How do information sources influence the reported Cerebral Performance Category (CPC) for in-hospital cardiac arrest survivors? An observational study from the UK National Cardiac Arrest Audit (NCAA)

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Key words

Resuscitation, cardiac arrest, cerebral performance category

Abstract

Aim

Cerebral Performance Category (CPC) can be used to categorise neurological outcome after cardiac arrest. There is no consensus on what information sources can be used to derive the CPC. This study describes the information sources used by hospitals participating in the UK National Cardiac Arrest Audit (NCAA) and their impact on the CPC reported for individuals surviving an in-hospital cardiac arrest (IHCA).

Methods

Data on the CPCs and on the information source used to assess the CPC (either case note review, communication with clinical team or direct patient assessment) were abstracted for individual adult patients who survived to discharge following an IHCA in an acute hospital participating in NCAA between 1 May 2014 and 30 April 2016.

Results

Data for 33,114 IHCAs (in 31,783 patients) from 195 hospitals were reported to NCAA, of whom 6,093 (18.4 %) survived to hospital discharge. Of these hospital survivors, 5,492 (90.1%) had both the CPC and information source reported: case note review (3,989 patients, 72.6%), communication with the clinical team (1,053 patients, 19.2%); and direct patient assessment (450 patients, 8.2%). Most (96.6%) survivors were reported to have had a good neurological outcome (CPC 1 or 2). There were small differences in the CPC reported derived from the different information sources but these differences were not clinically important.

Conclusion

In the UK IHCA audit, the most commonly used information source for CPC assessment is case notes. Most survivors of IHCA are reported as having a CPC score of 1 or a good outcome (CPC scores 1 or 2).

Introduction

Cerebral Performance Category (CPC) is a five-point scale used to categorise the neurological outcome after cardiac arrest.[1] Categories 1 and 2 are generally considered to be a good outcome whereas categories 3 and 4 are considered a poor outcome (a CPC of 5 is death) (electronic supplementary material).[2] The CPC is commonly used as a primary outcome in cardiac arrest studies and the category correlates with longer-term survival after hospital discharge.[3-6] The CPC is usually assessed at discharge from hospital.

In the UK National Cardiac Arrest Audit (NCAA), participating hospitals collect in-hospital cardiac arrest (IHCA) data including an assessment of CPC in those who survive to hospital discharge.[7] Preliminary work indicated that, among hospitals participating in NCAA, the information sources used to derive the CPC were[8]:

1. inference by the assessor from review of the patient case notes;
2. communication between the assessor and the clinical team looking after the patient; and
3. direct review of the patient by the assessor.

There is currently no consensus on which information sources can be used to derive CPC or whether different sources lead to different categories being recorded.

This study aims to describe how hospitals participating in the UK NCAA derive the CPC in survivors of IHCA and in the absence of a gold-standard, does the information source used to derive the CPC lead to survivors of in-hospital arrest having different distributions of CPC.

Methods

The NCAA is the UK national clinical audit for all patients aged over 28 days who receive cardiopulmonary resuscitation (CPR) following an IHCA attended by a hospital-based resuscitation team (or equivalent) in response to a 2222 call (2222 is the emergency telephone number used to summon a resuscitation team in UK National Health Service (NHS) hospitals). The definition of CPR used for inclusion in NCAA is the receipt of chest compression(s) and/or defibrillation. NCAA has approval from the Confidentiality Advisory Group within the Health Research Authority to hold patient identifiable data under Section 251 of the NHS Act 2006 (approval number: ECC 2-06(n)/2009).

At the time of this study, 200 hospitals in England, Wales, Northern Ireland and Scotland participated in NCAA, with coverage in England representing >90% of adult acute hospitals.

NCAA collects data according to strict rules and definitions, via a dedicated, secure online data entry system. Data are validated, both locally (at the point of data entry) and centrally, for completeness, illogicalities and inconsistencies.

Validated data for the period 1 May 2014 to 30 April 2016 were selected for analysis. All adults (aged 16 years or over) surviving to hospital discharge, who were not sedated at discharge and for whom a CPC along with the information source used to derive the CPC were recorded were included in the analyses.

A statistical analysis plan was agreed *a priori*. Data were analysed using Chi-squared tests of independence. The analyses were performed using Stata/SE V14.2 (StataCorp LP, Texas, USA).

Results

Between 1 May 2014 and 30 April 2016, 34,311 IHCAs (32,914 patients) from 200 hospitals were recorded in the NCAA database. Five hospitals (1,197 IHCAs) were excluded from analysis due to incorrect data collection. For the remaining 195 hospitals, 33,114 IHCAs (31,783 patients) were recorded, of which 6,093 (18.4%) were for adult patients who survived to hospital discharge (electronic supplementary material). After excluding patients who were sedated at discharge (4.7%) and those with missing data (5.2%), data for 5,492 patients in 189 hospitals (90.1% of hospital survivors) were included in the analysis.

Case note review (3,989 patients, 72.6%) was the most commonly used information source used to derive the CPC, followed by communication with the clinical team (1,053 patients, 19.2%) and direct patient assessment (450 patients, 8.2%) (Table 1). Most hospitals used more than one information source, and there was wide variation between use of sources to derive the CPC (Figure 1).

Most survivors were categorized with a CPC of 1 (85.9%) or a good outcome (96.6% with a CPC 1 or 2) at hospital discharge (Table 2). The variation in CPC reported for each information source was statistically significant ($P < 0.0001$ for all categories and $P = 0.033$ for good versus poor outcome across the three information sources) (Table 2). Patients reviewed directly were more likely to be assigned a CPC of 1 compared with those whose CPC was derived from other information sources (Table 2).

