



ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE

GRADUATE STUDY PROGRAM

**DETERMINANTS OF CARDIAC SURGERY OUTCOMES AMONG
CHILDREN WHO UNDERWENT CARDIAC SURGERY AT CARDIAC
CENTERS, ADDIS ABABA ETHIOPIA.**

BY: YOHANNES DESTA

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St. Paul Hospital Millennium Medical College

Graduate Study Program

Determinants Of Cardiac Surgery Outcomes Among Children Who Underwent Cardiac Surgery At Cardiac Centers, Addis Ababa Ethiopia.

By: Yohannes Desta

Advisors: Sr. Altayework Mekonnen (Assistant Professor)

Sr. Tigist Tsegaye (MSc in Cardiovascular Nursing)

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Academic Research Submission Guide

Name of investigator	Yohannes Desta
Full title of the research project	Determinants of cardiac surgery outcomes among children who underwent cardiac surgery at cardiac centers, Addis Ababa Ethiopia, from May2019- October 2022.
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Source of funding	St Paul's Hospital Millennium Medical College
Address of investigator	Tel: 0919489011, 0911766985
	Cell Phone:
	Fax:
	P.O. Box:
	Email: johneyman2000@gmail.com
Name of advisor	Sr. Altayework Mekonnen (Assistant Professor) Sr. Tigist Tsegaye (MSc in Cardiovascular Nursing)

ABSTRACT

Background: Cardiac surgery causes high risk for the development of post-operative complications involving cardiovascular and respiratory system, as well as kidneys and central nervous system. Limitations in human resources and facilities for cardiac surgery and postoperative management in low-to-middle-income countries may have a negative impact on children cardiac surgery outcomes. This specific research is the first study in Ethiopia, will aid in understanding the factors that influence cardiac surgical outcomes at Addis Ababa's cardiac centers.

Objective: To assess the determinants of cardiac surgery outcomes among children who underwent cardiac surgery at Cardiac centers, Addis Ababa, Ethiopia, from May 2019-October 2022.

Method: Institutional based retrospective cross-sectional study design was conducted. Simple random sampling technique was used to select medical records. The collected data was coded and entered into Epi data version 3.1 then exported to SPSS version 25 for descriptive and inferential statistical analysis. Binary logistic regression was done to see significant relation of independent and dependent variables. Adjusted odds ratio at 95% confidence level was estimated to assess the strength of the association and a p value of <0.05 was considered to declare the statistical significance in the logistic regression multivariable analysis.

Result: In this study 413 patients were analyzed which make 97.6% chart completeness. From this 17.4% of them developed poor cardiac outcome. In multivariable logistic regression being Female (AOR: 1.456, CI: (1.12, 2.49)), Age > 5 years (AOR: 0.751, CI: (0.21, 0.91)), cardiac arrest (AOR: 2.06, CI: (1.21, 5.34)), blood loss (AOR: 0.59; CI: (0.12, 0.95)), were significantly associated with poor cardiac surgery outcome.

Conclusion and Recommendation: the magnitude of poor cardiac surgery outcome in this study comparable to a study conducted in Ethiopia. In this study post-operative complication accounts for less morbidity and mortality. Due focus should be given on factors associated with poor cardiac outcome. A careful monitoring and follow-up of patients developed complication like blood loss, cardiac arrest during intra operation since they had high risk of developing poor outcome.

Key words: Pediatrics cardiac surgery; outcome; Determinants; Addis Ababa Ethiopia.

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ABBREVIATIONS AND ACRONYMS

CA: Cardiac Arrest

CBP: Cardiopulmonary Bypass

CHB: Complete Heart Block

CHFE: the Children's Heart Fund of Ethiopia

CI: Confidence Interval

CPR: Cardiopulmonary Resuscitation

DHCA: Deep Hypothermic Circulatory Arrest

ETB: Ethiopian Birr

ICU: Intensive Care Unit

JET: Junctional Ectopic Tachycardia

JR: Junctional Rhythm

LBW: Low Birth Weight

PE: Pulmonary Embolism

PVCS: Premature Ventricular Contractions

PICU: Pediatric Intensive Care Unit

SD: Standard Deviation

SPSS: Statistical Package for the Social Science

SVT: supraventricular Tachycardia

VT-ventricular Tachycardia

1. Introduction

1.1. Background

Children with heart disease often undergo several cardiac surgical procedures at a young age and are at risk for important morbidity and mortality. Cardiac surgery procedure causes high risk for the development of post-operative complications involving cardiovascular and respiratory system, as well as kidneys and central nervous system(1,2).

The onset of continuous changes in age, growth, maturation, development, pre-operative state, and surgical technique, the post-operative period in children requires much closer observation than in adults. The immaturity of the primarily cardiovascular, respiratory, neurological, and renal systems in newborns causes a large number of complications leads to an increase in morbidity and mortality. Children with complex congenital heart diseases who have varying degrees of heart failure, respiratory failure, or shock are at risk of developing multiple concomitant complications. So these patients require more complex surgeries, otherwise the mortality rate is expected to be higher(3). Post-operative cardiovascular, pulmonary and renal complications remain the major cause of morbidity in patients who undergo cardiac surgery(4).

In developing countries, pediatric cardiac surgery is a major challenge. It is difficult to use evolving methods to meet the surgical needs of a large number of children with congenital heart defect while dealing with severe budgetary constraints, securing funding to keep the program running, and maintain quality in the face of constant turnover of trained medical, nursing and other paramedical personnel. Choosing the best procedure to achieve maximum palliation at the lowest possible cost, as well as prioritizing one-stage corrective procedures albeit at a higher risk, necessitates practice changes(5).

Surgical procedures are associated with considerable risk of complications, including infections that can adversely affect patient outcomes and increase health care costs. The most serious general complications are acute low cardiac output, pulmonary hypertension, and diastolic dysfunction, whereas valve dysfunction, residual shunts, or residual obstruction of ventricular outflow tracts are likely after several congenital heart diseases and surgical techniques(3,5).

1.2 statement of the problem

The perioperative management of surgical patients poses challenges. Baseline conditions of the patients, complex surgery and several post-operative complications contribute to a high in-hospital and after-discharge mortality(6). Post-operative complications in pediatric cardiac surgery have been reported inconsistently, but they contribute significantly to mortality, hospital stay, cost, and quality of life after surgery(7–9).

The best-performing heart surgery centers may not report fewer complications, but rather have systems in place to detect and correct complications before they have negative consequences. The ability to predict, prepare for, recognize, and treat similar complications will result in different paths and outcomes(8).

