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Review

Pre-hospital guidelines for CPR-Induced Consciousness (CPRIC): A scoping review

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Abstract

Background: CPR-Induced Consciousness is an emerging phenomenon with a paucity of consensus guidelines from peak resuscitative bodies. Local prehospital services have had to implement their own CPR-Induced Consciousness guidelines. This scoping review aims to identify prehospital CPR-Induced Consciousness guidelines and compare or contrast their management options.

Objective: The purpose of this scoping review is to identify and compare as many prehospital CPR-Induced Consciousness guidelines as feasible, highlight common management trends, and discuss the factors that might impact CPR-Induced Consciousness guidelines and the management trends identified.

Design: To search for prehospital CPR-Induced Consciousness guidelines, a bibliographical search of five databases was undertaken (MEDLINE, EMBASE, Cochrane, Scopus, and CINAHL plus). Also included was a grey literature search arm, comprised of four search strategies: 1. Customised Google search, 2. Hand searching of targeted websites, 3. Grey literature databases, 4. Consultation with subject experts.

Results: Our search extracted 23 prehospital CPR-Induced Consciousness guidelines and one good practise statement from the International Liaison Committee on Resuscitation. Of the 23 prehospital guidelines available, we identified 20 different ways of treating CPR-Induced Consciousness. Midazolam was the most frequently used drug to treat CPR-Induced Consciousness (14/23, 61%), followed by Ketamine (11/23, 48%) and Fentanyl (9/23, 39%).

Conclusion: Prehospital CPR-Induced Consciousness guidelines are both exceptionally uncommon and vary substantially from each other. This has a flow-on effect towards data collection and only serves to continue CPR-Induced Consciousness's relatively unknown status surrounding both knowledge of, and the effect CPR-Induced Consciousness treatment has on cardiac arrest outcomes.

Keywords: CPR-induced consciousness, CPRIC, Prehospital, Paramedic, Emergency medical services, Resuscitation, Cardiopulmonary Resuscitation, Heart arrest, Consciousness, Awareness

Introduction

The emerging phenomenon of CPR-Induced consciousness (CPRIC) continues to be increasingly reported and discussed in the prehospital field. Community CPR responder programs, increased focus on high-quality CPR, and earlier implementation of the chain of survival are some of the contributors to this increasing rate.[1–3] As our prehospital systems and community responder programs become more efficient, the incidence of CPRIC continues to rise.[3,4] One study found a 0.6% rise in CPRIC incidence over 6 years.[3]

CPRIC is defined as consciousness during CPR, ranging from eye-opening to actively grabbing and talking to clinicians, despite having no return of spontaneous circulation.[2,3,5,6] This is a confronting presentation for clinicians and bystanders to deal with and may be especially distressing for patients who survive and are possibly left with traumatic memories from their increased consciousness during resuscitation.[7]

Management of CPRIC is complicated in the prehospital environment.[8] The luxuries of space, lighting, adequate staffing, or basic scene control are not necessarily afforded to prehospital scenes.[9] These factors coupled with a CPRIC presentation during a resuscita-

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tion amplify the difficulty clinicians face in the prehospital environment.[8]

CPRIC creates numerous obstructions to cardiac arrest management. It can produce delays to defibrillation, interrupt CPR, or prevent adequate airway management.[10,11] Aside from the delay to basic lifesaving management skills, CPRIC can be a distressing presentation for all involved, taking focus from the resuscitation at hand.[8,11] The patient may appear visually distressed, leaving post-traumatic memories for the clinician and bystander.[11,12] CPRIC is a complex phenomenon to manage in the prehospital environment.

Management strategies in the prehospital setting for CPRIC remain unclear.[1] There are considerations about ethically treating patients who appear in pain but also not wanting to negatively affect perfusion during arrest or post Return of Spontaneous Circulation (ROSC).[13–15] It is unknown which drug dose or interval is optimal for managing CPRIC. Consequently, clinicians at a prehospital level have professed an ardent desire for CPRIC guidelines.[14,16]

This ardent desire, paired with a lack of published literature on the topic of CPRIC guidelines, is the reason we have conducted this scoping review in order to identify available evidence of prehospital CPRIC management.

