Time matters: reviewing the care provided to patients admitted to hospital following an out-of-hospital cardiac arrest

The National Confidential Enquiry into Patient Outcome and Death reviewed the organisation of services and the quality of clinical care provided to patients who were admitted to hospital following an out-of-hospital cardiac arrest. The report looked at all four links in the 'chain of survival', covering the last link, in-hospital advanced life support and post-resuscitation care, in most detail.

Neil Smith[1]

D'Marieanne Koomson[1]

Simon McPherson[1]

Mark Juniper[1]

Author details can be found at the end of this article

Correspondence to:
Neil Smith;
nsmith@ncepod.org.uk

Introduction

Approximately 60 000 out-of-hospital cardiac arrests occur in the UK every year (Resuscitation Council (UK) et al, 2014) and UK ambulance services attempt resuscitation in an estimated 30 000 people per year (Hawkes et al, 2017). There is considerable variation in both the rate of return of spontaneous circulation at hospital handover (13–27%) and the rate of survival to hospital discharge (2.2–12%) (Perkins and Cooke, 2012). On average, fewer than 1 in 10 people in the UK survive an out-of-hospital cardiac arrest.

The four links in the out-of-hospital cardiac arrest 'chain of survival' are:

1. Early recognition of cardiac arrest and call for help
2. Early bystander cardiopulmonary resuscitation
3. Early defibrillation
4. Early advanced life support and standardised post-resuscitation care.

Since 2013, the Out-of-Hospital Cardiac Arrest Outcomes Registry has been collecting comprehensive data on the first three links in the 'Chain of Survival' from ambulance services in England (Out of Hospital Cardiac Arrest Outcomes (OHCAO) Registry, 2018). The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) study (Juniper et al, 2020) included data on all aspects of the chain, but focused on the fourth link by addressing the following:

- Percutaneous coronary intervention for acute coronary syndromes
- Targeted temperature management
- The timing and approach to assessment of neurological prognosis
- Assessment by a heart rhythm specialist
- The availability of rehabilitation support.

The National Confidential Enquiry into Patient Outcome and Death method

The NCEPOD undertook a review of the organisation of services and the quality of clinical care provided to patients who were admitted to hospital following an out-of-hospital cardiac arrest. A cohort of patients was identified for study inclusion who were 16 years old or over, had an out-of-hospital cardiac arrest and achieved subsequent sustained return of spontaneous circulation for more than 20 minutes. Patients were excluded if their out-of-hospital cardiac arrest was a result of trauma, drowning, asphyxia, drug overdose or poisoning. Up to nine patients per participating hospital were selected.

A retrospective clinical questionnaire was completed by the consultant caring for the patient during the admission and peer review of case notes was undertaken in 416 patients by a multidisciplinary group of healthcare professionals. Organisational data were collected regarding facilities, equipment and policies relevant to the management of patients who had experienced an out-of-hospital cardiac arrest.

How to cite this article:
Smith N, Koomson D, McPherson S, Juniper M. Time matters: reviewing the care provided to patients admitted to hospital following an out-of-hospital cardiac arrest. Br J Hosp Med. 2022. https://doi.org/10.12968/hmed.2021.0646

Results

In this study, 271 out of 416 (65.1%) patients were men (mean age 63.3 years) and 146 out of 416 (34.9%) were women (mean age 64 years). The Rockwood Clinical Frailty score was retrospectively applied to the cohort. Before their out-of-hospital cardiac arrest, 204 out of 357 (57.1%) patients were very fit, well or managing well. However, the majority of patients (357 out of 415; 86.0%) had a previous medical history that the reviewers considered was relevant to the cardiac arrest.

Even in this group of patients in all of whom sustained return of spontaneous circulation was achieved, the impact of bystander cardiopulmonary resuscitation was apparent. Survival to hospital discharge was greater for patients who received bystander cardiopulmonary resuscitation compared with patients where bystander cardiopulmonary resuscitation was not administered (145 out of 409; 35.5% vs 21 out of 105; 20.0%).

When a decision has been made about care based on an individual's prior wishes, it is essential that this is communicated across the healthcare system. Only 65 out of 178 (36.5%) hospitals had an electronic system in place for advanced care directives that included do not attempt cardiopulmonary resuscitation decisions. There was a small number of patients (21 out of 661; 3.2%) who had a do not attempt cardiopulmonary resuscitation decision in place before their out-of-hospital cardiac arrest, reflecting a failure to communicate this to the team performing cardiopulmonary resuscitation.

