

## **Prognostic Outcomes for Children Undergoing Cardiac Surgery and Assessment of General Complications**

**Dr. AHMED A SAEED ALHASSO**

M.B.Ch.B., F.I.B.M.S. (CTS) DIU

Iraqi Ministry of Health, Baghdad Medical office Al-Karkh, Ibn Al-Bitar Specialized Center for  
Cardiac Surgery, Baghdad, Iraq  
ahmedhasso16@yahoo.com

**NADIA AHMED SUAAD ALFAEZ**

Department of Anesthesia Techniques, Technical College of Health and Medical Sciences, Al-  
Hadba University, Mosul, Iraq.  
nadia.ahmed@hu.edu.iq

**Dr. Hassanain Mohammed Ibraheem**

M.B.Ch.B., F.I.C.M.S. \ (Cardiovascular and Thoracic Surgery)

Iraqi Ministry of Health, Karbala Medical Office, Karbala Heart Center,  
Cardiac Surgical Department, Karbala, Iraq.  
hassanainalogla@gmail.com

**Dr. Yasir Qays Majeed**

M.B.Ch.B., F.I.C.M.S. \ (Cardiovascular and Thoracic Surgery)

Iraqi Ministry of Health, Karbala Health Institute, Al-Hussein Teaching Medical City, Karbala  
Heart Center, Cardiac Surgical Department, Karbala, Iraq.  
Yassirqays@gmail.com

**Abstract: Background:** To improve care, it is crucial to evaluate results and identify indicators that predict serious complications in children having heart surgery. This article aims to evaluate the general health of children who underwent to cardiac surgery as well as post-operative complications.

**Methods:** A study was conducted in Baghdad, Iraq, between January 2023 and October 2024, in which 87 children who underwent cardiac surgery were recruited. The study documented the pathological outcomes of children during and after surgery, including morbidity, mortality, and complications. Furthermore, a questionnaire was administered to assess the general health-related quality of life of the children.

**Results:** A total of 87 children who underwent cardiac surgery were included in this study. The age of the subjects ranged from 7 to 10 years, with 37.93% of the male and 45.98% of the female. Intraoperative outcomes included cardiopulmonary bypass time ( $92.51 \pm 25.33$  minutes), intensive care unit admission ( $34.13 \pm 11.19$ ), and ventilator use (13 cases). Death occurred in 13.79% of cases. Postoperative complications included seizure (5.75%), wound infection

(3.45%), and pleural effusion (3.45%), with a total of 31.03% of cases experiencing complications.

**Conclusion:** The present study revealed that approximately 13% of children had succumbed, while 31% of children exhibited complications. Despite this, cardiopulmonary bypass was identified as an ideal and effective procedure, with subsequent factors having a detrimental impact on children's physical and social well-being.

**Keywords:** Congenital heart disease; Cardiac surgery; Morbidity and Mortality; Postoperative complications.

## INTRODUCTION

Congenital heart diseases (CHDs) are developmental abnormalities affecting the structures of the heart and are characterised by the presence of congenital anomalies [1,2]. These anomalies are the most prevalent congenital anomalies and are present at birth, though they can be discovered later in life [3,4,5,6,7]. Out of every three deaths due to congenital anomalies, one is due to cardiac anomalies [8]. Consequently, there has been progress in the Latin American and Caribbean regions in the implementation of screening programs for cardiac abnormalities, as well as the introduction of policies that facilitate the provision of timely care for children afflicted by these abnormalities. [9,10,11,12,13,14]

The mortality and morbidity rates of this population with this pathology constitute a significant health problem, thus necessitating additional scientific and organisational efforts directed towards enhancing care and prognosis, thereby facilitating successful outcomes [15,16]. While surgery remains the prevailing option for addressing this condition, it is not immune to the potential complications that may arise during the postoperative period. [17]

## PATIENTS AND METHODS

Between January 2023 and October 2024, a cross-sectional study was conducted within the cardiac intensive care unit (CICU) of hospitals in Baghdad, Iraq. We involved children who had congenital as well as acquired heart conditions that hospitalized to the intensive care unit (CICU) after heart surgery. To detect the existence of problems following heart surgery, all kids who participated were tracked every day at the time of the procedure until they were released or passed away. The criteria of the Mult societal Database Committee in Pediatric, along with congenital heart diseases, were used to determine complications. There were factors related to the emergence of serious problems.