The purpose of this scoping review is to identify as many prehospital CPRIC guidelines as we can and then compare them, highlighting common pharmacological management trends, and discuss the factors that might impact CPRIC guidelines, and the management trends identified.

Methods

Protocol and registration

Our protocol was reported according to the PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation.[17] The final protocol was registered with Open Science Framework on the 27th of April 2022.[18]

Eligibility criteria

Due to the specific nature of this scoping review the eligibility criteria were not extensive. Papers, articles, or guidelines needed to specifically state or reference official prehospital CPRIC guidelines, protocols, or management options. Lack of published material is why the team chose to include any articles published from any period and any language. We did not want to narrow down our already limited resources to review.

Due to being a prehospital guideline scoping review, the only exclusion criteria were any in-hospital guidelines and any articles with no management reference to CPRIC.

Information sources and search

To identify potentially relevant documents, the following five databases were searched over the 11th and 12th of April 2022: MEDLINE, EMBASE, Cochrane, Scopus and CINAHL Plus. The search strategy was drafted, trialled, and further refined through team discussion. The population arm of our Population, Context and Concept (PCC) search strategy, was the Paramedic Filter, optimised for specificity, from a paper by Olaussen et al, which maximised any search yield of prehospital relevant results.[19] The final search strategy for MEDLINE can be found in Appendix A. The final search results were exported into EndNote,[20] and then we imported them into Covidence[21] for screening and extraction. Any articles written in a language other than English were translated using Google translate for documents website.

Early search trials revealed limited published prehospital guidelines for CPRIC, so a robust grey literature search strategy was also developed in conjunction with our bibliographic database searches. The grey literature search arm was based on a detailed approach described in a paper by Godin, et al.[22] We incorporated four different search strategies.

Customised Google search

The first strategy was a customised Google search, conducted over the 30th and 31st of March 2022. A typical systematic search strategy for an academic database includes one search strategy combining all search terms for which all results will be screened for eligibility. In contrast, Google searches may require creating several search strategies containing multiple combinations of search terms.[22] We used eleven different search strategy combinations. For each search, potentially relevant documents were "bookmarked" in Google Chrome web browser under a folder named after the date and specific search strategy it identified. Documents were accessed and screened for CPRIC guidelines later. Post-screening the search strategies and results were uploaded into an Excel spreadsheet and can be found in Appendix B.

Targeted websites

The second search strategy was hand searching through targeted websites we knew contained out-of-hospital resuscitation guidelines. We conducted a primary Google search, on the 5th of April 2022, for the website of the International Liaison Committee on Resuscitation (ILCOR). They are recognised worldwide as the standard for evidence-based resuscitation management. The ILCOR website contains guidelines from multiple national and continental resuscitation councils. The potential guidelines for inclusion were bookmarked into Google chrome under the date and search strategy used for further screening so they could be hand searched later.

Grey literature databases

The third strategy used was a search of grey literature databases. We used seven different databases: TRIP, APAIS-Health, TROVE, SIGN, CPG InfoBase, National Guideline Clearinghouse and GIN databases. A search strategy was developed and undertaken on the 7th of April 2022. Potential documents for inclusion were bookmarked in Google chrome, under the date and database used to find them for screening. The search strategy was uploaded into an Excel spreadsheet and can be found in Appendix C.

Consultation with subject experts

This grey literature search strategy's fourth and final arm was consultation with subject experts. This strategy used a two-pronged approach, utilising both Twitter and email. On the 31st of March 2022, an author asked his Twitter followers to comment and share if their prehospital service had a CPRIC guideline. Twitter is emerging as a positive platform in which research is being conducted and disseminated.[23,24] We received three prehospital guideline replies, and any non-duplicates were saved into an Excel spreadsheet Appendix D, documenting the date received and region where the guideline originated from.