There is a loose relationship between some metabolic parameters and survival after cardiac arrest. For example, survival was more common in patients with an initial lactate level of 6 mmol/litre or below (survival 55 out of 103; 53.4%), than in those with a higher lactate level over 6 mmol/litre (survival 28 out of 196; 14.3%). However, survival was possible even with very high lactate levels; 4 out of 35 patients with an initial lactate level of >14 mmol/litre survived. The highest lactate level noted in a survivor was 19.8 mmol/litre. Metabolic parameters are not accurate determinants of prognosis in individual patients and thus should not be used in isolation as an assessment for prognosis. In addition, assessment of neurological prognosis is more accurate if delayed until at least 72 hours after out-of-hospital cardiac arrest. Case reviewers considered that the timing of neuroprognostication was not appropriate for 26 out of 131 (19.8%) patients.

Fever is common after cardiac arrest and is associated with worse neurological outcome. Active temperature management improves this. A policy for targeted temperature management was available from 130 out of 167 (77.8%) hospitals. In 289 of the patients reviewed targeted temperature management would have been appropriate, but only 131 (45.3%) of these patients were managed using this method. Case reviewers rated the temperature management as 'good' in only 41 out of 219 (18.7%) patients and as 'poor' or 'unacceptable' in 126 out of 219 (57.5%). Case reviewers considered that the approach to temperature management was poor or unacceptable in a greater proportion of patients when targeted temperature management was not used (48/113; 42.5% vs 78/106; 73.6%, Figure 1).

Maximising the benefit of survival after out-of-hospital cardiac arrest involves detailed assessment and treatment of the physical, neurological and psychological needs of every survivor. Physical rehabilitation is generally offered to all intensive care survivors who require it. In hospitals from which an answer was received, neurorehabilitation was not

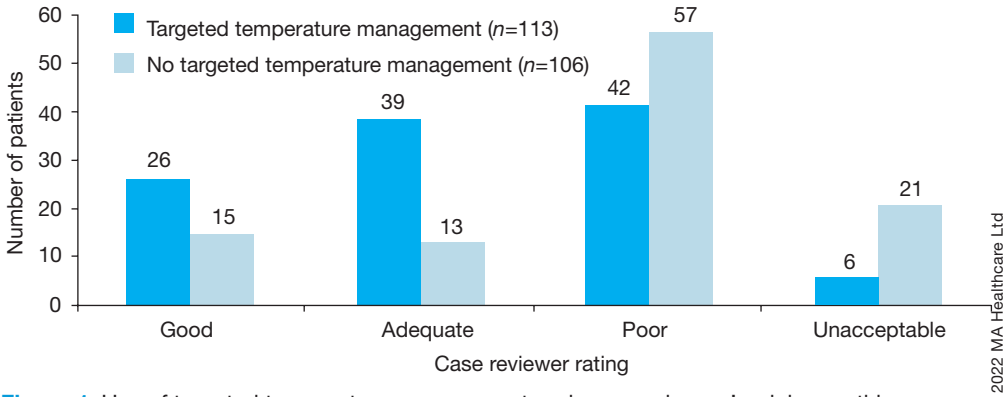

Figure 1. Use of targeted temperature management and case reviewers' opinion on this.

available in 22 out of 121 (18.2%) hospitals and psychological support was not available in 63 out of 123 (51.2%). Before discharge, 133 out of 187 (71.1%) survivors were assessed for physical rehabilitation and 55 out of 187 (29.4%) for neurological rehabilitation. Only 21 out of 105 (20.0%) survivors were offered psychological review.

Recommendations

Based on these findings, 13 recommendations were agreed, covering five key areas. The six recommendations relevant to the current editorial are shown in Table 1.

Bystander cardiopulmonary resuscitation

Ongoing strategies are needed at a population level to ensure that people who sustain an out-of-hospital cardiac arrest are treated rapidly with high quality resuscitation, including defibrillation, through a coordinated network of accessible and identifiable public access devices. This is in line with guidance from the Resuscitation Council UK (Perkins et al, 2021).

Advance treatment plans

When advance treatment plans are in place, they should be documented using a standard process (such as the ReSPECT form; https://www.resus.org.uk/sites/default/files/2020-09/ReSPECT%20v3-1-formSPECIMENFINAL_0.pdf) to ensure that patients receive treatments based on what matters to them and what is realistic. Effective communication between all parts of the healthcare system, including primary care, community services, ambulance services and acute hospitals, is then needed to ensure that appropriate decisions are made, irrespective of time or location.

Targeted temperature management

Elevated temperature is common following an out-of-hospital cardiac arrest and is associated with a worse prognosis, but this can be improved by accurate, active temperature control. The approach in current practice appears to be inconsistent and a more active approach is needed.

