



# Perioperative pediatric cardiac arrest: etiology, treatment, and outcomes

Andrew Renuart MD, MSc<sup>1</sup>, Elizabeth Laverriere MD, MPH<sup>1</sup>, Elizabeth Elliott MD<sup>1</sup>, Matthew Kirschen MD, PhD<sup>1</sup>, Vinay Nadkarni MD<sup>1</sup>, Robert Berg MD<sup>1</sup>, Robert Sutton MD<sup>1</sup>, Jorge Galvez MD, MBI<sup>1</sup>

Department of Anesthesiology and Critical Care Medicine<sup>1</sup>  
Perelman School of Medicine, The University of Pennsylvania and The Children's Hospital Of Philadelphia - Philadelphia, PA



## Objectives:

- Describe the incidence of perioperative cardiac arrest among patients under the care of the general anesthesia service at an academic quaternary medical center.
- Detail the duration and etiology of cardiac arrests and associations with neuro-functional outcomes

## Abstract

- INTRODUCTION:** Perioperative cardiac arrest (CA) remains one of the most feared complications of anesthesia for children. The incidence and etiology of cardiac arrest associated with anesthesia and surgical care have been well described.<sup>1,2</sup> However, details about the duration of arrest, post-arrest disposition, and outcomes have not been well detailed. We conducted a retrospective study of pediatric CA focusing on survival and neuro-functional outcomes.
- METHODS:** The study was approved by the institutional review board. We included all patients ≤ 18 years of age who had CA, defined as a patient receiving chest compressions of any duration between January 24, 2015, and March 31, 2020. Patients were identified via the following institutional databases: Anesthesia quality improvement, post-cardiac arrest registry, and the electronic health record. We retrieved demographic information, duration of CA, postoperative disposition, pediatric cerebral performance category (PCPC) score, and death within 30 days of procedure. CA was classified as anesthesia or non-anesthesia related by two investigators (AR, EL).
- RESULTS:** A total of 189,707 anesthetics were administered during the study period, of which 173,830 (92%) were under the care of the general anesthesia service. The overall incidence of CA was 5.2 per 10,000. The incidence of perioperative CA for the general anesthesia service was 3.6 per 10,000. The incidence of perioperative CA attributable to anesthesia was 2.6 per 10,000. The highest proportion of anesthesia-related CA occurred in the 6-11 month old age group (55%) (Table 1). None of the patients who suffered an anesthesia-related CA had a change from pre-operative neurologic baseline based on the PCPC score. There were a total of 22 deaths. Six deaths occurred in patients suffering anesthesia-related CA.
- DISCUSSION:** We report perioperative CA in patients ≤ 18 years of age over a five-year period at our institution. We observed that patients experiencing CA by factors attributable to anesthesia have favorable outcomes regardless of the duration of the arrest.
- CONCLUSIONS:** We present a cohort of children receiving cardiopulmonary resuscitation for CA with post-arrest outcomes. This report provides additional information to guide future research in pediatric perioperative resuscitation.

## Introduction

- Perioperative cardiac arrest (CA) remains one of the most feared complications of anesthesia for children.
- Incidence and etiology of cardiac arrest associated with anesthesia and surgical care has been well described.<sup>1,2</sup>
- Details about the duration of arrest, post-arrest disposition, and outcomes have not been well detailed.
- We conducted a retrospective study of pediatric CA focusing on survival and neuro-functional outcomes.

Table 1. Distribution of perioperative cardiac arrest by age, duration of arrest, neurologic outcomes

	Favorable Neurologic Outcomes				Unfavorable Neurologic Outcomes			
	ARCA	Non-ARCA	Unknown	Total	ARCA	Non-ARCA	Unknown	Total
<b>Total</b>	36	9	3	48	0	6	0	6
<b>Age</b>								
< 1 month	2	0	0	2	0	0	0	0
1-5 months	8	1	2	11	0	1	0	1
6-11 months	23	4	0	27	0	1	0	1
12mo - 5 yr	3	3	1	7	0	4	0	4
5y-18y	0	1	0	1	0	0	0	0
<b>CPR Duration</b>								
< 30 sec	12	1	0	13	0	0	0	0
30 sec to < 60 sec	10	1	2	13	0	0	0	0
1 min to < 3 min	8	4	1	13	0	2	0	2
> 3 minutes	6	3	0	9	0	4	0	4

## Methods

- We included all patients ≤ 18 years of age who had CA, defined as a patient receiving chest compressions of any duration between January 24, 2015, and March 31, 2020.
- Patients were identified via the following institutional databases: Anesthesia quality improvement, post-cardiac arrest registry, and the electronic health record.
- We retrieved demographic information, duration of CA, postoperative disposition, pediatric cerebral performance category (PCPC) score, and death within 30 days of procedure.
- CA was classified as anesthesia or non-anesthesia related by two investigators (AR, EL).

## Results

- A total of 189,707 anesthetics were administered during the study period, of which 173,830 (92%) were under the care of the general anesthesia service.
- The overall incidence of CA was 5.2 per 10,000.
- Incidence of perioperative CA for the general anesthesia service was 3.6 per 10,000.
- Incidence of perioperative CA attributable to anesthesia was 2.6 per 10,000.
- The highest proportion of anesthesia-related CA occurred in the 6-11 month old age group (55%) (Table 1).
- None of the patients who suffered an anesthesia-related CA had a change from pre-operative neurologic baseline based on the PCPC score.
- There were a total of 22 deaths. Six deaths occurred in patients suffering anesthesia-related CA.

## Discussion

- We report perioperative CA in patients ≤ 18 years of age over a five-year period at our institution.
- We observed that patients experiencing CA by factors attributable to anesthesia have favorable outcomes regardless of the duration of the arrest.

## Conclusions

- We present a cohort of children receiving cardiopulmonary resuscitation for CA with post-arrest outcomes.
- This report provides additional information to guide future research in pediatric perioperative resuscitation.

## References

- Christensen. Pediatric Perioperative Cardiac Arrest, Death in the Off Hours: A Report From Wake Up Safe, The Pediatric Quality Improvement Initiative. A&A 2018.
- Bhananker. Anesthesia-related cardiac arrest in children: update from the Pediatric Perioperative Cardiac Arrest Registry. A&A 2007.