The second prong of this search strategy involved emailing prehospital services internationally for CPRIC guidelines. Our customised Google search strategy unveiled multiple Australian and American-based guidelines, so we specifically targeted Asian, European, and African prehospital services. Our limited knowledge of international prehospital services made finding contact information difficult. After multiple search attempts, a Google search revealed a Wikipedia page that named multiple prehospital services worldwide. Those specific service names were searched through Google and a hand search was conducted through their respective websites to identify contact emails. Any websites not written in English were translated through the Google Translate service. The authors drafted and refined an email sent on the 7th of April 2022. A total of 29 prehospital services, across 18 countries were emailed. A reminder email was sent weekly if a prehospital service did not reply to the original email. Google Translate was used to translate the initial email into the primary language spoken in the country the prehospital service operated in. No further attempts to contact non-responders were made after a third email. All guidelines provided before the 5th of May 2022, were considered, and screened. All services contacted were added to an Excel spreadsheet documenting the name of the service, its location, and existence of a CPRIC guideline. All of which can be found in Appendix D.

Selection of sources of evidence

Our scoping review had a very specific source of evidence criteria. The only evidence to be included for screening was articles containing specific prehospital CPRIC guidelines. For our bibliographic database search, two authors independently screened the search results in Covidence. A title and abstract screening were conducted. The articles that made it through this first screening process then had a full-text screening. Any conflicts during the screening process were discussed between the screening authors first and then adjudicated by a third party if an agreement could not be reached.

The grey literature search results revealed specific prehospital CPRIC guidelines, and thus did not need as robust a screening process as they were screened at the time of searching. These, specific prehospital guidelines were added to Covidence after the full-text screening to be included in the review.

Data charting process

The guidelines found were uploaded into an Excel spreadsheet detailing: the name of the prehospital service, region of operation, what pharmacotherapy intervention the guideline utilised, dosages and time intervals between doses.

Data items

The data extracted from our searches had a clear focus, there was little room for variance. The only data item we were extracting was prehospital guidelines or drug management options for CPRIC. Anything outside of this was disregarded.

Synthesis of results

We grouped the guidelines by the region, year published and what management options they used to treat CRPIC. The synthesis of our data was grouped into a table format, charting what CPRIC management options each guideline offered and any additional commentary around the guideline itself.

Results

Selection of sources of evidence

Bibliographic search

After duplicates were removed, 3582 articles were identified from our bibliographic database searches. Title and abstract assessment led to the exclusion of 3510 articles, with 72 full-text articles to be retrieved and assessed for eligibility. Fifteen full-text articles could not be found, of the remaining 57 articles, 52 were excluded as they had no relation to prehospital CPRIC management. The remaining five were considered eligible for this review, from which, we could only extract two prehospital guidelines.

Grey literature search

Customised Google search. The custom Google search identified 1379 websites. After hand-searching these sites title and abstract, we found 201 potential websites across the 11 custom searches. Fifty-six were excluded as they were duplicates. The remaining 145 websites were hand searched identifying 33 websites containing articles or prehospital guidelines specific to CPRIC. Seventeen of these were duplicate resources and were excluded, leaving a total of 16.

Targeted websites. The targeted website hand search through the ILCOR website found four prehospital applicable guidelines, three of which had to be excluded as they had no CPRIC management protocols.

Grey literature databases. Our search of the seven grey literature databases revealed 371 results, 368 had to be discarded as they had no relation to prehospital guidelines in the abstract or title. The three remaining resources were excluded as they did not mention of CPRIC management options.

Consultation with subject experts. The Twitter request for guidelines of our expert consensus search found three prehospital guidelines, two of which were excluded as duplicates of the Google search strategy. In our emails to international prehospital services, only 11 of the 29 services replied (38%). Seven services had no CPRIC guideline, leaving a total of four prehospital CPRIC guidelines.

Grey literature search summary

Across all four search arms, the grey literature search found 21 prehospital CPRIC guidelines and one good practice statement from ILCOR that were considered eligible for this review.

Combined search summary

Our bibliographical and grey literature search combined to identify 27 articles. From this we were able to extract 23 prehospital CPRIC guidelines and one good practice statement from ILCOR. This information can be found in Fig. 1.