Nowadays, following cardiac surgery the mortality rate as reported by many centers is approximately 6% in children compared with 3% only in adult heart surgery(3). An European study found that the primary survival rate was 56% and the one-year survival rate was 19%. In particular, post-operative complications can involve several organs and have a major effect on in-hospital length of stay and quality of life of the patients after discharge from the hospital(9,10).

According to a study conducted in Saudi Arabia, post-procedural complications were reported in 96 (73.8%) of the procedures performed on children. A study conducted in Ethiopian cardiac center found that 5 (4.4%) of the 114 Patients died within 30 days of the index surgery. Nineteen patients (16.7%) experienced at least one type of post-operative complication. Due to massive pericardial effusion, eight (7.0%) patients developed cardiac tamponade, and all required sub-xiphoid surgical drainage. Four (3.5%) patients required re-exploration surgery due to bleeding(11,12).

Heart surgery in pediatrics improved and advanced significantly in recent years. However, postoperative complications, either general or lesion-specific, should be expected early after surgery. The primary role is to avoid low cardiac output and major organ damage(3).

According to a study conducted in Indonesia, Limitations in human resources and facilities for cardiac surgery and post-operative management in low-to-middle-income countries may have a negative impact on pediatric cardiac surgery outcomes. Major complications are frequently

preceded by a period of insufficient oxygen balance, and identifying the oxygen imbalance in children after cardiac surgery is difficult(2).

In Ethiopia there are not enough surgeons, cardiac centers and study. Many Cardiac Patients arrive to cardiac center at end stage.

As a result, knowing the predictors of major complications is critical for developing a preventive strategy for major complications after cardiac surgery and improving care. To the knowledge of researcher there is no published study in Ethiopia that evaluates the outcome of cardiac surgery and its predictors, so this study aimed to evaluate the outcomes and predictors for major complications in children undergoing cardiac surgery as initial problems at a national referral hospital of cardiac service at Children's heart Fund of Ethiopia and Tazma medical and surgical specialized center which is located at the capital city Addis Ababa.

1.3 Significance of the Study

This research will aid in understanding the factors that associated cardiac surgical outcomes at Addis Ababa's in Children's heart fund of Ethiopia and Tazma medical and surgical specialized center which is located at the capital city Addis Ababa cardiac centers. Because there is no study in this specific topic at Cardiac Centers, the findings of this retrospective study will be used as sources of information, providing surgeons with a better basis for judging and improving their practices, providing patients with the information they need to make informed decisions about their care, evidence for service improvement and quality assurance of operations, and increasing public transparency and accountability.

Furthermore, it is hoped that this study will assist health care policymakers in developing programs to train health care providers, so that they have adequate theoretical and technical preparation to prevent post-operative complications in children undergoing cardiac surgery. Finally, it will serve as a foundation for future research projects on post-operative cardiac surgery complications.

The study's findings benefit researchers interested in the field by providing information on outcome of cardiac surgery in the study area.

2. Literature Review

2.1 Cardiac Surgery Outcomes

A study conducted in Europe suggested that from total 793 children's underwent cardiac surgery Eighty-two children experienced CA (Cardiac arrest) during post-operative care in PICU, mainly from cardiovascular causes. Thirty-four (41%) were declared dead without attempted resuscitation, CPR was initiated in 48 (59%). The primary survival rate was 56% and 1 year survival rate was 19%. The incidence of CA was 3.6% for closed heart operations, 4.9% for intra-cardiac surgery without DHCA, and 27% for operations involving DHCA. Thirty three per cent of patients with CA arrested during the 24 post-operative hour(14).

A retrospective study collected 203 patients followed at the Bambino Gesù children's Hospital of Rome who underwent cardiac surgery; Sepsis also one of post-operation complication occurred in children underwent cardiac surgery. Its prevalence in cardiac surgery patients is estimated around 2.5%, or 20% of all the ICU infections, with an exceptionally high mortality rate, above 65–80%(19). A study conducted in North Carolina suggested that Among pediatric surgery patients, 19% of patients met one definition of malnutrition, 6% met two, 1% met 3, and <0.1% met all 4. After adjustment, requiring nutritional support, stunting were associated with increased odds of post-operative infection while wasting was not(4).

A retrospective cohort of 124 infants and neonates included published bleeding definitions and cumulative chest-tube output over different post-operative period. Excessive bleeding was defines as ≥ 7 ml/kg/hr for ≥ 2 consecutive hours in the first 12 post-operative hours and/or ≥ 84 ml/kg total for the first 24 post-operative hours and/or surgical re-exploration for bleeding in the first 24 post-operative hours. Excessive bleeding was associated with longer length of hospital stay, increase 30 day readmission rate, and increased transfusions in the post-operative period (25).

A study conducted in Brazil suggested that a cardiopulmonary bypass was necessary in 70.3% of surgeries, with duration of use ranging between 25 and 180 minutes, and of those, only 7.6% had pulmonary complications. The median found was 80 minutes. Mechanical ventilation was required in the post-operative in 64.9% of patients, with duration of use ranging between 1 and 362 hours, with a median of 6.6 hours. Of those patients, only 8.3% had pulmonary complications. From the

total 282,046 sample patients, only three (8.1%) had pulmonary complications: one with subcutaneous emphysema, one with pulmonary hemorrhage and one with a pleural effusion, empyema, and atelectasis, whereas the latter two died. Both patients who died showed CPB time above 100 minutes and mechanical ventilation time longer than 24 hours(18).

A study on Complications of Heart Surgery in Children With Congenital Heart Disease at Dena Hospital of Shira suggested that from The overall adverse cardiovascular complications were renal complications (44/3%), lung (40/3%), anemia (35/9%), heart (34/4%), gastrointestinal (17/2%), brain (14/2%), need for re-intubation of the trachea 11/3%), infection (7/8%) required re-operation (5/9%) and vascular complications (1/4%)(15).

On study from Turkey revealed that of the 3849 pediatric cardiac surgery patients were screened, 162 had neurological complications in the early period (the first 10 days after surgery). The incidence was calculated as 4.2%; 69 patients (42.6%) experienced seizures, 17 (10.5%) experienced confusion, 39 (24.1%) had stupor, and 37 (22.8%) had hemiparesis. Of the patients who developed neurological complications, 54 (33.3%) died. Patients with neurological complications were divided into 3 groups: strokes (n = 90), intracranial bleeding (n = 37), and no radiological results (n = 35). Thirty-four patients (37.8%) in the stroke group died, as did 15 (40%) in the bleeding group, and 5 (14.3%) in the no radiological results group(17).

