

Predictors of cardio pulmonary resuscitation outcome in postoperative cardiac children

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Background: Outcomes of cardiopulmonary resuscitation (CPR) in children with congenital heart disease have improved and many children have survived after an in-hospital cardiac arrest.

Aim: The purpose of this study is to determine predictors of poor outcome after CPR in critical children undergoing cardiac surgery.

Methods: We conducted a retrospective chart review and data analysis of all CPR records and charts of all postoperative cardiac children who had a cardiac arrest and required resuscitation from 2011 until 2015. Demographic, pre-operative, and postoperative data were reviewed and analyzed.

Results: During the study period, 18 postoperative pediatric cardiac patients had CPR. Nine of them had return of spontaneous circulation and survived (50%). On average CPR was required on the 3rd postoperative day. Univariate analysis demonstrated that poor outcome was associated with higher lactic acid measured 4–6 hours prior to arrest ($p = 0.045$; $p = 0.02$) coupled with higher heart rate ($p = 0.031$), lower O₂ saturation ($p = 0.01$), and lower core body temperature ($p = 0.019$) recorded 6 hours before arrest. Nonsurvival required longer resuscitation duration and more epinephrine doses ($p < 0.05$).

Conclusion: Higher heart rate, lower core body temperature, lower O₂ saturation, and higher lactic acid measured 6 hours before arrest are possible predictors of poorer outcome and mortality following CPR in postoperative cardiac children.

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Table 1. Cardiac diagnosis and surgical repair of patients having a cardio-pulmonary arrest.

Diagnosis	No.	Procedure	Outcome	
			Survived	Deceased
Atrioventricular defect	2	PA banding	2	–
Atrioventricular defect	2	Total repair	2	1
Ventriculoseptal defect	1	VSD closure	1	–
Ventriculoseptal defect VSD	1	PA banding	1	–
VSD, PDA, pulmonary hypertension	1	PA Banding and PDA ligation	–	1
Double inlet left ventricle	2	Glenn shunt	2	–
Coarctation of aorta	1	Coarctation repair	1	–
Tetralogy of fallot	4	Tetralogy of Fallot repair	–	4
Pulmonary atresia	3	Modified Blalock taussig shunt	–	3
Total no. of cases	18		9	9

PA = pulmonary artery; PDA = patent ductus arteriosus; VSD = ventricular septal defect.

Table 2. Summary of demographics data in the survivor group and nonsurvivor group.

Variable	Survivors	Nonsurvivors	p
Age (mo)	11.6 ± 4.2	9.27 ± 3.01	0.55
Weight (kg)	6.19 ± 0.89	6.09 ± 0.65	0.92
Presence of associated syndrome	4	2	1
Persistent pulmonary hypertension	3	2	1
Univentricular repair	2	3	1
Rachs (surgical risk category score)	2.4 ± 0.24	2.6 ± 0.18	0.54
CPB time	93 ± 7.04	117 ± 12.85	0.12
Maximum inotropic score	8.6 ± 2.63	23 ± 8	0.2

CBP = cardiopulmonary bypass.

Introduction

Cardiac arrests occur in 0.7–3% of pediatric hospital admissions and 1.8–5.5% of pediatric intensive care unit admissions [1], representing significant social, familial, and economic burden. Survival rates after in-hospital cardiac arrests improved from 9% in 1986 to 35–40.2% in 2012 and 2013 [2,4]. Children undergoing cardiac surgery are at greater risk of experiencing a cardiac arrest [1]. According to European Resuscitation Council Guidelines for Resuscitation incidence of cardiac arrest after cardiac surgery in children is 4% [3]. Early prediction, prevention, and proper management of cardio-pulmonary arrest are fundamentally important to avoid cardiopulmonary arrest and to improve outcome after cardiopulmonary resuscitation (CPR). The aim of this retrospective study was to determine influence of different pre-arrest variables on the outcome of CPR in postoperative cardiac children.

Materials and methods

We conducted a retrospective review of the medical charts of all children who needed CPR in the pediatric cardiac surgical intensive care unit in Prince Sultan Cardiac Center, Qassim, Saudi

Arabia over a 4-year period extending from April 2011 until April 2015. Institutional approval was obtained for this retrospective study. Patients were divided into two groups. The survivor group includes patients who responded to CPR with return of spontaneous circulation (ROSC) and survived until hospital discharge. The nonsurvivor group includes patients who failed to survive after arrest or had transitional ROSC but subsequently deceased during the same hospital admission and before discharge. Medical charts including patient's chart, operative reports, and the laboratory database were reviewed. Pre-arrest and resuscitation records were reviewed for the following variables: age of patient, weight, cardiac diagnosis and type of repair, Rasch score for surgical risk category, presence of univentricular or biventricular heart physiology, bypass time, cross clamp time, and highest inotropes score postoperatively. Laboratory results that include serum lactate level, pH, PaO₂, base deficit, HCO₃, white blood cell counts, hemoglobin, platelet count, international normalized ratio, and creatinine at 6 hours, 4 hours, and 2 hours prior to arrest and immediately pre-arrest were also reviewed. Physiological parameters such as heart rate (HR), systolic blood pressure, mean blood pressure, oxygen saturation, central venous

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