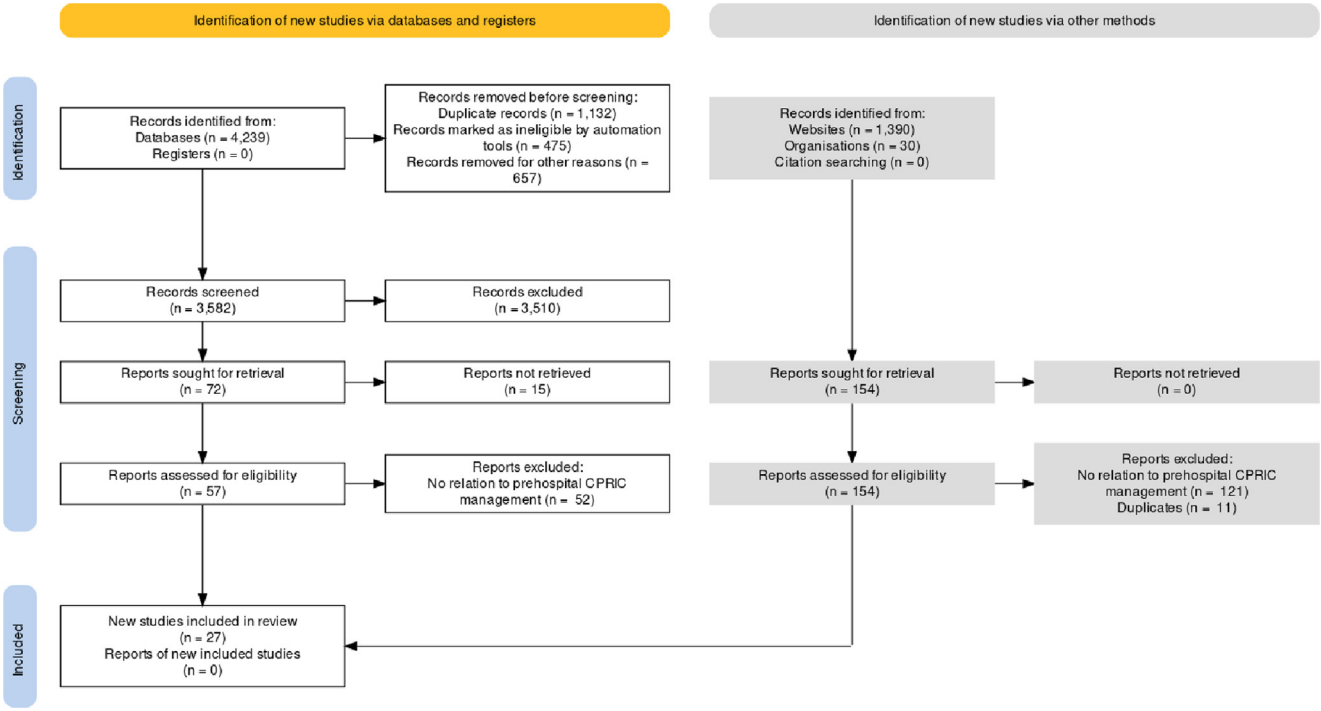

Fig. 1 – Prisma flow diagram.

Characteristics of sources of evidence

The prehospital guidelines included in this review are described in Table 1. We extracted the name of the prehospital service the guideline belonged to, the region and country they were in, the year the guideline was published, what management options they treated CPRIC with and any other notes included in the guideline.

Results of individual sources of evidence

The CPRIC prehospital guidelines found in our search have been produced in Table 1 below.

Synthesis of results

Our combined bibliographic database search and grey literature search uncovered a total of 23 prehospital service CPRIC guidelines and one good practice statement from ILCOR. Of the 23 prehospital guidelines the majority were from the United States of America (USA) (n = 10) and Australia (n = 5), followed by New Zealand (n = 2), Norway (n = 2), Canada (n = 1), Netherlands (n = 1), Israel (n = 1), and England (n = 1). The guidelines were all published between 2014 and 2022, 16 of the 24 guidelines (67%) were published since 2020.