There was a cross-sectional study carried out in Pediatric Department, Faculty of Medicine, Ainshams University, and Cairo, Egypt; in 2017 between March 2013 and March 2014. According to this study all patients had pre-operative sinus rhythm and normal pre-operative magnesium and other electrolyte levels and arrhythmias were found in 15 out of 30 patients. They represented an overall incidence of 50%. Those were grouped as follow: 5 patients (33.33%) with functional ectopic tachycardia (JET), 4 patients (26.67%) with Functional rhythm (JR), 2 patients (13.33%) with complete heart block (CHB), 2 patients (13.33%) with premature ventricular contractions (PVCs), 1patient (6.67%) got attack of ventricular tachycardia (VT) and another one (6.67%) got supraventricular tachycardia (SVT)(15).

A study conducted in Pediatric cardiac surgery patients done in a tertiary hospital in Egypt observed that chest infection is the commonest complication, accounting for 10% of all patients,

followed by heart failure (8%), wound infection (7%), pulmonary hypertension (7%), postoperative bleeding (4%), and arrhythmia (3%). Mortality accounted for 7% in this study(3).

A study conducted in Saudi Arabia suggested that from the overall children post-procedural complications were reported in 96 (73.8%) of the procedures. The most frequent complications were prolonged post-operative mechanical ventilation (27%), pleural effusion (21%), excessive bleeding (19%), cardiac arrest (18%), and systemic infections (18%)(11).

A study conducted in cardiac center of Ethiopia and EL-Ouzier cardiac center, Addis Ababa Ethiopia suggested that out of the total 114 patients, 5 (4.4%) patients died within 30 days following the index surgery. Nineteen (16.7%) patients developed at least one form of post-operative complication. Eight (7.0%) patients developed cardiac tamponade due to massive pericardial effusion and sub-xiphoid surgical drainage was done for all. Four (3.5%) patients had bleeding and required re-exploration surgery. Two (1.8%) patients developed third-degree complete heart block and one of them required permanent pacemaker implantation. Another two patients had a stroke and one of them died due to the stroke. Additional two patients developed surgical site infection and wound exploration was done. One more patient who was a case of mitral valve disease and who underwent valve repair during the current surgery but ended up with failed initial repair and successful re-repair of the valve was done on the fifth day of the first operation(12).

2.2 Determinants of cardiac surgery outcomes

2.2.1 Patient characteristics

A prospective cohort study conducted in Indonesia suggested that ,Predictors of major complications were cyanotic congenital heart disease, having longer duration of cardiopulmonary bypass had more risk to develop complication. Also high inotropes and increase in lactate >0.75 mmol/L/h or more in the first 24 h were predictors for poor outcome in children underwent cardiac surgery(2).

A retrospective study in Italy suggested that weight for height percentiles and fever post-surgery were predictors of pericardial infusion in children underwent cardiac surgery. According to this study the group with moderate/severe PE fever in the 48 h after surgery occurred with a significantly higher incidence compared to the group with mild PE: 57.1% of patients with

moderate/severe PE compared to 16.1% of patients with mild PE. Regarding to weight for height percentiles. The median was 24.2 in patients with mild PE and 89.6 in patients with moderate/severe PE.(20).

Also a study on Epidemiology and Outcomes after In-Hospital Cardiac Arrest after Pediatric Cardiac Surgery conducted in America suggested that Younger age, lower weight, and presence of pre-operative morbidities were associated with cardiac arrest after children cardiac surgery(20).

A study conducted in America Suggested that Gender is also one of risk factor for developing complication in children underwent cardiac surgery. According to study conducted in USA being male were one of significant factor for developing arrhythmia after cardiac surgery (14).

A study conducted in Europe suggested that the following risk factors were associated with increased mortality: age, female gender, serum creatinine, extra-cardiac arteriopathy, chronic airway disease, severe neurological dysfunction, previous cardiac surgery, and recent myocardial infarction(21).

2.2.3 Factors related to facility

2.2.3.1 Waiting time since diagnosis

The impact of time between diagnoses and surgical treatment on post-operative complications is significant. More than 8 hours after diagnosis, surgery has the highest mortality rate, which may be exacerbated by longer intervals since symptom onset. Early diagnosis and treatment, on the other hand, are critical to achieving successful outcomes(22).

2.2.3.2 Duration of surgery

A pooled analysis of a study conducted in Canada found that the likelihood of complications increased significantly with prolonged operative duration, nearly doubling with operative time thresholds of two or more hours. A meta-analysis also revealed a 14% increase in the likelihood of complications for every 30 minutes of extra time(22).

2.2.4 Intra-operative condition

Longer CBP time and greater intra-operative blood product transfusion requirement were both associated with increase mortality, but other intra-operative variables including cannulation strategy, extent of repair, aortic valve intervention, coronary artery bypass grafting and extracorporeal membrane oxygenation requirement were not(22).

2.2.4 Health related variables

Studies have shown that delays or errors in diagnosis continue to persist with relative frequency; one study reported the time between a patient arrival to emergency department and diagnosis was 4hrs, while others reported that delays in diagnosis occur in up to 25% of cases. Two of the most commonly cited pre-operative factors that portend worse prognosis are the presence of MPS and renal dysfunction. Patients with pre-operative renal dysfunction had higher post-operative mortality. Initially hypothesized that more complex and longer operations, such as total arch or root replacement, would be associated with worse outcome. Pre-operative clinical status, rather than operative complexity, is the primary factor affecting post-operative mortality and outcome(22).