Prediction of survival

No single factor is accurate enough for clinical decision making at the time of admission to hospital following an out-of-hospital cardiac arrest. Time is needed to ensure an accurate

Table 1. Recommendations from 'Time Matters'

1	Implement whole population strategies to increase the rate of cardiopulmonary resuscitation by bystanders and the use of public access defibrillators
2	Put effective systems in place to share existing advance treatment plans (such as the ReSPECT form; https://www.resus.org.uk/sites/default/files/2020-09/ReSPECT%20v3-1-formSPECIMENFINAL_0.pdf) between primary care services, ambulance trusts and hospitals so that people receive treatments based on what matters to them and what is realistic in terms of their care and treatment
3	On admission after an out-of-hospital cardiac arrest, prioritise patients for coronary intervention, in line with the European Resuscitation Council and European Society of Intensive Care Medicine guidelines (Nolan et al, 2021), because a primary cardiac cause for their cardiac arrest is likely
4	Use active targeted temperature management during the first 72 hours in critical care to prevent fever (temperature over 37.5°C) in unconscious patients after an out-of-hospital cardiac arrest
5	Assess neurological prognosis in unconscious patients after an out-of-hospital cardiac arrest, using at least two of the following methods: ■ Clinical assessment ■ Imaging ■ Neurophysiological assessment (including electroencephalogram, to exclude subclinical seizures and improve accuracy) ■ Biomarkers
6	Identify all inpatient survivors of an out-of-hospital cardiac arrest who would benefit from physical, cardiac, neurological and/or psychological rehabilitation before hospital discharge and ensure this is offered to them

Key points

- Strategies to improve rapid high quality bystander cardiopulmonary resuscitation, including defibrillation with public access defibrillators are required.
- Advance treatment plans need standardising and processes in place to communicate them between all parts of the healthcare system.
- An active approach to targeted temperature management needs widespread, consistent implementation.
- A multimodal approach to neuroprognostication should be undertaken and the final assessment delayed for at least 72 hours after the return of spontaneous circulation.
- Targeted rehabilitation and support for physical, neurological, cardiac and emotional impairment following an out-of-hospital cardiac arrest needs improving.

assessment of prognosis can be made. Neurological prognosis is particularly difficult to assess, and this should be delayed for at least 72 hours after return of spontaneous circulation.

Rehabilitation

Physical, neurological, cardiac and emotional impairment following an out-of-hospital cardiac arrest can all affect quality of survival, and patients benefit from targeted rehabilitation and support. However, in some areas of the UK there is no provision of these services. These gaps should be closed by local clinical teams and commissioners working together.

Conclusions

Ongoing strategies are needed at the population level to ensure rapid high quality resuscitation when someone has a cardiac arrest. The advance treatment wishes of the patient should be accessible to all parts of the healthcare system. Organisations must ensure a consistent active approach to targeted temperature management and multimodal neuroprognostication. Survivors of an out-of-hospital cardiac arrest should receive appropriate rehabilitation for physical, neurological, cardiac and emotional impairment.

Author details

[1]National Confidential Enquiry into Patient Outcome and Death (NCEPOD), London, UK

References

Hawkes C, Booth S, Ji C et al. Epidemiology and outcomes from out-of-hospital cardiac arrests in England. Resuscitation. 2017;110:133–140. https://doi.org/10.1016/j.resuscitation.2016.10.030

Juniper MC, McPherson SJ, Smith NCE et al. Time matters: a review of the quality of care provided to patients aged 16 years and over who were admitted to hospital following an out-of-hospital cardiac arrest. 2020. https://www.ncepod.org.uk/2021ohca/Time%20Matters_Full%20Report.pdf (accessed 14 January 2022)

Nolan JP, Sandroni C, Böttiger BW et al. European Resuscitation Council and European Society of Intensive Care Medicine Guidelines 2021: post-resuscitation care. Resuscitation. 2021;161:220–269. https://doi.org/10.1016/j.resuscitation.2021.02.012

Out of Hospital Cardiac Arrest Outcomes (OHCAO) Registry. Review of the first 5 years and forward strategy. 2018. https://warwick.ac.uk/fac/sci/med/research/ctu/trials/ohcao/publications/showcase/57904_ctu_report-final.pdf (accessed 16 December 2021)

Perkins GD, Cooke MW. Variability in cardiac arrest survival: the NHS Ambulance Service Quality indicators. Emerg Med J. 2012;29(1):3–5. https://doi.org/10.1136/emermed-2011-200758

Perkins GD, Colquhoun M, Deakin CD et al. Adult basic life support guidelines. 2021. https://www.resus.org.uk/library/2021-resuscitation-guidelines/adult-basic-life-support-guidelines (accessed 17 January 2022)

Resuscitation Council (UK), NHS England, British Heart Foundation. Consensus paper on out-of-hospital cardiac arrest in England. 2014. https://www.resus.org.uk/sites/default/files/2020-05/OHCA_consensus_paper.pdf (accessed 16 December 2021)