Chemical

The use of Ketamine to sedate CPRIC was present in 11 of the 23 guidelines (48%). The lowest bolus Ketamine dose was 10 mg and the largest was a 200 mg intravenous (IV) dose. Weight-based dosage calculations were used in six of the guidelines (55%). No maximum dose of Ketamine was stated in five of the guidelines (45%). One guideline used a weight-based calculation of 1.5 mg/kg as a maximum dose and another required clinicians on scene to ring the local hospital for direction if a second dose was required. The rest of the guidelines had maximum doses ranging from 100 mg IV to 400 mg IV. Ketamine was used both as a first line agent (n = 9) and a second line agent (n = 2). Delivery of Ketamine was divided amongst IV, intramuscular (IM) and intraosseous (IO) routes. Intervals between doses ranged from one minute to 10 minutes.

Fentanyl was used to treat CPRIC in nine of the 23 guidelines (39%). The lowest bolus dose used was 25mcg IV and the largest was 100mcg IV. Weight based dosage calculations were used in two of the guidelines (22%). No maximum Fentanyl dose was stated in six of the guidelines (67%). One guideline used a weight-based calculation of 4 mg/kg as a maximum dose and the last two guidelines had a maximum of 100mcg IV. Fentanyl was only used as a first line agent in guidelines (n = 9). Delivery of Fentanyl was divided amongst IV, IO, Intramuscular (IM) and intranasal (IN) routes. Intervals between doses ranged from one minute to 10 minutes.

Prehospital services used Midazolam in 14 of the 23 guidelines (61%). The lowest IV bolus dose used to treat CPRIC was 1 mg IV and the largest was 2.5 mg. The lowest IM bolus dose was 2 mg, whilst the highest was 10 mg. Weight based dosage calculations were used in 1 of the guidelines (7%). No maximum dose was stated in five of the guidelines (36%). The rest of the guidelines had the highest maximum dose at 30 mg IV, whilst the lowest dose was 1 mg IV. Only one guideline required consultation with local hospital services to give a second dose. Midazolam was used as a first line agent (n = 12), and a second line agent (n = 2). Delivery of Midazolam was divided amongst IV, IO, IM and IN routes in the guidelines. Intervals between doses ranged from three minute to 15 minutes.

Other drugs to appear in prehospital CPRIC guidelines were Morphine (n = 2), Etomidate (n = 1) and Rocuronium (n = 3). One guideline had Morphine administered in conjunction with Midazolam. It was given in IV form in a bolus dose, as needed, of 2.5–5 mg at a maximum total dose of 10 mg IV. The second guideline treated with Morphine in isolation, 5 mg IV every-two minutes, to a maximum of 20 mg. Etomidate was used if CPRIC was present in a non-intubated patient. In which case it was given with Rocuronium at a

Table 1 – List of Prehospital services with CPRIC guidelines, their location and year published.