2.3 Conceptual frame work

Health related variables

Patient presentation

Presence of co-morbidities

Patient diagnosis

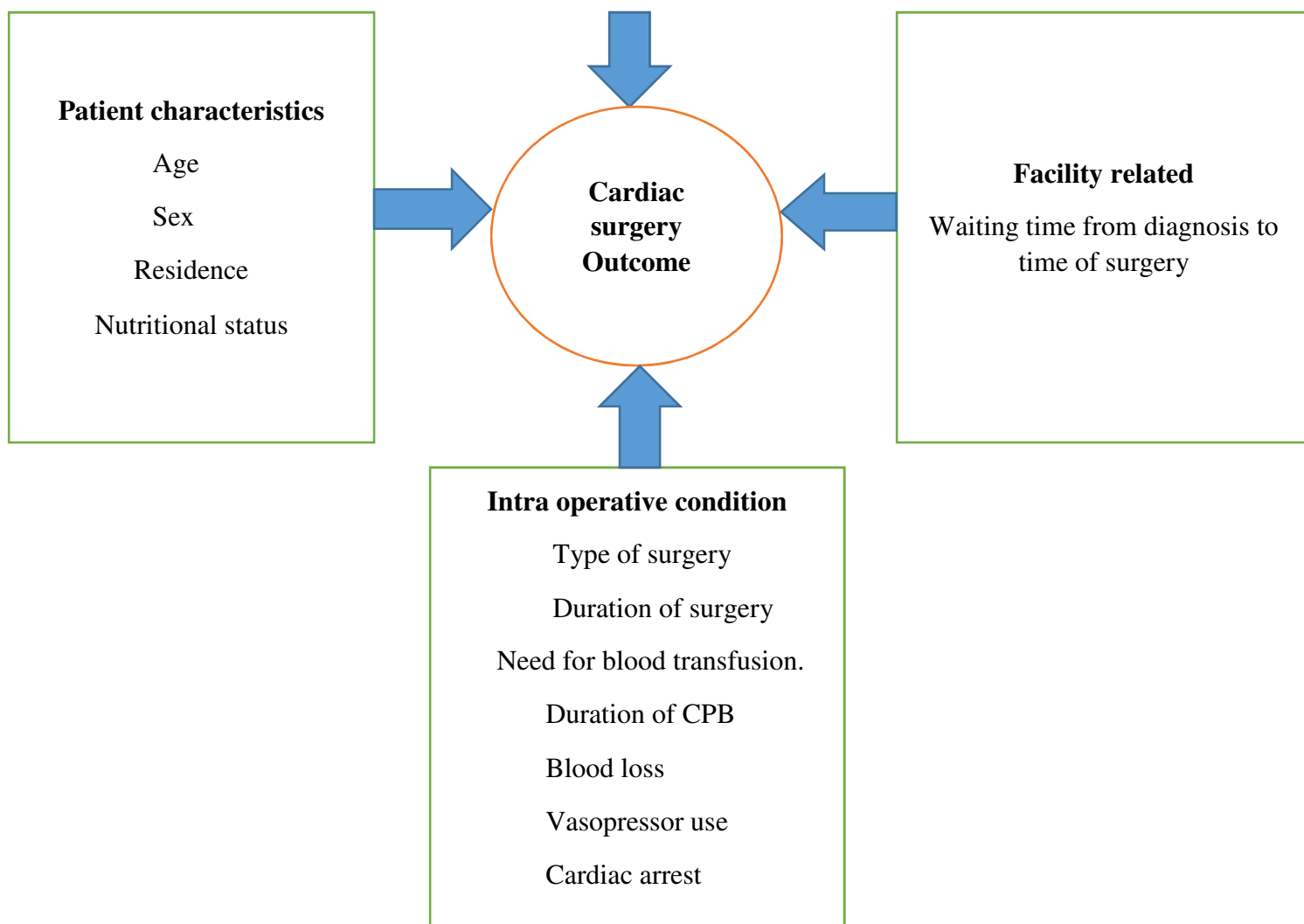


Figure 1: Determinants of cardiac surgery outcome among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia, From May 2019-October 2022 (2, 6, 15, 22).

3. OBJECTIVES

3.1 General objectives

To assess the determinants of cardiac surgery outcomes among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia, From May 2019-October 2022.

3.2 Specific objectives

To assess the cardiac surgery outcomes among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia, From May 2019-October 2022.

To identify factors that determine the outcomes of cardiac surgery among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia, From May 2019-October 2022.

4. METHOD AND MATERIAL

4.1. Study area

The study area of this research was in children's heart fund of Ethiopia and Tazma medical and surgical specialized center which is located at the capital city Addis Ababa. The Children's Heart Fund of Ethiopia was founded in 1989 G.c. by Dr. Belay Abegaz and fellow Ethiopians. Since the establishment, the founders with key donors were able to save more than 9,500 children with free open-heart surgery. It was established in 1989 G.C. as a non-governmental and charitable organization focused on helping children with congenital heart disease being the first organization to provide pediatric open-heart surgery and still the sole provider of the service in Ethiopia. Tazma medical and surgical specialized center is one of cardiac center in Ethiopia which giving surgical intervention for patients. It is established in 2009 by Ethiopian and Swedish doctors.

4.2. Study Period

The study was conducted From May 2019-October 2022.

4.3. Study Design

Institutional based retrospective cross-sectional study design.

4.4. Population

4.4.1. Source Population

All cardiac children underwent surgery at the children's heart fund of Ethiopia and Tazma medical and surgical specialized center, Ethiopia.

4.4.2. Study Population

The study population was randomly selected cardiac children charts who underwent cardiac surgery at Children's heart fund of Ethiopian and Tazma Medical and Surgical specialized center from May, 2019 to October 2022 and whose records were available.

4.5. Eligibility Criteria

4.5.1. Inclusion Criteria

Charts of Children who were operated for cardiac problems.

4.5.2. Exclusion Criteria

Charts of patients excluded from the study: –

- ✓ Patients chart with unclear or Unreadable, Lost and missed chart.
- ✓ Lost follow-up

4.6. Sample size determination and sampling technique

4.6.1 Sample size determination

The sample size was calculated by using single population proportion formula based on the following assumptions: Proportion of outcomes taken as 50% (as far as i know here is no published study in Ethiopia) at significant level $\alpha= 0.05$, 95% confidence interval, Margin of error 5% and 10% for incomplete charts, the sample size was calculated by the following formula:

$$n = \frac{(Z_{\alpha/2})^2 P (1-P)}{d^2}$$
$$= \frac{(1.96)^2 0.5(1-0.5)}{(0.05)^2} = 384$$

Where:

n = the required Sample size

p= Proportion of Outcomes (50% or P=0.5)

Z= the value of the standard normal curve score corresponding to the given confidence interval 1.96.

d = the permissible Margin of error (the required precision) = 5%. By adding 10% for incomplete charts, total of 423 charts was recruited as study units among children underwent cardiac surgery in cardiac centers in Addis Ababa.

