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Original Research

Title

Awareness of CPR-Induced Consciousness by UK Paramedics

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Abstract

Objectives: Guidelines for the management of hospital cardiac arrest advocate minimally interrupted chest compressions in order to maintain cerebral perfusion pressures and improve the likelihood of a positive outcome. One condition that may lead to interruptions in the delivery of chest compressions is Cardiopulmonary Resuscitation Induced Consciousness (CPR-IC). This study investigates the understanding that UK paramedics have of CPR-IC and how they came by their knowledge.

Methods: This study was a cross-sectional survey of paramedics who were registered with the Health and Care Professions Council (HCPC) and practising in the United Kingdom (UK) at the time of the survey. Participants completed an online survey; the first two sections are reported here. Section one asked for demographic data pertinent to the study outcomes and section two asked participants to explain what they understood about CPR-IC and the source of their information.

Results: 293 eligible participants completed the survey. Most had over 5-years' experience as a paramedic and declared no specialist clinical role. Over 50% of respondents said that they had heard of CPR-IC prior to the study and the majority of those provided an explanation that demonstrated some understanding when compared with the definition used by the study team. Over 40% of respondents became aware of CPR-IC having witnessed it in clinical practice.

Conclusion: Nearly half of the study population were not aware of CPR-IC and few have had formal training on the phenomenon. There is a clear need for further education on CPR-IC in order for paramedics to better manage CPR-IC when presented with it in practice.

Introduction

Guidelines for the management of cardiac arrest strongly advocate the provision of high quality, minimally interrupted chest compressions (Soar, Deakin, Lockey, Perkins, Nolan, 2015). A condition that may impact on the provision of high-quality compressions is a phenomenon known as Cardiopulmonary Resuscitation Induced Consciousness (CPR-IC), whereby a patient appears to regain some level of consciousness during cardiac arrest when chest compressions are being performed, even though they have no return of spontaneous circulation.

Epidemiological data surrounding CPR-IC are scant with only a single retrospective study conducted in Australia (Olaussen et al., 2017). Olaussen et al., (2017) found that of 16,558 out of hospital cardiac arrests (OHCA) 0.7% appeared to show signs of consciousness. Characteristics which increased the likelihood of CPR-IC included clinician witnessed cardiac arrest, short response times and a presenting rhythm of Ventricular Fibrillation or Ventricular Tachycardia.

While there are case reports in the published literature (Lewinter, Carden, Nowak, Enriquez, & Martin, 1989; Tobin & Mihm, 2009; Bihari & Rajajee, 2008), there is limited high quality research into this emerging topic. There is also a wide variation in the level of consciousness displayed in these cases, from patients who moved their limbs and groaned, to patients who displayed higher levels of cognitive function, for example following commands and making purposeful movements such as pushing clinicians away, attempting to remove devices (e.g. endotracheal tubes) and following instructions (Olaussen, et al., 2015). There is no universally accepted definition of CPR-IC, although one group (Olaussen, et al., 2016) have classified signs into non-interfering (eye-opening, agonal breaths or mild restlessness) and interfering (purposeful movement, withdrawing from CPR, attempting to pull out airway-securing devices, combating or pushing rescuer away) categories.

The aim of this study was to identify how many UK paramedics are aware of CPR-IC and how they came to learn about the topic.

Methods

Design and Instrumentation

This study was a cross-sectional survey of paramedics who were registered with the Health and Care Professions Council (HCPC) and practising in the United Kingdom (UK) at the time of the survey. The survey was conducted using an online survey tool (Online surveys, <https://www.onlinesurveys.ac.uk/>) between 08 December 2017 and 17 January 2018 following the receipt of ethical approval. The decision to close on the 17 January was made because there had been no responses made in the preceding 5 days. The final survey (Supplementary 1) was produced from several pilot questionnaires that were tested within the Institute of Health at the University of Wolverhampton prior to release. In the absence of a formal definition of CPR-IC, we

proposed our own definition as “signs of consciousness perceptible to the rescuer during the application of cardiopulmonary resuscitation in a patient in confirmed cardiac arrest”. Determination of cardiac arrest would need to be clinical judgement based upon the absence of a palpable pulse at a major site accompanied by an ECG rhythm check. It was understood that there may be a potential for a pseudo-pulseless electrical activity to be mistaken for CPR-IC but that it would be difficult to remove this bias. This would enable us to determine the concordance of participants’ understanding with our own interpretation. Our definition of CPR-IC was based upon previous literature and derived from consensus within the study team, the wider paramedic teaching team and the Professor of Nursing at the University of Wolverhampton.