Service name	Country	Region	CPRIC guideline	Year published
Ambulance Victoria	Australia	Victoria	Fentanyl 100mcg IV every 1–2 mins (no max dose) **If Fentanyl ineffective:** Ketamine 50–100 mg IV every 1–2 mins (no max dose) **No IV access:** Fentanyl 100mcg or Ketamine 100 mg IM (single dose)	2021
New South Wales Ambulance	Australia	New South Wales	Midazolam 2.5 mg IV every 5 mins (7.5 mg max dose) **No IV access:** Midazolam 5 mg IM every 5 mins (10 mg max dose) **If Intensive care paramedic in attendance:** Ketamine 20 mg IV every 3 mins (100 mg max dose)	2021
Queensland Ambulance Service	Australia	Queensland	Fentanyl 25 mcg every 3–5 mins (no max dose) **Alternating with:** Midazolam 1 mg every 3–5 mins (no max dose)	2021
South Australia Ambulance Service	Australia	South Australia	Midazolam 1–2 mg IV/IO every 5 mins (5 mg max dose)	2021
St John Ambulance Australia (NT)	Australia	Northern Territory	Ketamine 10–20 mg IV every 5 mins (no max dose)	2021
British Columbia Ambulance Service	Canada	British Columbia	Midazolam 2.5 mg IV when required (30 mg max dose) **No IV access:** Midazolam 5–10 mg IM (30 mg max dose) Contact Clinician if higher doses required	2021
ILCOR guideline	International	International	Follow local pain relief and sedation regimes	2021
Magen David Adom	Israel	National	Ketamine 2 mg/kg IV, Consult for second doseFentanyl 1mcg/kg IV (100mcg max dose) Midazolam.1mg/kg IV, Consult for second dose	2022
Dutch Ambulance Institution	Netherlands	National	Fentanyl 2mcg/kg IV (4mcg/kg max dose) Midazolam 2.5 mg IV (5 mg max dose)	2014
St John Ambulance Service	New Zealand	National	Ketamine 1 mg/kg IV, single dose (100 mg max dose) **If Intensive care paramedic in attendance:** Providing Ketamine has no effect and ETT in situ Rocuronium: <90 kg–150 mg IV >90 kg–200 mg IV	2019
Wellington Free Ambulance	New Zealand	Wellington	Ketamine 1 mg/kg IV, single dose (100 mg max dose) **If Intensive care paramedic in attendance:** Providing Ketamine has no effect and ETT in situ Rocuronium: <90 kg–150 mg IV >90 kg–200 mg IV	2019
Helse Vest RHF	Norway	Western region	Midazolam 2.5 mg IV, as required (5 mg max dose) Morphine 2.5–5 mg IV, as required (5–10 mg max dose)	2022
Oslo University Hospital HF	Norway	Southeast region	Morphine 5 mg IV every 2 mins (20 mg max dose)	2022
London Ambulance Service NHS Trust	United Kingdom	London	**If Intensive care paramedic in attendance:** Ketamine 0.1–0.25 mg/kg every 2 mins (1.5 mg/kg max dose)	2022
Delaware Paramedic Service System	USA	Delaware	For CPR induced consciousness contact medical control	2018

(*continued on next page*)

Table 1 (continued)

Service name	Country	Region	CPRIC guideline	Year published
East Cascade Emergency Medical Service	USA	Central Oregon	Midazolam 2.5 mg IV/IO with Fentanyl 50mcg IV/IO every 5–10 mins (no max dose)	2022
Marion and Polk County Emergency Medical Service	USA	Oregon	Midazolam 2.5 mg IV/IO every 5–10 mins (no max dose) Fentanyl 50mcg IV/IO every 5–10 mins (no max dose)	2021
Northeast Ohio Regional Emergency Medical Service	USA	Northeast Ohio	Fentanyl 25mcg IV/IO/IN/IM as required (no max dose) Ketamine 10 mg IV/IO/IM as required (no max dose)	2018
Palm Beach County Fire Rescue	USA	Florida	Ketamine 200 mg IV/IOMay repeat x1 as required (400 mg max dose)	2016
Rhode Island State-wide Emergency Medical Service	USA	Rhode Island	Ketamine 0.5–1 mg/kg IV every 5–10 mins (no max dose) Midazolam 1 mg IV every 5–10 mins (no max dose)	2022
Seminole Tribe of Florida Fire Rescue	USA	Florida	Midazolam 5 mg IM/IN every 5 mins (10 mg max dose)	2019
Virginia Beach Rescue	USA	Virginia	**Advanced airway in place:** Midazolam 2.5 mg IV every 5–15 mins (no max dose) **Advanced airway not in place:** RSI protocol Etomidate: <165lbs – 20 mg IV/IO >165lbs – 30 mg IV/IO Rocuronium: <165lbs – 80 mg IV/IO >165lbs – 100 mg IV/IO	2021
Metro Regional EMS (Washington County)	USA	Oregon	Midazolam 2.5 mg IV/IO with Fentanyl 50mcg IV/IO every 5–10 mins (no max dose)	2022
Nebraska EMS	USA	Nebraska	Ketamine 0.5–1 mg/kg IV every 5–10 mins (no max dose) Midazolam 1 mg IV, single dose **No IV access:** Midazolam 2 mg IM, single dose	2016

standard 30 mg IV/IO to perform a Rapid Sequence Intubation (RSI). Rocuronium was used in 3 guidelines and always given in a bolus dose based on the patient's weight.