4.6.2 Sampling technique

A simple random sampling technique was used for the selection of patient chart. Cardiac patients' follow-up charts and Medical registration book was revised then those who fulfilled the inclusion criteria were listed in each cardiac center. Samples for selected cardiac centers were proportionally allocated by the number of cardiac patients who underwent surgery from May, 2019 to October, 2022. Finally, after recording all eligible clients by their unique numbers then it was extracted through simple random sampling by lottery method in each health facility to take 423 participants. From May, 2019 to October, 2022 528 children's were underwent surgery in cardiac facility (two hundred twenty eight in Tazma medical and surgical specialized center report and 300 in the children's heart fund of Ethiopia).

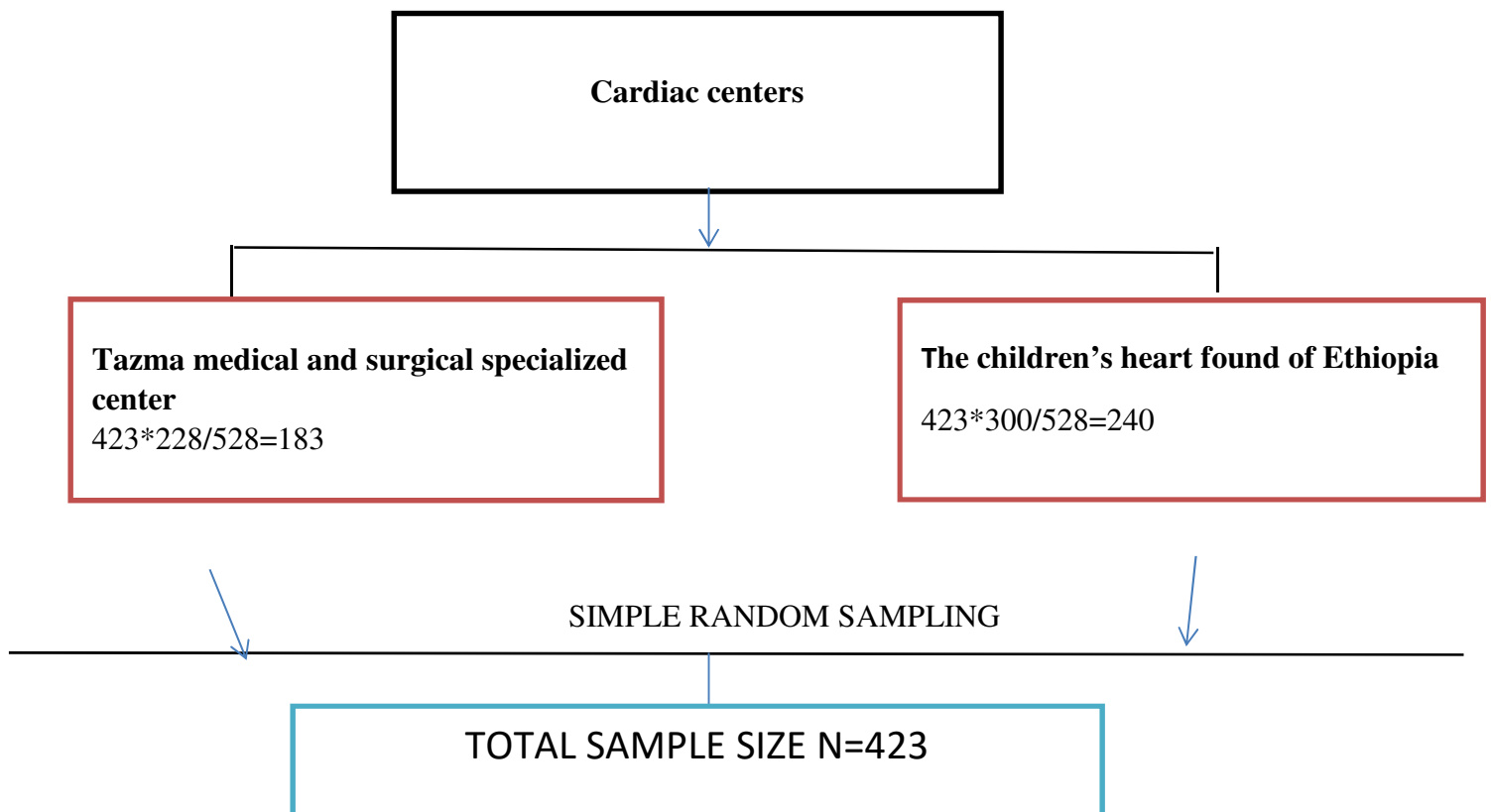


Figure 2: shows a schematic illustration of sample allocation in the two cardiac centers.

4.7. Study Variables

4.7.1. Dependent Variables

Outcome of cardiac surgery

4.7.2. Independent Variables

Socio demographic characteristics

- ✓ Age
- ✓ Sex
- ✓ Residence
- ✓ Nutritional status

Factors related to other determinants and Comorbidities

Intra operative condition

- Type of surgery
- Duration of surgery
- Need for blood transfusion.
- Duration of CPB
- Blood loss
- Vasopressor use
- Cardiac arrest

Facility related

Waiting time from diagnosis to time of surgery

Health related variables

- Patient presentation
- Presence of co-morbidities
- Patient diagnosis
- Pre-operative states

4.8. Operational definitions

Outcome: Early post-operative outcome within 30 days of cardiac surgery. Cardiac surgery is the end consequence of cardiac patients at the end of surgery mentioned on the patient chart. It will be categorized as a good outcome and poor outcome(23).

Good outcome: is considered as good if patients were not developing any complications post-operative and had uneventfully post-operative course(23).

Poor outcome: is considered as poor if any of the following has happened post-operatively: bleeding, surgical site infection, mortality, neurological dysfunction, renal dysfunction, and pulmonary complication(23).

Bleeding: A blood loss $> 1.5\text{ml/kg/hr}$ for six consecutive hours within 24hrs after surgery or in case of re-operation for hemostasis during the first 12 post-operative hours(24).

Surgical site infection: occurs within 30 days after surgery in the surgical incision area, muscle and surrounding tissue that was involved in surgery(23).

Mortality: Early post-operative mortality occurs within 30 days after surgery in the hospital.

Neurological dysfunction: is an impairment of cognitive, motor and sensory function arising after surgical procedure.

Renal dysfunction: a condition characterized by persistent oliguria $< 1\text{ml/kg/hr}$ and elevated serum creatinine level $> 0.3\text{-}0.7\text{mg/dl}$.

Pulmonary complication: is a complication affecting the respiratory system after anesthesia and surgery.

