Resuscitation 169 (2021) 39–40

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Letter to the Editor

In-hospital cardiac arrest characteristics, CPR quality, and outcomes in children with COVID-19

To the Editor,

Adult patients with SARS-CoV-2 (COVID-19) and in-hospital cardiac arrest (IHCA) demonstrated low survival rates.[1–6] Moreover, donning of PPE led to concerns about cardiopulmonary resuscitation (CPR) quality being inadequate and speculation whether CPR of COVID-19+ patients was futile.[7,8] Little is known about COVID-19+ IHCA in children. We present the first report describing a cohort of pediatric patients with acute COVID-19 suffering an IHCA.

We reviewed the PediRES-Q database (March 1st 2020 - April 1st 2021) for index pediatric (<18 years) IHCA events including patient and event characteristics, CPR quality (Zoll R-series electrodes) and outcomes. We categorized patients as COVID-19+ if having a positive polymerase chain reaction (PCR) test during admission and Patient Under Investigation (PUI) if isolated for suspected COVID-19 during CPR without a positive PCR test. Other patients (non-COVID-19/non-PUI) were the reference group. No multisystem inflammatory syndrome (MIS-C) patients were included in the COVID-19+ group. We analyzed associations between COVID-19 status and survival using multivariate logistic regression with mixed effects, accounting for clustering by site and age group as a confounding variable (<1 year, 1–8 years, >8 to <18 years).

We identified 376 pediatric IHCAs: 14 COVID-19+, 14 PUI, and 348 non-COVID-19/non-PUI (reference). COVID-19+ and PUI patients were older and more frequently had an invasive airway when compared to other patients (Supplementum 1). No notable differences in CPR quality existed between COVID-19+, PUI, and reference group patients (Table 1). Rates of ROSC were lower for COVID-19+ and PUI patients compared to the reference group whereas survival to hospital discharge and survival with favorable neurological outcome trended lower with longer median CPR duration, although not statistically significant (Table 1). Zero COVID-19+ patients achieved return of circulation with extracorporeal CPR (E-CPR) as compared to 1 PUI (7%), and 38 (10.5%) reference group patients. A sensitivity analysis comparing COVID-19+ and PUI patients combined to non-COVID/non-PUI patients showed results comparable to the primary analysis (Supplementum 2).

This is the first report on CPR quality, duration, and outcomes of pediatric COVID-19+ cardiac arrest patients. Almost 29% of COVID-19+ children survived to hospital discharge, considerably better than previously reported adult COVID-19+ IHCA outcomes[2–6] but worse when compared to the reference group (after adjustment for age and clustering by site). However, no reported differences in time to initiation of chest compressions or CPR quality existed between groups. Extensive efforts to resuscitate COVID-19+ patients were noted, with a median total CPR duration of 19 minutes, and median CPR duration for non-survivors of 34 minutes. These resuscitative efforts are notable considering the initial discouraging outcomes reported for COVID-19 + adults who had considerably shorter CPR durations.[1–2,4]

Limitations include: The number of COVID-19+ patients was small, data from a CPR quality improvement collaborative may not be generalizable, and we were unable to account for MIS-C.

In conclusion, substantial resuscitative efforts and comparable CPR quality for COVID-19+ patients and non-COVID-19 patients were identified. A survival rate of almost 29% for COVID-19+ patients, while lower than non-COVID-19 patients, suggests that CPR of children with COVID-19 is far from futile.

Collaborators

The following collaborators have contributed to this research: Todd Sweberg, MD, MBA; Sarah Haskell, DO; Robert M. Sutton, MD, MSCE; Dana Niles, MS; Sophie Skellett, MD; Jordan Duval-Arnould, MPH, DrPH; Gabriella Bottari, MD; Vinay Nadkarni, MD, MS. A full list of all pediRES-Q collaborators are listed in Supplementum 3.

Acknowledgement

We would like to thank the clinicians and staff at all of the pediRES-Q sites for their time and dedication to this collaborative effort.

Funding

The pediRES-Q is supported by an unrestricted grant to the Children's Hospital of Philadelphia from Zoll Medical. The sponsor had no role in designing or executing the study or in the interpretation, writing, or submission of the manuscript.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resuscitation.2021.10.013.

Table 1 – IHCA Event Characteristics, CPR quality, and Outcomes.

	Other (Non-COVID-19/Non-PUI) (n = 348)	COVID-19+ (n = 14)	PUI (n = 14)
Time to first chest compression (min)	0 [0; 0]	0 [0; 0]	0 [0; 0]
Time to first epinephrine dose (min)	2 [0; 3]	2 [0; 3]	2 [0; 2.5]
Chest compression rate (CC/min)*	112 [109; 118]	115 [111; 119]	114 [104; 126]
Compressions within target depth (%)*	7 [0; 29]	32 [8; 43]	27 [2; 64]
Chest compression fraction*	89 [82; 95]	92 [90; 93]	89 [80; 93]
Median CPR duration (survivors and non-survivors)	10 [4; 33]	19 [5; 33]	23 [14; 32]
Median CPR duration (non-survivors only)	35 [20; 55]	34 [24; 34]	25 [20; 34]
ROSC	79.0%	57.1%	42.9%
- ROSC without E-CPR	68.5%	42.9%	35.9%
- ROC with E-CPR	10.5%	0%	7%
Survival to hospital discharge	45.0%	28.6%	21.4%
Favorable neurological outcome	38.8%	21.4%	21.4%
Association with ROSC	Reference	0.48 (0.24–0.98)	0.27 (0.13–0.56)
Association with survival to hospital discharge	Reference	0.63 (0.25–1.57)	0.45 (0.14–1.46)
Association with favorable neurological outcome	Reference	0.62 (0.24–1.61)	0.57 (0.17–1.89)

IHCA event characteristics, CPR quality, and outcomes comparing three cohorts: (1) Non-COVID-19/non-PUI, (2) COVID-19+ patients, and (3) patients under investigation (PUI). Dichotomous outcomes are presented as percent and age is reported as median [quartile 1; quartile 3]. Chest compression rate is reported as chest compressions/ minute. Associations for survival outcomes are reported as adjusted odds ratios with 95% confidence intervals. *Chest compression quality metrics obtained for 173 non-COVID-19/non-PUI patients, 6 COVID-19+ patients, and 10 PUI patients.

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Received 20 September 2021
Received in revised form
5 October 2021
Accepted 6 October 2021

https://doi.org/10.1016/j.resuscitation.2021.10.013