospectively.

The second stage of data collection will use the standard NCEPOD method and we will ask NCEPOD Local Reporters to identify all patients retrospectively who underwent a resuscitation attempt in the given time period via the hospital 2222 log and/or PAS/local system. We will ask the local reporters to complete a spreadsheet supplied by NCEPOD, with the details of each case including the name of the consultant at the time of the 2222 log/resuscitation attempt who will subsequently be asked to complete a questionnaire in order to collect

retrospective data on the 48 hours preceding and following the cardiac arrest and resuscitation attempt.

This spreadsheet will be returned to NCEPOD in a password protected format. This method will also ‘double-check’ that all patients were captured in the first identification of cases. NCEPOD will then request photocopied case note extracts for these cases for the standard peer review process.

. The data will be collected from the following sources:

• Resuscitation lead forms - sent to the resuscitation department to distribute in order to collect prospective data about the cardiac arrest procedure at the time of each arrest (that occurs during the time period).

• From the spreadsheet received back from the Local Reporters, NCEPOD will request case notes for patients that underwent a resuscitation attempt in hospital. NCEPOD non-clinical staff will then review in detail the medical records and the resuscitation audit form.

• The clinician responsible for the patient at the time of the arrest will be identified and required to complete a clinical questionnaire. Together with the case-notes (once fully anonymised) these will inform the opinion of advisors completing the Assessment Form.

• An organisational questionnaire will be sent to all hospitals that have a resuscitation protocol in place to obtain information on the facilities and resources available for the management of patients who receive a resuscitation attempt. This will include a snapshot of resources available for resuscitation during a specified time period. For the purposes of this study , ‘organisation’ will be defined as a hospital/ centre rather than a trust as a whole.

Sites

All National Health Service and independent hospitals that administer resuscitation to their patients in the National Health Service in England, Wales and Northern Ireland, and public hospitals in the Isle of Man, Jersey and Guernsey, will be included in the study.

Pilot Study

A pilot study will take place in September 2010 that will assist further in determining our sample size and identifying possible areas for adjustment and/or improvement in our methodology and questionnaire design.
The aims of the pilot study are to assess:

1 The appropriateness and clarity of the questionnaires

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2 The time period allocated to the study.

3 To assess the effectiveness of the method chosen to identify patients that have received a resuscitation attempt from trigger calls and/or audit forms.

4 To estimate how many cardiac arrests occur per week per hospital.

Analysis and Review of Data

Advisors

A multidisciplinary advisory group will review the data collected and provide expert opinion on the process of care and management of patients who have experienced cardiac arrest within the agreed limits of this study.
All identifiable information will be removed prior to review by the advisors, i.e. all data will be anonymised (see below).
With the assistance of Professor Martin Utley (Clinical Operational Research Unit, University College London), the data, where possible will be analysed quantitatively.

Confidentiality and Data Protection

Once the data have been extracted by the NCEPOD researchers, the forms and casenotes will be anonymised to remove patient, clinician and hospital identifiers prior to review by the Advisory Group.

All electronic data are held in password protected files and all paper documents in locked filing cabinets. As soon as possible after receipt of data NCEPOD will encrypt electronic identifiers and anonymise paper documents. Section 251 (of the NHS Act 2006) approval has been obtained to perform this study without obtaining patient consent. The reason for obtaining this approval is because a high proportion of patients in this study will be admitted as emergency patients and go straight to theatre. As this is a national one day snapshot of activity if we can only include patients who consent then our sample will be meaningless. To ensure that data are reported accurately in this study we need to have true denominator data.

Approval for the study methods of all NCEPOD studies is granted by the National Information Governance Board for Health and Social Care (NIGB) during an annual review.

Dissemination

On completion of the study, a report will be published and widely disseminated.

Provisional Study Time Scale

Event	**Time**
Expert Group Meeting	10th June 2010
Pilot Study	August/September 2010
Protocol to Steering Group	August 2010
Data collection	Autumn 2010
Start Advisor Meetings	December2010/January 2011
Data Analysis	August/September 2011
Publish Report	Summer 2012

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