



CPR-induced consciousness: A cross-sectional study of healthcare practitioners' experience



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ABSTRACT

Introduction: Consciousness may occur during effective management of cardiac arrest and ranges from eye opening to interfering with rescuers' resuscitation attempts. Reported cases in the medical literature appear scant compared to anecdotal reports. The aim of this study was to evaluate health care providers' experience with consciousness during cardio-pulmonary resuscitation (CPR).

Methods: A cross-sectional survey of 100 experienced health care professionals, including doctors, nurses and paramedics. Participants were asked about their experience with both CPR-non-interfering consciousness (e.g. eye opening, agonal breaths or mild restlessness) and CPR-interfering consciousness (e.g. purposeful movement, withdrawing from CPR, attempting to pull out airway-securing devices).

Results: A third of responders reported attending more than 100 cases of arrests, while another third had attended 20 or less arrests. The responders had a mean of 11 (SD 8.7) years of practice. Most responders (59 of 67) to the question had experienced CPR-non-interfering consciousness and reported experiencing it a median of 3 (IQR 1–5) times. CPR-interfering consciousness had been experienced by 51 of the 63 responders and was experienced overall 1 (IQR 1–3) time. Management of these cases varied widely with varied opinion on ideal management ranging from no action to sedation and/or paralysis. A guideline describing the management of this presentation was considered necessary by 40 out of 57 (70%) responders.

Conclusions: Contrasting to a few reports in the medical literature, CPR-induced consciousness appears to be experienced more commonly during resuscitation. Management strategies varied widely and clinician opinion of ideal management was also varied. The desire for consensus guidelines on this topic exists. Acute care nurses are integral members of all resuscitation teams and in conjunction with other clinicians, ideally placed to develop, implement and disseminate such guidelines to delivering evidence based care to this sub-group of patients.

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What is known about the topic?

CPR-induced consciousness (CPRIC) to varying levels has been described in only a small number of case reports, with anecdotal evidence suggesting it is far more common than realised. No consensus recommendations on the recording or assessment of CPRIC during cardiac arrest exist. There are no current consensus recommendations for the optimal management of CPRIC, leading to considerable variation in management.

What this paper adds or contributes?

This paper collates experience with CPRIC by surveying a targeted group of healthcare practitioners, demonstrating the prevalence of CPRIC, management strategies, and need for a consensus-based guideline.

Introduction

Cardiopulmonary resuscitation (CPR) aims to facilitate blood flow around the body. [1]. Cerebral perfusion pressure (CPP) correlates closely with brain oxygenation during CPR [2], and effective CPR may induce levels of consciousness in some patients. Clinical signs such as breathing efforts, movements and eye opening can occur during CPR and was recognised by the 2015 International Liaison Committee on Resuscitation (ILCOR) [3].

Only a handful of case reports have described CPR-induced consciousness (CPRIC) in patients being resuscitated from cardiac arrest [4], although anecdotal evidence suggests its occurrence is more common in clinical practice. CPRIC has been described in varying levels, ranging from mild eye opening and agonal breathing, through to active interference of rescuers' attempts to perform CPR.

The mechanism behind CPRIC is unclear, but is likely to consist of a combination of factors. Individual factors such as autoregulation [5], ischaemic threshold [6], and presence of co-morbidities [7] have been linked to CPRIC as they influence brain oxygenation. Surrogates of CPR quality such as a high mean arterial pressure (MAP) (i.e. >50 mmHg) could also increase the likelihood of CPRIC [8,9]. Furthermore, early and good quality CPR have been hypothesised to be linked to CPRIC [9].

Although the true incidence of CPRIC remains unknown, there are some reports that suggest that up to 11% of survivors of cardiac arrest report memories of their resuscitation attempt [10]. Moreover, in the prospective AWAREness during RESuscitation (AWARE) trial [11], as many as 55 out of the 101 survivors from cardiac arrest, had self-reported perceived awareness or memories. To date, there are no consensus recommendations on the recording or assessment of CPRIC during cardiac arrest [12]. Consensus recommendations for the optimal management of CPRIC do not exist [13]. This has led to considerable variability in its management.

The aim of this study was to collate experience with CPRIC by surveying a targeted group of healthcare practitioners. A wide range of clinicians were targeted, and not limited to medical team leaders. Nurses were specifically included as it has been previously demonstrated that nurses contribute significantly to communication, leadership and effective team work, which ultimately impact patient outcomes both as part of medical and surgical resuscitation teams [14,15]. We aimed to explore the prevalence, management strategies, and need for a consensus-based guideline.