Other management

Only two resources presented no specific management options. One prehospital service guideline stated if CPRIC was encountered in the field, then medical control should be contacted for advice. Nothing further was stated in the guideline. The second guideline or treatment recommendation, from ILCOR, was did not provide any definitive management just recommendations to follow local pain relief and sedation regimes.

Single vs multi-drug management

Seven of the guidelines use a single drug management protocol. Midazolam ($n = 3$) and ketamine ($n = 3$) were the most popular drugs to use as monotherapy for CPRIC. Morphine ($n = 1$) was also used as a monotherapy. Multi-drug combinations include fentanyl/midazolam ($n = 5$), midazolam/ketamine ($n = 3$), fentanyl/ketamine ($n = 2$), ketamine/rocuronium ($n = 2$), morphine/midazolam ($n = 1$), ketamine/fentanyl/midazolam ($n = 1$), midazolam/etomidate/rocuronium ($n = 1$).

Indication for treatment

Indications for treatment also varied. Half of the guidelines ($n = 12/23$) explain how CPRIC presents, ranging from simply "moving during CPR" to a multiple point list detailing symptoms such as, eye-opening, groaning and movements that will impede cardiac arrest management. The remaining guidelines state if CPRIC is present then it is to be treated without any mention to how or what CPRIC may entail.

Discussion

The aim of this scoping review was to identify as many prehospital CPRIC guidelines as possible. The results of our search let us compare these guidelines, identifying management trends and how these trends and guidelines may have been influenced by external factors.

We uncovered 23 prehospital CPRIC management protocols worldwide. To our knowledge, this is the largest collection of CPRIC guidelines to appear in a published review. These 23 guidelines were revealed following a literature search of 5659 articles, further signifying the complete lack of evidence or literature around CPRIC. There is a clear trend to using either ketamine, midazolam, or fentanyl to manage CPRIC presentations. The prehospital selection of medication treatment options may be based upon familiarity, cost, access or training.[25] Due to this reason, a multi-drug management statement would be of benefit to the international prehospital community.

No official guideline exists amongst major international resuscitation bodies such as, the American Heart Association (AHA), European Resuscitation Council (ERC), Australian and New Zealand Committee on Resuscitation (ANZCOR).[26–28] As of writing, ILCORs latest annual treatment recommendations in 2021, is the first peak body to make a consensus statement on the issue. A definitive management strategy was unable to be recommended, due to the lack of evidence available on CPRIC presentations.[29]

Current prehospital CPRIC guidelines vary significantly. Of the 23 guidelines we identified, there were 20 different ways of treating CPRIC. The only services who pharmacologically managed CPRIC the same way were two services based in New Zealand, of whose guidelines are governed by a national paramedic working group.[30] Three services from counties in the North-West/Central Oregon also have the same guidelines. Given the distance between the three county borders, we suggest this cannot be coincidence. The other 18 guidelines differ in varying degrees from each other. This variation continues into the indications for treating CPRIC. Only 12 of the 23 guidelines give a clear indication to manage CPRIC, of which, 9 different definitions of CPRIC exist amongst the 12 guidelines. The complete discrepancy between the vast majority of CPRIC guidelines is concerning. Cardiac arrest management has been based off standardised care recommendations for decades.[28] This review has identified a cohort of these patients are receiving extremely varied management techniques, without any research into how these discrepancies affect ROSC rates. Whilst standardisation of care is not always of benefit, in critical care areas, such as in airway management,[31–34] cardiac arrest,[32] and sepsis[34] there has been significant benefit.

The discrepancy between guidelines has a flow on effect to research. The non-standardised treatment of CPRIC across multiple prehospital services makes it impossible to look for trends and relationships between treatment and outcome. This creates a paradox where peak bodies cite not enough evidence exists to provide definitive guidelines, yet any data extracted from such inconsistent management, in the hopes of gaining understanding or evidence of this largely unknown phenomenon is unavailing. The more guidelines that are created with increasing disparity from the last, the greater this paradox becomes. Standardised guidelines for CPRIC will simplify its complexities and provide a constant framework from which to report outcomes.