Excessive bleeding: was defines as $\geq 7\text{ ml/kg/hr}$ for ≥ 2 consecutive hours in the first 12 post-operative hours and/or surgical re-exploration for bleeding in the first 24 post-operative hours(25).

4.9. Data collection tools and procedure

A pre-tested tool was used to collect data from patient's medical records. The data collection check list was based on previous research structured questionnaire on similar studies. Data was gathered from cardiac patients who have been registered for the last two years and five months (May, 2019 to October, 2022). This entails going through the logbooks of cardiac patients during the specified time period. Electrocardiogram and vital sign sheet records, as well as pre-operative and ten post-operative physician evaluation notes, were reviewed. Two trained data collectors were collected data for the cardiac and thoracic medical records.

4.10. Data Quality management

The check list was pre-tested (5%) to ensure the quality of the data at El Ouzier cardiac center before actual data collection. Data collectors were trained on how to review charts and extract data, check questionnaires for completeness. The principal investigator was checked and revises questionnaires for completeness and provided necessary feedback to data collectors.

4.11. Data processing and analysis

4.11.1. Quantitative analysis

After data collection, the check list was checked for completeness and data entry was made by the principal investigator. The collected data was entered in to Epi-info 3.1 and exported to Statistical Package for Social Science (SPSS) version 25 for analysis. A logistic regression was used to identify the association of the independent variables on the dependent variable and then multivariate logistic regression was used to control cofounders and statistically significant associations in between variables and descriptive statistics was applied to describe mean and standard deviation (SD). Lastly, Significant of statistical association was assured or tested using 95% confidence interval (CI) and p value (<0.05).

4.12 Ethical consideration

Ethical clearance was assured prior to data collection from Institutional Review Board of SPHMMC. Authorization will be obtained from Human resource managers and Directors of all health facilities. As review of medical charts and other patient records was used, the individual patient was not being subject to harm. To keep confidentiality all collected data was coded and locked in a separate room before entering into the computer and names was not included in the data collection format. At the data entering stage, the computer data was locked by password and the data was disclosed to any person other than the principal investigator. Since the study was carried out by reviewing charts, permission letter was obtained from the responsible body in each health facilities.

4.13 Dissemination of the results

The result of research was disseminated both with hard and soft copy to SPHMMC School of post graduate studies. The research result will disseminate and accessed to others as source of information to do further research and even to critique the findings. It will be provided also to Health Bureau of Addis Ababa administration and cardiac centers on which study will be conducted. The findings may be presented in annual scientific meeting and conferences. Finally, the soft copy will be released on internet to all research consumers and/or may be published in a scientific journal.

CHAPTER FIVE: RESULT

5.1. Socio-demographic characteristics of the study participants

In this study a total of 413 patients charts were investigated which make 97.6% chart completeness. The mean age was 6.48 ± 3.59 years (1 year to 14 years, WHO). And also the majority of participants were found in the age group >5 years 221 (53.5%). From total study participants 239 (57.9%) of the patients were female and 174 (42.1%) were male. In the report 250 (60.5%) were from rural, the rest 163 (39.5%) were from urban area (Table 1).

Table 1: Socio demographic characteristics among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

Variable	Category	Frequency	Percent
Age	<5	192	46.5
	>5	221	53.5
Sex	Female	239	57.9%
	Male	174	42.1%
Residency	Urban	163	39.5%
	Rural	250	60.5%

5.2 Pre-operative characteristics of patients

In this study, most of the patients 387 (93.7) were symptomatic before surgery. Regarding to medical morbidity 149 (36.1) of patients had co-morbidity. Majority of the patients 367 (88.9%) were underwent cardiac surgery for the first time. Minority 46 (11.1%) of them were redoing (Table 2).

The primary diagnosis from this study were Arterial Septal Defect 71 (17.2%), Ventricular Septal Defect 58 (14%), Severe Mitral Regurgitation 54 (13.1%), Double Valve Problem 50 (12.1%), Tetralogy Of Fallot 42 (10.2%), Aortic Stenosis 30 (7.26%), Severe Mitral Stenosis 19 (4.6%), Mitral and tricuspid problem 14 (3.38%), Mitral Regurgitation 13 (3.1%), Triple valve problem 13 (3.1), Severe Aortic Regurgitation 11 (2.6%), Atrioventricular Septal Defect 10 (2.4%), Patent Ductus Arteriosus 9 (2.2), Others 19 (4.6) (Table 3).

Table 2: Pre-operative characteristics among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

Variable	Category	Frequency	Percent
Patient presentation	Symptomatic	387	93.7
	Asymptomatic	26	6.3
Frequency of surgery	1 st time	367	88.9
	Redo	46	11.1
Stunting	Yes	37	9
	No	376	91
Wasting	Yes	154	37.3
	No	259	62.7
Medical comorbidity	Yes	149	36.1
	No	264	63.9
DM	Yes	12	2.9
	No	401	97.1
HTN	Yes	110	26.6
	No	303	73.4

Table 3: Diagnosis of patients / children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

Type of diagnosis	Frequency	Percent
ASD	71	17.2
VSD	58	14
Severe MR	54	13.1
Double valve problem	50	12.1
TOF	42	10.2
Severe AS	30	7.26
Severe MS	19	4.6
Mitral and tricuspid problem	14	3.38
MR	13	3.1

Triple valve problem	13	3.1
Severe AR	11	2.6
AVSD	10	2.4
PDA	9	2.2
Others (Left Atrium myxoma, tricuspid Valve regurgitation, Coronary Artery Disease, TAPVD, Left Ventricular Outflow Tract Obstruction & Cortriatriatum)	19	4.6

5.3: Intra-operation characteristics

In this study among all surgical procedures 383 (92.7 %) were done by local team (Ethiopian) surgeons, the rest 30 (7.3) were by foreign surgeons. The mean CPB duration was 115.35 + 49.36 minute. In the time of surgery 238 (57.6%) of patients had needed blood transfusion (Table 4).