Major issues, including death, multiorgan failure, cardiac arrest, and the necessity for an emergency chest opening, were recorded using a standardized form. Furthermore, we investigated the patients' baseline characteristics, clinical signs and symptoms, the results of heart surgery, and potential signs of significant complications following surgery. The usage of at least two medication classes in high dosages ( $\geq 10$  mcg/kg/min for dopamine or dobutamine and epinephrine or norepinephrine at least 0.1 mcg/kg/min, as well as milrinone a minimum of 0.5 mcg/kg/min) was considered a high inotropic drug requirement.

Our key outcomes were 30-day death and in-hospital mortality, along with the frequency of complications, especially serious complications following heart surgery. Death that took place outside of a hospital and within 30 days following heart surgery was described as a 30-day mortality. A variation from the anticipated result in heart surgery was referred to as a complication. In addition, we investigated additional factors that may predict the emergence of major issues after pediatric heart surgery in Iraqi children.

## RESULTS

**TABLE 1.** IDENTIFY DEMOGRAPHIC FEATURES OF CHILDREN OBSERVED IN THIS STUDY.

	Variables	Children, 87	%
Age			
1 – 3		24	27.59%
4 – 6		30	34.48%
7 – 10		33	37.93%
Kids			
Boys		40	45.98%
Girls		47	54.02%
Nutritional state			
Normal		32	36.78%
Un - normal		55	63.22%
BMI, Kg/m2			
Underweight		14	16.09%
Normal		29	33.33%
Overweight		44	50.57%
Thrive State of Kids			
Successful		64	73.56%
Failure		23	26.44%
Parents state			
Marital status			
Married		57	65.52%
Divorced		30	34.48%
Economic state			
Low, < 400		43	49.43%
Moderate, 400 – 700		24	27.59%
High > 700		20	22.99%

**TABLE 2.** DIAGNOSTIC DATA OF CHILDREN.

Parameters	Children, 87	%
Ventricular septal defect	25	28.74%
Tetralogy of Fallot	22	25.29%
Atrial septal defect	14	16.09%
Mitral stenosis	6	6.90%
Double outlet right ventricular	5	5.75%
Single ventricle	4	4.60%
Atrioventricular septal defect	4	4.60%
Ductus arteriosus	3	3.45%
Tricuspid atresia	1	1.15%
Ebstein's anomaly	2	2.30%
Mitral atresia	1	1.15%

**TABLE 3.** CHILDREN CARDIAC OPERATION.

	Variables	Children, 87	%
Use of cardiopulmonary bypass, n (%)			
Yes		87	100%
Cardiopulmonary bypass time,		92.51 ± 25.33	

minutes			
Intensive care unit, ICU			
	ICU stay, hours	34.13 ± 11.19	
	ICU admission		
	Yes	14	16.09%
	No	73	83.91%
Mechanical ventilation			
	Mechanical ventilation time, hours	22.06 ± 5.20	
Use of ventilator			
	< 8 days	74	85.06%
	≥ 8 days	13	14.94%
Hospital stays			
	< 12	71	81.61%
	≥ 12	16	18.39%
Death status			
	Yes	12	13.79%
	No	75	86.21%

**TABLE 4. POSTOPERATIVE COMPLICATIONS.**

Complications	Children, 87	%
Shock	1	1.15%
Low cardiac output syndrome	2	2.30%
Pericardial effusion	0	0.00%
Pulmonary hypertension	1	1.15%
Bleeding	3	3.45%
Arrhythmia	1	1.15%
Acute respiratory distress syndrome	2	2.30%
Chylothorax	0	0.00%
Pleural effusion	3	3.45%
Pneumonia	2	2.30%
Wound infection	3	3.45%
Sepsis	2	2.30%
Acute renal failure	2	2.30%
Seizure	5	5.75%
<b>Total</b>	<b>27</b>	<b>31.03%</b>

**TABLE 5. PREDICTING OF ADVERSE VARIABLES EFFECT LONG-TERM AFTER PEDIATRIC CARDIAC SURGERY.**

Items	Parameters	No of children, 87	%
<b>- Preoperative</b>			
	Congestive heart failure	70	80.46%
	Cyanotic heart failure	17	19.54%
<b>- Intraoperative</b>			
	CPB time > 110	48	55.17%
	High inotropic support	44	50.57%
<b>- Postoperative</b>			
	Increase of lactate more than 1 hour	79	90.80%