Participants

The survey was promoted to paramedics via social media, the College of Paramedics, and by word of mouth. Statutory ambulance services within the NHS had the option to distribute the survey but generally opted not to as despite university level ethics ambulance services felt uncomfortable distributing research without NHS research ethics committee approval. Any paramedic who was registered and working within the UK at the time of the study was eligible to complete the survey, irrespective of their current employment. In the UK, the majority of paramedics are employed within NHS ambulance services but there is a growing number who work outside the NHS in a variety of emerging and established roles. It was important not to restrict the population to those employed by NHS ambulance services as it would potentially eliminate a large portion of the paramedic population. Responding to the survey was both voluntary and anonymous with no individual identifying information being recorded.

Data analysis

Numerical descriptive data were analysed using the online survey tool, whilst free text answers were exported, and themes identified by two of the study team (BM and CS) working independently. Once the themes had been identified, PG reviewed the coding to assess for concordance between the two investigators. Any anomalies were discussed within the study group to achieve consensus. Finally, the study definition of CPR-Induced Consciousness was compared to the participants’ definitions.

Ethical Approval

Ethical approval was granted by the University of Wolverhampton’s Ethics committee in November 2017.

Results

323 participants commenced the survey of which 320 consented to participate in the study. The three who did not provide consent were not allowed to access the survey

questions. Of the remaining 320 participants, 27 were excluded as they were ineligible to participate in the study (Figure 1). This left 293 participants, which comprised approximately 1.17% of the total number of UK registered paramedics at the time (25,000).

Participant Demographics

The majority of respondents were currently working in clinical practice in a 'generalist' paramedic role, had qualified as a paramedic via a higher education route and had attended more than 10 cardiac arrests in which CPR was attempted during their career (Table 1).

Table 1: Summary of survey respondent demographic information

	n (%)
Currency of Clinical Practice	
Current	271 (92.5)
Within the last 12 months	5 (1.7)
Between 1 and 5 years ago	8 (2.7)
More than 5 years ago	9 (3.1)
Length of Service (WTE)	
0–4 Years	93 (31.7)
5–9 Years	93 (31.7)
10 years or more	107 (36.5)
Education Route	
IHCD (or equivalent)	89 (30.4)
Certificate of Higher Education	10 (3.4)
Foundation Degree/Diploma of Higher Education	132 (45.1)
BSc/BSc (Hons)	62 (21.1)
Specialist Role	
No specialist role	191 (65.2)
Primary Care	22 (7.5)
Critical Care	39 (13.3)
Other	41 (14)
Number of Cardiac Arrests Attended	
Up to 10	21 (7.2)
11–50	122 (41.6)
More than 50	150 (51.2)

157 respondents (53.6%) indicated that they were familiar with the term CPR-IC prior to completing the survey and provided a response to the question that asked them to explain their understanding of the term. 140 respondents discussed some but not all of the components of CPR-IC and were deemed to show varying degrees of understanding of the term when compared with our definition. The most commonly cited themes are identified in Table 2. Examples of explanations that were deemed to show an understanding of CPR-IC included:

A state in cardiac arrest which the standard of cpr is so high that the brain is being perfused in such a manor (sic) that the patient is 'light' and possibly aware of surroundings/pain/incident/emotions (participant 27928723)

Where consciousness occurs as a result of the effectiveness of CPR not because of Physiological improvements. (participant 27986012)

When effective CPR was performed to the point where the pt was able to achieve some level of consciousness. (participant 27993915)

Of the 17 who were deemed to have incorrectly defined CPR-IC, 7 identified it as a return of spontaneous circulation (ROSC), 7 discussed awareness rather than consciousness, and one discussed low flow pulseless electrical activity (PEA). One participant said that they had "no idea" and one other inserted an "N" in the text box. Notably, 31 participants said that they did not know what CPR-IC was prior to commencement of the study but declared that they had experienced the phenomenon on two or more occasions.