Table 4: Intra-operation characteristics among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

Variable	Category	Frequency	Percent
Need for blood transfusion	Yes	238	57.6
	No	175	42.4
Excessive bleeding	>7mg/kg/hr	383	92.7
	<7mg/kg/hr	30	7.3
Surgeon	Ethiopia	383	92.7
	Foreigner	30	7.3
Blood loss	Yes	57	13.8
	No	356	86.2
Cardiac arrest	Yes	20	4.8
	No	393	95.2

Type of major cardiac surgical procedures

Type of procedures	Frequency	Percent
MV replacement	75	18.2%
ASD closure	73	17.7%
VSD closure	55	13.3%
TOF Repair	40	9.7%
MV repair	39	9.4%
DV replacement	38	9.2
AV replacement	32	7.7%
Triple valve repair	26	6.3%
SAM excision	13	3.1%
Others(Coronary Artery Bypass Graft ,Left Ventricular Outflow Tract Obstruction Relief, Atrioventricular Septal Defect Closure, Conjugated Surgery)	22	5.4%

5.4 Immediate outcomes of patients underwent open heart surgery

In this study, the mean post-operative HCT and post-operative creatinine of patients were $38.57 \pm 6.54 \%$ and $0.6 \pm 0.57 \text{ mg/dl}$ respectively. Only 49 (11.9%) of patients had post-operative kidney dysfunction. 30 (7.3 %) patients had post-operative pulmonary complication. Acute pulmonary disease 240 (58.1%) (Table 5). Similarly 20 (4.8%) developed cardiac arrest (Table 4). Only on 9 (2.2%) mortality had occurred after cardiac surgery. (Table 5).

Table 5: Immediate outcomes among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

Variable	Category	Frequency	Percent
Vasopressor use	Yes	193	46.7
	No	220	53.3
Surgical infection	Yes	35	8.5
	No	378	91.5
Neurological dysfunction	Yes	9	2.2
	No	404	97.8
Renal dysfunction	Yes	49	11.9
	No	364	88.1
Pulmonary complication	Yes	30	7.3
	No	383	92.7
Acute pulmonary disease	Yes	240	58.1
	No	173	41.9
Extra cardiac atriopathy	Yes	47	11.4
	No	369	88.6
Mortality	Yes	9	2.2
	No	404	97.8
Waiting time	2-5 days	14	3.4
	5-7 days	64	15.5
	7-10 days	335	81.1

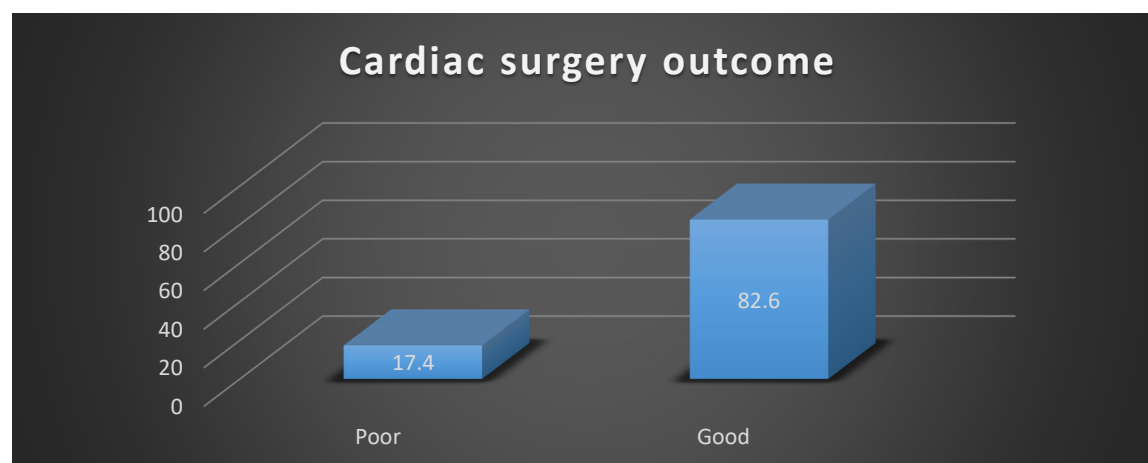


Figure 3: cardiac surgery outcome among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

5.5 Factors Associated with Cardiac Surgery Outcome

In the multivariable logistic regression analysis blood loss, female, cardiac arrest and age were significantly associated with poor outcome of cardiac surgery. Participants who were not significant blood loss during intra-operation were 41% less likely to have poor outcome of cardiac surgery than those who were significant blood loss (AOR: 0.59: CI (0.12, 0.95)). The odds of poor outcome of cardiac surgery were 25% lower among patients who are greater than five years of age as compared to those who are less than 5 year (AOR:0.751, CI: (0.21,0.91)).

Similarly patients who developed cardiac arrest during surgery were on 2 times more likely to have a poor outcome of cardiac surgery as compared to those who did not developed cardiac surgery (AOR: 2.06, CI: (1.21,5.34)). Those Female patients were 1.45 times more likely to develop poor outcome compared to male patients. (AOR: 1.456, CI: (1.12, 2.49)). (Table 6)

Table 6: Factors associated with cardiac surgery outcome among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia.

Variable	Category	Outcome		COR(95% CI)	AOR(95% CI)	P value
		Good	Poor			
Age	<5 years	154	38	1	1	0.015*
	>5 years	187	34	0.74(0.443,1.226)	0.751(0.21,0.91)*	
Sex	Male	139	35	1	1	0.021*
	Female	202	37	0.724(0.44,1.21)	1.456(1.12,2.49)*	
Residence	Urban	141	22	1	1	0.23
	Rural	200	50	1.6(0.928,2.77)	1.650(.89,2.92)	
Wasting	No	210	49	1	1	0.13
	Yes	131	23	0.75(0.0.48,1.29)	0.7(0.39,1.26)	
Patient Presentation	Symptomatic	318	69	1	1	0.22
	Asymptomatic	23	3	0.61(0.176,2.059)	0.56(0.16,2.01)	
Frequency of surgery	First time	301	66	1	1	0.25
	Redo	40	6	0.684(0.279,1.68)	0.59(0.22,1.544)	
Waiting time	2-5 days	11	3	1	1	0.14
	5-7 days	54	10	0.679(0.16,2.88)	0.561(0.126,2.49)	
	7-10 days	276	59	0.78(0.212,2.9)	0.64(0.166,2.48)	
Blood loss	Yes	44	13	1	1	0.012*
	No	294	59	0.67(0.34,1.33)	0.59(0.12,0.95)*	
Vasopressor use	Yes	156	37	1	1	0.28
	No	185	35	0.798(0.48,1.33)	0.9(0.52,1.57)	
Cardiac Arrest	No	327	66	1	1	0.01*
	Yes	14	6	2.123(0.787,5.725)	2.06(1.21,5.34)*	

CHAPTER SIX: DISCUSSION

6.1 Discussion

The goal of the study was to evaluate the Determinants of cardiac surgery outcomes among children who underwent cardiac surgery at cardiac centers, Addis Ababa Ethiopia. Over all, from patients 17.4 (95% CI: 13.8, 21.3) were developed poor cardiac surgery outcome.