Methods

Design

A cross-sectional analysis of experienced healthcare professionals was performed. Doctors, nurses, paramedics and other relevant groups (e.g. first aiders and volunteers) (i.e. clinicians) were invited to participate in a questionnaire describing their experiences of CPRIC. For the purposes of this study, CPRIC was categorised as CPR-non-interfering and CPR-interfering. These were defined as (i) eye opening, agonal breaths or mild restlessness, and (ii) purposeful movement, withdrawing from CPR, attempting to pull out airway-securing devices, combating or pushing rescuer away, respectively.

Questionnaire

The link to an online questionnaire (www.surveymonkey.com) comprising 16 questions was made available to participants. The questionnaire is presented in [Appendix A](#).

Participants

The link to the survey was made publically available through social media and word-of-mouth two days prior to the Australian Resuscitation Council Conference 2015, Melbourne, Australia. The link was further disseminated on the day of the conference through social media and an oral presentation on the topic of CPRIC. In addition, the link was marketed and available to all emergency department staff at a major hospital and designated trauma service—The Alfred Hospital, Melbourne, Australia. In order to limit selection bias, participants were encouraged to complete the survey regardless of experience with CPRIC.

Data analysis

Normally distributed continuous variables were presented using the mean and standard deviation. Ordinal or skewed data were presented using the median and inter-quartile range. Qualitative data were grouped into categories of similar answers using a thematic analysis. Specific management undertaken and opinions around optimal management were free text answers. Proportions were compared using the chi-squared (χ^2) test.

Ethics

The Alfred Hospital Research and Ethics Committee approved this study.

Results

There were one hundred responders with a varied range of clinical expertise ([Table 1](#)). The majority of medical doctors were of consultant level, whilst the majority of paramedics were of Advanced Life Support (ALS) level.

Approximately a third (32/100) of responders had attended 20 or less arrests, whilst another third (32/100) had attended >100 arrests.

Prevalence of CPRIC

CPR-non-interfering consciousness was reported to be observed a median (IQR) of 3 (1–5) times. Among the 67 responders to this question, there were 8 (11.9%) who had never seen this presentation. If all the 33 non-responders are assumed to have never experienced this presentation, there are still 59% participants that have had experience with CPR-non-interfering consciousness.

Table 1
Demographics of the responders.

Question	Answer	Response rate
Gender	Male: 67 (68.37%) Female: 30 (30.61%) Prefer not to say: 1 (1.02%)	98
Current level of practice	Medical Doctor: 16 Consultant: 11 Registrar: 2 Resident: 2 Intern: 1 Paramedic: 65 Intensive Care: 18 ALS: 41 Student: 6 Nurse: 17 Volunteer/First responder: 2	100
Years of practice, mean (SD)	11.0 (8.7)	98
Number of cardiac arrests attended	0–5: 10 6–10: 11 11–20: 11 21–30: 7 31–40: 7 41–50: 5 51–100: 17 101–200: 14 >200: 18	100

Table 2
Prevalence and mechanical CPR device usage amongst cases of both CPR-interfering and non-interfering.

Question	Answer	Response rate
CPR-non-interfering consciousness		
Prevalence	Median, IQR: 3(1–5) Never: n = 8	67
Mechanical CPR device use	Yes: 9.38% No: 89.06% Cannot remember: 1.56%	64
CPR-interfering consciousness		
Prevalence	Median, IQR: 1(1–3) Never: n = 12	63
Mechanical CPR device use	Yes: 16.07% No: 82.14% Cannot remember: 1.79%	56

CPR-interfering consciousness was reported to be observed a median (IQR) of 1 (1–3) time among the 63 responders to this question. Only 12 (19.0%) had never experienced CPR-interfering consciousness (Table 2). If the 37 non-responders are assumed to have never seen this presentation, there are still 51% participants that had experience with CPR-interfering consciousness. Mechanical devices were more commonly used in CPR-interfering cases compared with CPR-non-interfering cases, although not of statistical significance (16.1% vs. 9.4%, $\chi^2 = 1.24$, $p = 0.27$).

CPR-non-interfering consciousness

In the setting of CPR-non-interfering consciousness, 59 clinicians responded about specific management undertaken, with 23 (39.0%) reporting nil specific management. There were 10 (16.9%) participants that reported CPR was paused, with one clinician detailing “repeatedly rechecking pulses, electrocardiogram, heart sounds, with multiple cessations of CPR”. There were 7 (11.9%) clinicians who reported talking to and reassuring the patient (Table 3). Twelve clinicians reported using sedation to manage CPR-non-interfering consciousness, while 4 clinicians reported using

Table 3
Qualitative responses to patient reassurance descriptions in both types of CPRIC.