Table 2: Common themes when describing CPR-IC

Correct Themes	Number of Times Mentioned
Motor response/movement	33
Cerebral Perfusion Pressure	17
Glasgow Coma Scale Score	15
Eye opening	13
High/Good quality CPR	12
Verbalisation	10
Eyes, verbal and motor responses (specifically)	7

When asked how they became aware of the phenomenon (Table 3). They identified five key themes: Formal teaching, informal learning, word of mouth, that they had witnessed CPR-IC out-of-hospital, or in-hospital.

Table 3: Methods by which respondents became aware of CPR-IC

Method of Learning about CPR-IC	n (%)
Formal Learning	41 (26.1)
Informal Learning	22 (14.0)

Method of Learning about CPR-IC	n (%)
Word of Mouth	23 (14.6)
Witnessed CPR-IC out-of-hospital	63 (40.1)
Witnessed CPR-IC in-hospital	3 (2.0)
Did not respond	5 (3.2)
Total	157 (100.0)

Formal learning included being taught through universities, training received through the Lucas™ device manufacturers, and reading of peer-reviewed academic journal articles. Informal learning was derived largely through blogs, podcasts and social media with a number specifically mentioning Twitter. Those who learnt through word of mouth typically reported hearing from other crews who had experienced the phenomenon;

“I heard stories about patients regaining consciousness when a Lucas was being used” (Participant 27998235).”

Over 41% of respondents identified that they had learnt about CPR-IC when exposed to it in their practice. In what was not an uncommon reply one respondent reports learning of CPR-IC for the first time;

“When performing CPR on a patient and he was telling me to “get off” and trying to pull my hands off his chest. When we stopped CPR he became unconscious,” (Participant 28556665).

Discussion

Despite the wealth of resuscitation-related studies, there is a paucity of research addressing CPR-IC. Given that CPR-IC could be considered an atypical (but not rare) phenomenon (Grandi et.al., 2017) it is important that paramedics are aware of the potential for CPR-IC to occur and are able to correctly define and identify its characteristics. In our study, 136/293 (46.4%) had not heard of CPR-IC prior to completing the study and 17/293 (5.8%) who said that they had heard of it failed to offer an explanation that accorded with our proposed definition. This means that over half of our study population (153/293, 52.2%) had either no understanding, or an incorrect understanding of the phenomenon. It is not clear whether this affected the management of patients who presented with CPR-IC but it is possible that this may

have caused some confusion during the episode and impacted upon the continuance of resuscitation attempts.

The results also highlight that few respondents 41/152 (27%) had learnt about CPR-IC in formal teaching sessions, which means that fewer than 14% (41/293) of the overall study population had received formal teaching around CPR-IC. This concern is also reflected in the relatively high number of participants who first experienced the phenomenon when presented with it in their clinical practice. Cardiac arrest in the out-of-hospital environment can be stressful and it is reasonable to suggest that overall effectiveness in the management of cardiac arrest could be impaired where a previously unknown phenomenon is experienced. This would be even more likely if the patient displayed features consistent with interfering CPR-IC as described by Olauseen et al. (2016). In addition, there are further ethical considerations that may need to be explored when considering the management of a patient who has regained some level of consciousness due to the effects of CPR. These include whether survivors have any post traumatic symptoms and whether there is a humanitarian requirement for sedation in such patients. It is recommended that discussion around CPR-IC be included in all pre-registration paramedic programmes and forms part of mandatory training for registered paramedics.

Limitations

The study was primarily limited by the method of distribution as most NHS Trusts decided against promoting the study to their workforce due to lack of NHS research ethics committee approval (despite university level ethics). The study was promoted primarily through social media and word of mouth, which may mean that those who do not use social media were unaware of the study. The sample captured approximately 1.2% of the total number of registered paramedics (25,000) but it is unclear whether this sample was entirely representative of the wider paramedic population.