Discussion

Among hospitals submitting data to NCAA, inference from case notes is the most commonly used information source to derive CPC at discharge, but there is considerable variation in the reported information source used for CPC assessment both between and within hospitals.

These findings are understandable given that data are likely to be collected and submitted to NCAA at or after the point of patient discharge from hospital; accessing patient case notes is probably more convenient for data collectors, followed by speaking to clinical colleagues, with very few patients (8.2%) being directly clinically assessed. Indeed, many studies and registries use chart review to assess neurological outcome.[3,5,9]

The variation in CPC by information source used was statistically significant but not clinically important. In particular, direct patient review was more commonly associated with documentation of CPC 1 (92.7%) than either communication with the team (83.9%) or case note review (85.6%). A smaller study of 21 cardiac arrest survivors reported the opposite, with higher CPCs following chart review compared with a direct review of the patient.[10] There were, however, several differences between this study and ours. In the smaller study, the same patients were assessed by both case note review and directly. However, the case note reviews were performed at hospital discharge and the direct reviews at one-month follow-up biasing the comparison. In our study the direct patient assessment group also had a shorter median length of hospital stay. Direct patient observation could be associated with a good outcome and shorter length of hospital stay. This is probably because it is easier for data collectors to monitor and assess this patient group.

Although our observational data indicate that the CPC recorded for a patient varies according to the information source used, the main difference is in the proportion of patients assigned a CPC of 1. These differences could also lead to some of the observed differences between information source used in the reported CPC 2 scores. When comparing the percentage of survivors with a good outcome (CPC 1 or 2), there was a statistically significant difference between information sources but the absolute difference was small and not clinically important (Table 2).

Our overall incidence of CPC 1 (85.9%) after IHCA is higher than that reported in previous studies of IHCA. The first description of CPC data from the United States (US) IHCA registry reported that 59% of those who survived were reported as CPC 1.[11] More recent data from the US IHCA registry shows in 2009, that 59.8% of survivors were assigned a CPC of 1 and 83.6% of survivors had CPC of 1 or 2.[9] The higher CPC scores reported in our audit suggest our data requires validation as there could be a risk of bias towards a CPC score of 1, in addition to inherent difficulties in using the CPC score. The modified Rankin scale (mRs) score which uses a 7-point scale (0 – no symptoms, 6 – dead) has recently been recommended over CPC when assessing survivors in research studies of cardiac arrest interventions.[12, 13] The Core Outcome Set for Cardiac Arrest (COSCA) Collaborators, which includes the views of patients, state that CPC lacks discrimination between scores and can overestimate function.[13] Furthermore, a higher proportion of survivors with a good

outcome could suggest that withdrawal of life sustaining treatment and palliative care is more common in patients likely to have a poor neurological outcome. Our data does not enable us to test this hypothesis.

The main strengths of our study are the large sample size representing over 90% of acute hospitals in England, and over 90% of hospital survivors having a CPC recorded. The limitations include us not knowing who conducted the CPC assessment, their training, and the validity or reliability of the CPC. Previous studies show variable inter- and intra-rater agreement between assessors when assessing the CPC based on case note review.[14,15] Our data do not enable us to determine which information source for assessing CPC is the most accurate as the methods have not been tested head-to-head against each other in the same patients nor compared with a gold standard assessment. Any statistical differences we observed are likely due to the large numbers in our study. It is possible that the small differences between CPC categories observed were because it is easier or more common to directly assess survivors that are documented as CPC 1. Thus, the survivor's condition may partly determine the information source used to assess the CPC and therefore in turn, the CPC score assigned. We accept that using the cardiac arrest definition of receipt of chest comparisons and/or defibrillation and activation of the hospital cardiac arrest team could lead to the inclusion of a few patients who did not actually have a cardiac arrest and therefore increase the number of CPC 1 or 2 survivors. Finally, we acknowledge the limitation of assessing neurological function on hospital discharge rather than in the setting they will be living. The assessment at discharge is a chosen endpoint for practical reasons. It is also recognised that in many patients neurological function may improve for several months after discharge[13].

Conclusion

In the UK national audit of in-hospital cardiac arrest, the most commonly used information source used to derive the CPC is case note review and, for only a small proportion of survivors, are CPCs based on actual assessment of the patient at hospital discharge. The distribution of CPC scores is similar irrespective of the information source. Most survivors are documented as having a CPC 1 or a good outcome (CPC 1 or 2).

Acknowledgements

The authors wish to thank all the staff at hospitals participating in NCAA, the National Audit Programme Team at ICNARC and the NCAA Steering Group (Jerry Nolan – Chair, Jane Carnall, Viv Cummin, Peter-Marc Fortune, Kerrie Gemmill, Carl Gwinnutt, Bernadette Light, Federico Moscogiuri, Emily Reynolds, Kathy Rowan, Gary Smith, Jasmeet Soar, Ken Spearpoint).

Funding

This project was supported by internal funding from the Resuscitation Council (UK) and the Intensive Care National Audit & Research Centre.

Declaration of interests

DAH and KMR are employees of ICNARC. JPN is Editor in Chief of Resuscitation and receives an honorarium from the publisher. JS is an Editor of Resuscitation and receives an honorarium from the publisher. JPN and JS are Executive Committee members of the Resuscitation Council (UK) (unpaid volunteers). ECR is an Immediate Life Support Course subcommittee member of the Resuscitation Council (UK) (unpaid volunteer).

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