CPR-non-interfering
Continually talking to and reassuring the patients. When ROSC established sedation was used as the patients were intubated O2, TLC Reassurance to patient. Reassurance for the patient and the crew Nothing chemical, talking & reassurance Reassurance Talking to patient, continue resuscitation
CPR-interfering
The patient was GCS 15 during CPR which was very unsettling for the crews involved. At one point the patient was begging us to stop as the CPR was hurting. He said ‘tell my family I love them and I’m ok with dying, please let me die’. For this patient we continued CPR and other required care and achieved ROSC twice during transport. The only treatment for the LOC was reassurance and explaining to the patient that we could fix the problem with his heart as soon as we arrived at hospital and continually reassuring the patient and the paramedics O2, TLC Supportive: ensuring clinician’s actions are verbalised to the patient, etc. Reassurance. Continue CPR Continue resuscitation, psychological support (talk to patient)

paralysing agents and/or rapid sequence intubation (RSI). A further 2 clinicians reported the use of physical restraints.

Regarding opinion on optimal management for CPR-non-interfering consciousness, there were 58 responses received with 13 (22.4%) reporting “nothing specifically”. Sedation was recommended by 23 (39.7%) clinicians, whilst 6 said they were unsure, 5 advocated for reassessment, and 4 said they would talk to the patient and offer reassurance.

CPR-interfering consciousness

In the setting of CPR-interfering consciousness, 57 clinicians responded about specific management undertaken, with 13 (22.8%) reporting nil specific management was used. There were 7 (12.3%) who reported CPR was paused, 22 (38.6%) had administered sedation, 7 (12.3%) had used “restraints”, while one clinician administered a paralysing agent. There were 5 (8.8%) who reported talking to patient and/or family (Table 3).

There were 51 responses to opinion on optimal management for CPR-interfering-consciousness, with 5 suggesting “nothing specifically”. There were 17 (42.1%) that suggested sedation only, 11 (21.6%) suggested sedation and paralysis or RSI, and one response suggested paralysis only.

A management guideline describing how to handle CPR-induced consciousness was considered necessary by 40 out of 57 (70%) responders. Among the 32 respondents who reported experience with more than 100 resuscitations, 19 out of 27 (70%) felt the need for a guideline. In response to the specific question of use of sedation during CPR, there were 22 responses in opposition while 23 favoured sedation. The remaining 12 were undecided, citing lack of knowledge of the topic, or expressed concerns around the cardiac output and hypotensive effects of sedation.

When also asked if survivors had recall of their resuscitation attempt, 56 responded with 34 (60.7%) reporting they had never encountered this phenomenon. A further 7 clinicians did not know as they commonly do not follow up patients. There were 15 clinicians that reported that patients (a total of 26) had recalled their CPR.

Discussion

This cross-sectional study of healthcare practitioners highlights a higher prevalence of CPR-induced consciousness than that reported in the medical literature. This phenomenon may occur more frequently than previously regarded and the management provided varies. Emergency care practitioners desire a guideline on management of these cases, but disagree on the optimal constituents of a management strategy. Such a guideline is important because the presence of CPRIC has variable influence on treatment decisions and the decision to continue resuscitation efforts [4].

Locally derived guidelines on the management of CPR-induced consciousness, combativeness and/or pain have recently been developed. They vary both in their indications and components. A Dutch guideline [16] allows treatment of agitation and/or pain during (mechanical) chest compressions with 2 µg/kg of fentanyl intravenous (IV) (which can be titrated to 4 µg/kg), and 2.5 mg of Midazolam IV (which can be titrated to 5 mg). In Australia, Ambulance Victoria allows the use of small doses of sedation to facilitate endotracheal intubation in the presence of a gag reflex [17]. In New Zealand, The Wellington Free Ambulance allows sedation of combative patients in cardiac arrest if physical restraint is unable to control the combativeness and the movement makes it impossible to provide effective CPR, place an airway, or gain IV access [18]. The preferred agent is Ketamine IV (10–20 mg for adults, maximum 100 mg, every 3–5 min), with Midazolam IV (1–2 mg, for adults, no maximum dose, every 5 min) reserved for cases in which Ketamine cannot be used. Where Intensive Care Paramedic backup is further than 10 min away, IV Fentanyl (10–50 mcg, for adults, no maximum dose, every 3–5 min) or Midazolam Intramuscular (IM) (5–10 mg, for adults, maximum 15 mg, every 10 minutes) may be administered. In Nebraska Emergency Medical Service, the recently published guideline [19], involves Ketamine boluses (0.5–1.0 mg/kg IV, with repeat doses, or IM 2–3 mg/kg) or, if necessary, IV infusions, as well as potential co-administration of Midazolam (1 mg IV or 2 mg IM).

