Characteristics and Outcomes of Pediatric Perioperative Cardiac Arrest

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BACKGROUND

- Pediatric cardiac arrest (CA) in the perioperative period is a rare but high-risk event
- Prevalence of perioperative CA ranges between 2.9 to 7.4 events in 10,000 anesthetics for children undergoing non-cardiac surgery[1,2]
- Reported survival rates range from 46-92%[1,2]
- Data are challenging due to variations in definitions

OBJECTIVE

Evaluate time trends, risk factors for, and outcomes of perioperative CA in children undergoing non-cardiac surgery in a single quaternary care center.

METHODS

- Retrospective observational cohort study
- Data from Johns Hopkins Children's Center, 2013 - 2023
- Inclusion:
  - Age < 18 years
  - Pulselessness or pulse with inadequate perfusion requiring chest compressions
  - Reported to American Heart Association Get With The Guidelines-Resuscitation Registry
  - CA in the perioperative period, defined as intraoperative or within 24 hours post-anesthesia
- Exclusion criteria:
  - Cardiac surgery
  - Newborns with CA in the delivery suite or obstetric operating room
  - Events in the adult hospital or in transport
- Descriptive statistics were used

RESULTS

Figure 1: Study Diagram

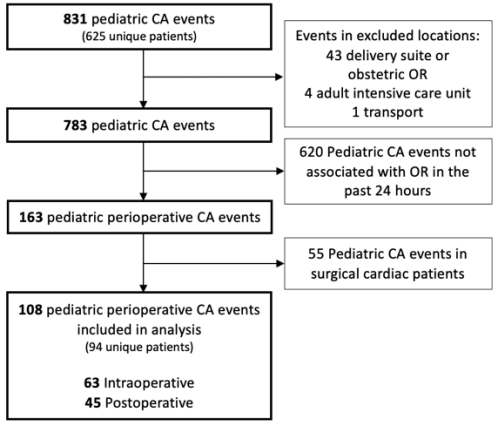
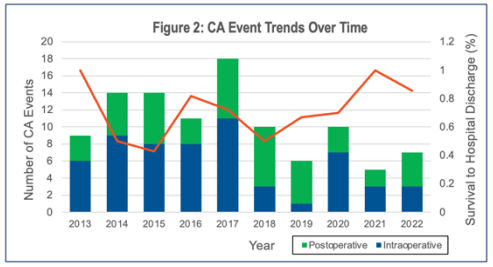


Table 1: Characteristics of Children with Perioperative CA Stratified by Survival to Hospital Discharge (median with interquartile range, or *n* (%))

	All (*n* = 108)	Survivors (*n* = 74)	Nonsurvivors (*n* = 34)	p-value[c]
Age (months)	11.6 (2.9 months to 4.6 years)	11.8 (3 months to 4.8 years)	11.6 (1.9 months to 2.8 years)	0.45
Age Category				
Neonate, <1 month	14 (13)	7 (9)	7 (21)	0.29
Infant, 1 month to <1 yr	41 (38)	30 (41)	11 (32)	
Child, 1-12 yr	41 (38)	27 (36)	14 (41)	
Adolescent, >12 yr	12 (11)	10 (14)	2 (6)	
Weight (kg)	8.5 (3.9 - 16.0)	9.0 (4.0 – 15.9)	8.3 (3.0 - 15.2)	0.40
Male Sex	56 (52)	37 (50)	19 (56)	0.72
ASA Score[a]	3 (3 - 4)	3 (3 - 3)	4 (4 - 5)	<0.001
Emergent procedure	50 (46)	25 (34)	25 (74)	<0.001
Illness Category				
Medical Cardiac	2 (2)	2 (3)	0 (0)	0.01
Medical Noncardiac	18 (17)	12 (16)	6 (18)	
Surgical Noncardiac	75 (69)	56 (76)	19 (56)	
Trauma	13 (12)	4 (5)	9 (26)	
Patient Condition on Initiation				
Pulseless on initiation	46 (43)	23 (31)	23 (68)	<0.001
Progressed to pulseless	13 (12)	9 (12)	4 (12)	
Never pulseless	49 (45)	42 (57)	7 (21)	
Use of ECPR	12 (11)	3 (4)	9 (26)	0.001
Year of Event[b]				
2013 - 2017	66 (61)	44 (59)	22 (65)	0.81
2018 - 2022	38 (35)	27 (36)	11 (32)	

[a]Variable with missing data; medians derived from 103 cases with available data
[b]Data from 2023 not included due to incomplete information
[c]Wilcoxon rank sum test for continuous variables, Chi-square test for categorical variables, Fisher's exact test for categorical variables with small sample size

Figure 2: CA Event Trends Over Time



Event trend over time:
Tau statistic* = -0.43, p-value = 0.10
Survival trend over time:
Tau statistic* = -0.349, p-value = 0.20

Figure 3: Distribution of CA Events by Age

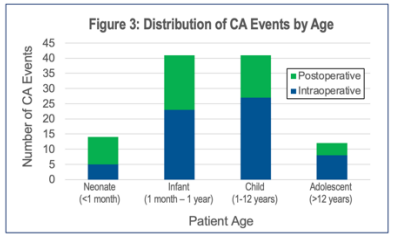


Figure 4: Distribution of CA Events by ASA Score

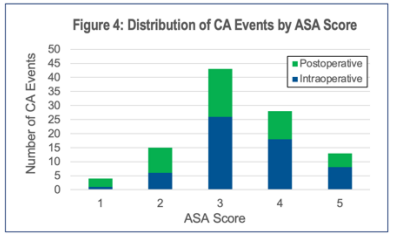


Table 2: Outcomes for Children with Perioperative CA (%)

Overall	
Return of circulation (ROC)	101/108 (94)
Survival to Hospital Discharge	74/108 (69)
Extracorporeal Cardiopulmonary Resuscitation (ECPR)	
ECPR event survival	9/12 (75)
ECPR survival to hospital discharge	3/12 (25)
Discharge destination	
Home	37/74 (50)
Acute care facility	8/74 (11)
Other healthcare facility	27/74 (36)
Continued inpatient	1/74 (1)
Hospice	1/74 (1)

CONCLUSIONS

- Although perioperative CA occurs in only a small percentage of anesthetics performed, it accounts for 13% of all CA events in this academic hospital
- 51% of all events occurred in children younger than 1 year, consistent with previously described risk factors
- 60% of cases were ASA 3 or lower and 54% of cases were non-emergent – this may represent a pool of patients who have time for optimization prior to surgery
- Although CA event mortality was only 6%, hospital mortality was much higher at 31%

LIMITATIONS

- Small sample size
- Single quaternary pediatric center –more complex patients and more specialized providers
- Potentially missing cases of brief arrests that did not get reported to the GWTG-R registry
- Missing data elements due to transition between electronic health record systems

FUTURE PLANS

- Further detailing of neurologic outcomes and ECPR cannulations
- Obtain data from monitors to analyze hemodynamics and interventions peri-arrest
- Analyze multicenter registry data to determine if these trends are also demonstrated nationally

References
1. Smith's Anesthesia for Infants and Children. In: Davis PJ, Cladis FP, editors. 10th Edition ed. Philadelphia, PA: Elsevier Inc; 2022. p. 1365-412.
2. Flick RP, Sprung J, Harrison TE, Gleich SJ, Schroeder DR, Hanson AC, Buenvenida SL, Warner DO. Perioperative cardiac arrests in children between 1988 and 2005 at a tertiary referral center: a study of 92,881 patients. Anesthesiology. 2007 Feb;106(2):226-37; quiz 413-4. doi: 10.1097/00000542-200702000-00009.