Conclusion

Around 50% of our study population were aware of CPR-IC and able to accurately define it when compared with the definition “Signs of consciousness perceptible to the rescuer during the application of cardiopulmonary resuscitation in a patient in confirmed cardiac arrest”. However, few had undertaken any formal learning on the topic and most respondents learnt of the phenomenon through attending patients displaying signs and symptoms of CPR-IC. Based on the results of this survey, there is a need for further education on CPR-IC in order for paramedics to prepare for the ethical and clinical dilemmas they may face when confronted with such patients.

Take home points

- A large number (>50%) of paramedics are unaware of CPR-IC and of those aware few have received any formal teaching on the subject, consequently increased paramedic education is required to increase the numbers of paramedics able to recognise CPR-IC.
- Of those aware of the phenomenon, most were able to accurately identify CPR-IC against a pre-agreed definition.
- The definition "Signs of consciousness perceptible to the rescuer during the application of cardiopulmonary resuscitation in a patient in confirmed cardiac arrest" appears to be appropriate.

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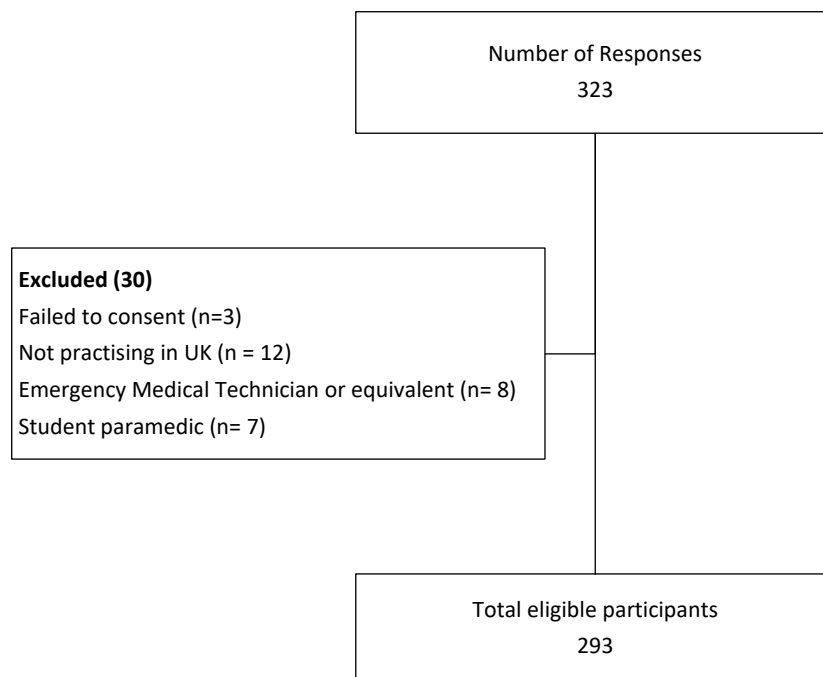


Figure 1 Study participants

Supplementary 1

Study survey

1. Are you currently practising prehospital care in the UK? Yes/NO
2. Which of the following best describes your professional discipline? Emergency Care Assistant or
Equivalent, Emergency Medical Technician or equivalent, Student Paramedic, HCPC Registered Paramedic
3. Do you have a specialist clinical role? No, Primary Care, Critical Care, Other (please state)
4. How many years (whole time equivalent) of clinical experience do you have as a paramedic working as part of a crew, rapid response vehicle and/or other such as air ambulance? 0-4 years, 5-9 years, 10 Years or more.
5. Is your clinical experience? Current, Within the last 12 months, between 1 and 5 years ago, more than 5 years ago
6. What educational route did you follow to become a Paramedic? IHCD certificate or equivalent (eg NHSTA, NHSTD), Certificate of Higher Education (level 4), Foundation degree or Diploma of Higher Education (Level 5), BSC/ BSc(hons) (level 6)
7. Do you have a higher degree in clinical practice (level 7 or 8)? Yes/No
8. Approximately how many out of hospital cardiac arrests have you attended in your career? (Please only refer to cardiac arrests where CPR has been attempted by you/your crew): Up to 10, 11-50, more than 50
9. Prior to commencement of this questionnaire were you familiar with the term CPR induced consciousness? Yes/No
10. What did you believe CPR induced conscious to be prior to commencement of this questionnaire?
11. How did you become aware of CPR induced consciousness (please be as specific as possible)