In developing such a guideline, a crucial first step is a definition of what CPRIC constitutes [20]. The definition must be pragmatic and simple to not interfere with life-sustaining treatment. That is to say, CPRIC must be recognised by clear clinical signs, and not advanced monitoring such as Bispectral Index (BIS) or other cerebral measures. We suggest using a simple dichotomisation of this presentation, as used herein, namely: CPR-interfering and CPR-non-interfering.

The benefits of sedating patients who present with CPR-non-interfering consciousness are less clear. However, justifying sedation of these patients based on perceived analgesic needs seems inappropriate, as patients that have memories after surviving cardiac arrests most often report pleasant features of near-death experience [10]. An argument against sedation is the potential for circulatory depression and obscuring of the neurological status assessment [9]. However, given the relatively minimal effect of medications on cardiac arrest outcomes in general [21,22], a controlled small dose of sedation is unlikely to influence survival outcomes.

The association between CPRIC and mechanical devices remains to be determined. From this survey, 1 in 6 cases were treated with mechanical devices. In a recent systematic review, 6 out of 10 CPRIC cases occurred in the setting of mechanical CPR devices [4]. Although mechanical CPR does not appear to improve mortality [23], the devices improve consistency and reduce interruptions of CPR [24], as well as improve CPP when compared to manual CPR [25]. CPRIC may therefore be more likely in cardiac arrests treated with mechanical devices.

This study must be viewed in light of its limitations. We targeted clinicians who were experienced in resuscitation, and the

responders may be biased towards those who have witnessed this phenomenon, thereby over-estimating the prevalence. Given our methodology, we are unable to determine a true denominator, and subsequently cannot comment on the incidence. Further, although that problem partly could have been ameliorated by asking the respondents about the number of witnessed cases within a given time frame, we opted not to do this given the presumed rare nature of the presentation. Although some of reported cases may not have been true cardiac arrests, we are confident that the responders both have the ability to recognise cardiac arrest and to respond appropriately to our survey. We did not control for the responders' qualifications or their exposure to cardiac arrests. Lastly, our study is subject to recall bias, but given the critical nature of such presentations, it is likely that clinicians may be able to accurately recall these cases.

Conclusion

CPR-induced consciousness is more commonly reported anecdotally, amongst a group of experienced practitioners, than in the medical literature. Impediment to resuscitative efforts was commonly reported and in the absence of clinical guidelines, management was varied. Clinicians desire a uniform management guideline when faced with this clinical scenario. Emergency nurses are a vital part of all resuscitation teams and ideally placed to recognise this common phenomenon, and developing, implementing and disseminating guidelines to address consequences of CPR-induced consciousness.

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Conflict of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Author contributions

All authors contributed to (i) the conception and design of the study, or acquisition of data, or analysis and interpretation of data, (ii) drafting the article or revising it critically for important intellectual content, and (iii) gave final approval of the version submitted. No author had any writing assistance.

Appendix A. CPR-induced awareness and consciousness.

Demographic of the responder

- Male/female/prefer not to say.
- What is your current level of practice?
 - Consultant, registrar, resident, Intern, Intensive Care Paramedic, Paramedic, Nurse, Other (please specify).
- For how many years have you practiced?
- How many cardiac arrests have you ever attended?
 - 0–5/6–10/11–20/21–30/31–4/41–50/51–100/101–200/>200.

• Scenarios

- Scenario 1: During cardiopulmonary resuscitation (CPR) the patient: opens his/her eyes, takes agonal breaths, and appears restless.

- In how many cardiac arrests, have you seen the patient display the above level of consciousness?
- What specific management towards the consciousness was undertaken?
- Was a mechanical device being used?

■ Yes/No/Cannot remember.

- Opinion: How do you think this level of consciousness should optimally be managed?

- Scenario 2: CPR-interfering.

During CPR the patient either moves purposefully, withdraws from CPR, attempts to pull out airway-securing devices, is combative, and/or pushes the rescuer away.

- In how many cardiac arrests, have you seen the patient display the above level of consciousness?
- What specific management towards the consciousness was undertaken?
- Was a mechanical device being used?

■ Yes/No/Cannot remember.

- Opinion: How do you think this level of consciousness should optimally be managed?

Clinical position

- Do you think we should use sedation during CPR? Why? Or why not?
- Of all the cardiac arrest patients you have seen, how many have survived and reported that they recall their CPR?
- Do you think we need an addition to the current guidelines describing the treatment of CPR-induced consciousness?
- Yes/No—Please explain.
- Do you have any additional comments in relation to CPR-induced consciousness?

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