Even if consensus guidelines existed, data extraction to further understand the phenomenon would prove difficult. The Utstein reporting framework consists of five domains, 23 core elements and 31 supplemental elements. Not one of these elements pertain to CPRIC.[35] The rarities of overt CPRIC presentations, its relative obscurity outside the prehospital field and recent increasing exposure to clinicians would be a contributing influence to this fact. The Utstein reporting framework was created to compare the epidemiology and outcome of cardiac arrest, which in turn, identify gaps in resuscitation science knowledge and drive quality improvement.[35] We cannot see how the lack of consensus on CPRIC knowledge or management can improve significantly without CPRIC incidence and outcomes becoming incorporated within the Utstein reporting framework.

Accurate incidence rates of CPRIC are largely unclear, what can be ascertained is that overt CPRIC is uncommon.[4] However, the patient cohort that CPRIC commonly occurs in are cardiac arrest patients with short downtimes and diminished levels of global hypoxia.[14] These patients are viable cardiac arrests, and this supports the data that patients that exhibit CPRIC have higher ROSC and survival rate.[3,4] CPRIC presentations cause significant impedance of vital lifesaving management in cardiac arrest.[36,37] This is especially pertinent in that CPRIC presents more commonly in the most viable of patients. Patients who will benefit most from CPRIC treatment algorithms have the highest chances of survival. Lack of consensus guidelines could indicate a large cohort of these patients are going untreated, decreasing their own survival rates.[37] Contrary to this issue are patients receiving treatment and the potential negative effects this can have on overall outcomes. The lack of consensus guidelines has directly produced significantly varied prehospital

CPRIC guidelines, the majority of which treat with Midazolam. Midazolam has negative inotropic properties and there are legitimate questions as to the potentially damaging outcomes from Midazolam, its perfusion altering properties and the negative association it shares with hospital discharge rates.[3,38] A consensus guideline would help alleviate the disparity around management and non-management of CPRIC.

CPRIC is increasing in occurrence.[1,3,37] Prehospital systems around the world continue to strive for more efficient ways to manage cardiac arrest. This results in higher quality CPR, improved prehospital services and earlier implementation of the chain of survival. It is theorised that CPRIC is being encountered more often because of these factors.[3,4] Clinicians are becoming more aware of this phenomenon as they encounter it in the field.[5,14] Increasing incidence is leading to an increase in articles being published and guidelines being written. We found 16 of the 24 guidelines (67%) were published since 2020. We can only see this want for guidelines improving and thus more disparity in the management of CPRIC and all the issues that are associated with this.

Limitations

Our scoping review has some limitations. A vast majority of prehospital service guidelines are not for public consumption. As such we were only able to present guidelines that were available for public consumption. The vast remainder of international prehospital guidelines which were unavailable may have altered the results data significantly. Our review did not explicitly explore the reason behind the differences in the individual guidelines, which future research could investigate further.

Conclusions

Prehospital guidelines containing CPRIC management are exceptionally uncommon. Those that do exist vary substantially. This paucity of guidelines, coupled with the substantial variation in management procedures, only serves to continue CPRIC's relatively unknown status surrounding both knowledge of, and effect treatment has on cardiac arrest outcomes. The complexity CPRIC generates at prehospital scenes both physically and mentally deserves consensus management statements. We recommend future research be focused on development of a consensus management statement and consideration to improved reporting systems to better understand the effects presentation and treatment have on cardiac arrest outcomes.

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CRediT authorship contribution statement

Jack Howard: Conceptualization, Writing – original draft, Methodology, Investigation. **Carlos Lipscombe:** Writing – review & editing, Investigation. **Bronwyn Beovich:** Writing – review & editing. **Matthew Shepherd:** Writing – review & editing, Investigation. **Eystein Grusd:** Writing – review & editing. **Nikiah G. Nudell:** Writing – review & editing. **Don Rice:** Writing – review & editing. **Alexander Olaussen:** Conceptualization, Supervision, Writing – review & editing, Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary material to this article can be found online at https://doi.org/10.1016/j.resplu.2022.100335.

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