**TABLE 6. MEASURING GENERAL HEALTH QUALITY-LIFE FOR PEDIATRIC AFTER CARDIAC SURGERY.**

Items	PedsQL scores
Physical functioning	57. 25 ± 12.44
Emotional functioning	61.98 ± 8.24
Social functioning	63.18 ± 14.20
School functioning	65.11 ± 4.55

## DISCUSSION

Children undergoing heart surgery showed an in-hospital death rate of 13.79%, as well as comorbidities such as malnutrition at 63.22%. Seizures, pleural effusions, and wound infections had the main causes for mortality in our research. These illnesses were often brought on by delayed surgery due to infants with congenital cardiac disorders appearing later than predicted.

Compared to other published studies [19,20], our patients' incidence of problems was comparatively lower, reaching up to 31%. The findings were consistent with those of prior studies conducted in poor nations. According to the American study, pleural effusion, nosocomial sepsis, and LCOS were the most common post-heart surgery complications.

According to some studies [21,22], preventing the variables that led to the development in LCOS is part of the therapy of children after heart surgery. These include preserving systemic as well as pulmonary vascular resistance, employing vasoactive medications to enhance contractility, and maintaining an appropriate preload.

Sepsis, also known as nosocomial bloodstream infections, is a common postoperative complication that occurred in 16.8% of children following heart surgery, according to the Netherlands research [23]. In low-to-middle-income nations, gram-negative sepsis is common in children who have postoperative bloodstream infections. It is related to substantial morbidity, increased mortality, and the emergence of antibiotic resistance.

After heart surgery, we found variables that predicted the emergence of serious problems. In our study, congenital cardiac disease, a longer duration for CPB, high inotropic, as well as a rise in blood lactate were predictors of the development of significant problems.

According to a lot of studies [24,25,26], children with cyanotic congenital heart disease usually need lengthier surgery and CPB times because of greater surgical difficulty, especially if patients suffer from complex cardiac defects. They may have tissue hypoxemia and severe metabolic acidosis, which may render them more likely to die. Although it can increase awareness to reduce adverse effects, the existence in cyanotic congenital heart disease represents an uncontrollable inherent factor that increases the possibility of serious issues after heart surgery.

## CONCLUSION

31% of children suffered from severe postoperative complications, with a mortality rate of 13.79% in children, where predicated risk factors affect the general health of children, including CPB time > 110, high inotropic support, and an increase of lactate in more than 1 hour.

## REFERENCES

1. Eghtesady P, Brar AK, Hall M. Prioritizing quality improvement in pediatric cardiac surgery. *J Thorac Cardiovasc Surg.* 2013; 145:631–9.
2. Welke KF, Ungerleider RM. Mortality as an outcome parameter for pediatric heart surgery. *ASAIO J.* 2006; 52:552–5.
3. Duke T, Stocker C, Butt W. Monitoring children after cardiac surgery: A minimalist approach might be maximally effective. *Crit Care Resusc.* 2004; 6:306–10.

4. Duke T, Butt W, South M, Karl TR. Early markers of major adverse events in children after cardiac operations. *J Thorac Cardiovasc Surg.* 1997; 114:1042–52.
5. Part IV. The dictionary of definitions of complications associated with the treatment of patients with congenital cardiac disease. *Cardiol Young.* 2008;18(Suppl 2):282–530.
6. Charpie JR, Dekeon MK, Goldberg CS, Mosca RS, Bove EL, Kulik TJ, et al. Serial blood lactate measurements predict early outcomes after neonatal repair or palliation for complex congenital heart disease. *J Thorac Cardiovasc Surg.* 2000; 120:73–80.
7. Gazit AZ, Huddleston CB, Checchia PA, Fehr J, Pezzella AT. Care of the pediatric cardiac surgery patient-Part 1. *Curr Probl Surg.* 2010; 47:185–250.
8. Tefuarani N, Vince J, Hawker R, Sleigh A, Williams G. The medium-to-long-term outcome of Papua New Guinean children after cardiac surgery. *Ann Trop Paediatr.* 2004; 24:65–74.
9. Roodpeyma S, Hekmat M, Dordkhar M, Rafieyan S, Hashemi A. A prospective observational study of paediatric cardiac surgery outcomes in a postoperative intensive care unit in Iran. *J Pak Med Assoc.* 2013; 63:55–9.
10. Leon-Wyss JR, Veshti A, Veras O, Gaitán GA, O'Connell M, Mack RA, et al. Pediatric cardiac surgery: A challenge and outcome analysis of the Guatemala effort. *Semin Thorac Cardiovasc Surg Pediatr Card Surg Annu.* 2009; 12:8–11.
11. Joshi SS, Anthony G, Manasa D, Ashwini T, Jagadeesh AM, Borde DP, et al. Predicting mortality after congenital heart surgeries: Evaluation of the Aristotle and risk adjustment in congenital heart surgery-1 risk prediction scoring systems: A retrospective single center analysis of 1150 patients. *Ann Card Anaesth.* 2014; 17:266–70.
12. Ho TC, Ouyang H, Lu Y, Young AH, Chintala K, Detrano RC, et al. Postprocedural outcomes of rural children undergoing correction of congenital heart lesions in Yunnan Province, China. *Pediatr Cardiol.* 2011; 32:811–4.
13. Tchervenkov CI, Jacobs JP, Bernier PL, Stellin G, Kurosawa H, Mavroudis C, et al. The improvement of care for paediatric and congenital cardiac disease across the world: A challenge for the world society for pediatric and congenital heart surgery. *Cardiol Young.* 2008;18(Suppl 2):63–9.
14. Gauvreau K. Reevaluation of the volume-outcome relationship for pediatric cardiac surgery. *Circulation.* 2007; 115:2599–601.
15. Hasan A, Pozzi M, Hamilton JR. New surgical procedures: Can we minimise the learning curve? *BMJ.* 2000; 320:171–3.
16. Robertie PG, Butterworth JF, 4th, Prielipp RC, Tucker WY, Zaloga GP. Parathyroid hormone responses to marked hypocalcemia in infants and young children undergoing repair of congenital heart disease. *J Am Coll Cardiol.* 1992; 20:672–7.
17. Lou S, Ding F, Long C, Liu J, Zhao J, Feng Z, et al. Effects of peri-operative glucose levels on adverse outcomes in infants receiving open-heart surgery for congenital heart disease with cardiopulmonary bypass. *Perfusion.* 2011; 26:133–9.
18. Ascenzi JA, Kane PL. Update on complications of pediatric cardiac surgery. *Crit Care Nurs Clin North Am.* 2007; 19:361–9, v.
19. Anderson JB, Czosek RJ, Knilans TK, Meganathan K, Heaton P. Postoperative heart block in children with common forms of congenital heart disease: Results from the KID database. *J Cardiovasc Electrophysiol.* 2012; 23:1349–54.
20. Elella RA, Najm HK, Balkhy H, Bullard L, Kabbani MS. Impact of bloodstream infection on the outcome of children undergoing cardiac surgery. *Pediatr Cardiol.* 2010; 31:483–9.

21. Murni IK, MacLaren G, Morrow D, Iyer P, Duke T. Perioperative infections in congenital heart disease. *Cardiol Young*. 2017;27: S14–S21.
22. Gaies MG, Jeffries HE, Niebler RA, Pasquali SK, Donohue JE, Yu S, et al. Vasoactive-inotropic score is associated with outcome after infant cardiac surgery: An analysis from the pediatric cardiac critical care consortium and virtual PICU system registries. *Pediatr Crit Care Med*. 2014; 15:529–37.
23. Nguyen N, Pezzella AT. Pediatric cardiac surgery in low-and middle-income countries or emerging economies: A continuing challenge. *World J Pediatr Congenit Heart Surg*. 2015; 6:274–83.
24. Nguyen N, Leon-Wyss J, Iyer KS, Pezzella AT. Paediatric cardiac surgery in low-income and middle-income countries: A continuing challenge. *Arch Dis Child*. 2015; 100:1156–9.
25. Rao SG. Pediatric cardiac surgery in developing countries. *Pediatr Cardiol*. 2007; 28:144–8.
26. Murni IK, Musa NL. The need for specialized pediatric cardiac critical care training programs in limited resource settings. *Front Pediatr*. 2018; 6:59.