This finding is in line to study conducted in cardiac center of Ethiopia and EL-Ouzier cardiac center; Addis Ababa Ethiopia. In this study 16.7% patients were developed at least one form of post-operative complication(12).

The finding of this study is higher than study conducted in Turkey. In this study the incidence of complication was calculated as 4.2%(16). The finding of this study is lower than study conducted in Saudi Arabia(11). A study conducted in Saudi Arabia suggested that from the overall children post-procedural complications were reported in 96 (73.8%) of the procedures. The most frequent complications were prolonged post-operative mechanical ventilation (27%), pleural effusion (21%), excessive bleeding (19%), cardiac arrest (18%), and systemic infections (18%)(11). Also a cross-sectional study carried out in Pediatric Department, Faculty of Medicine, Ainshams University, and Cairo, Egypt suggested that 50% of patients developed post-operative complication which is higher than the finding of this study(14). This difference might be due to socio-economic status, facility, study population as well as caring practice.

In this study from total 413 children's, surgical infection (8.5%), neurological dysfunction (2.2%), renal dysfunction (11.9), pulmonary complication (7.3%), mortality (2.2%) was developed post-operatively. This finding is similar with study conducted in Ethiopia. A study conducted in Ethiopia in cardiac center suggested that out of the total 114 patients, 5 (4.4%) patients died within 30 days following the index surgery. Also a similar finding was published in a study in Dena hospital of shira and tertiary hospital in Egypt suggested that the incidence of wound infection was 7% and 8% respectively(12,15).

Also it is comparable finding from Turkey. On study from Turkey reveled that of the 3849 pediatric cardiac surgery patients we screened, 162 had neurological complications in the early period (the first 10 days after surgery). The incidence was calculated as 4.2%(17).

A study conducted in Brazil suggested that 8.3% of patients had pulmonary complications which is similar to this research finding(18).

In multivariable logistic regression age was one of significant factor. Those patients greater than 5 years had risk of developing poor cardiac surgery outcome. This finding is similar to a study conducted in America. a study on Epidemiology and Outcomes after In-Hospital Cardiac Arrest after Pediatric Cardiac Surgery conducted in America suggested that Younger age were associated with cardiac arrest after children cardiac surgery(20). Also a study in Europe suggested that age was one of significant factor for increased mortality after cardiac surgery(22). This could be because those younger children may have less immature organs and weak immunity compared to older children so this may make them to have more risk to develop poor outcomes.

Sex was one of significant factor for developing poor outcome after cardiac surgery. Female patients had higher risk of developing poor cardiac surgery outcome. This finding is similar to study conducted in Europe. The study conducted in Europe suggested that being female were associated with increased mortality. But another study suggested opposite to this, According to study conducted in USA being male were one of significant factor for developing arrhythmia after cardiac surgery(22). In this study majority of the patients were females which in fact make them to have high risk of developing poor outcome compare to boys.

Similarly cardiac arrest during intra-operation was one of significant factor for poor outcome in post-operative cardiac surgery in children's. Those patients developed cardiac arrest during cardiac surgery have higher risk of developing complication after surgery. This could be due to they are more vulnerable for other poor outcomes after cardiac surgery if they have complication during surgery.

Blood loss also one of significant factor associated with poor outcome after cardiac surgery. Those patients significant blood loss during cardiac surgery had higher risk of developing poor outcome after cardiac surgery. This could be due to those patients significant blood loss during surgery could have risk factor for anemia which in fact makes them having more risk to develop other poor outcomes after surgery.

6.1. STRENGTH AND LIMITATION OF THE STUDY

6.1.1 Strength of the study, the strengths of this study include

The study was conducted for comprises different years of admission/observations this may increase number of events and decrease variability.

It is the first study to see outcome of cardiac surgery in children's so it gives an insight for researchers especially in carrying out prospective study.

6.1.2. Limitation of the study

The nature of study because of retrospective, the study was merely based on secondary data, so analysis of associated factors for cardiac surgery outcome was limited by the information that could be obtained from the patients' charts.

Nutritional status of patients was not adequately assessed, due to limited information that could be obtained from the patients' charts.

Hence, data on some demographic characteristics and other clinical related factors could not be available in the record of the patient and these variables were not integrated in the study.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

7.1 Conclusion

In this study patients developed poor cardiac surgery outcome which is comparable with study finding in Ethiopia. From multivariable logistic regression model being female, age greater than 5 years, significant blood loss during intra-operation and cardiac arrest during cardiac surgery was significantly associated with poor outcome of cardiac surgery. Open heart surgery can be performed in cardiac center of Ethiopia was done successfully for majority of patients with good outcome by available number of cardiac surgeon and instruments. In this study post-operative complication accounts for less morbidity and mortality.

7.2 Recommendation

7.2.1 for Health Facility

- ✓ A careful monitoring and follow-up of patients developed complication like blood loss, cardiac arrest during intra-operation since they had high risk of developing poor outcome.
- ✓ Develop a way to control the completeness and reliability of base line and follow up data being collected since there were incomplete charts during the study.
- ✓ More attention should give for those younger patients since they may have higher risk of developing poor cardiac surgery outcome.
- ✓ To provide safely open heart surgery in this center with better outcome, we recommend our government to assist cardiac center of Ethiopia.

7.2.3 Future researchers

As this is, a retrospective secondary data analysis; future researchers should use a prospective cohort study design for better information including other factors not included under this study.

REFERENCES

1. Gruenwald CE, Manlhiot C, Crawford-lean L, Foreman C, Brandão LR, Mccrindle BW, et al. Management and Monitoring of Anticoagulation for Children Undergoing Cardiopulmonary Bypass in Cardiac Surgery. 2010;(3):9–19.
2. Murni IK, Djer MM, Yanuarso PB, Putra ST, Advani N, Rachmat J, et al. Outcome of pediatric cardiac surgery and predictors of major complication in a developing country. 2019;
3. Gamal, Ahmed E-MK, Ahmed IE, Omar SA. Postoperative complications in pediatric cardiac surgery patients done in a tertiary hospital. *J Curr Med Res Pract*. 2020;5(2):121.
4. Ball L, Costantino F, Pelosi P. Postoperative complications of patients undergoing cardiac surgery. *Curr Opin*. 2016;22(4):386–92.
5. Cheng H, Jw C, Bph C. *J Surg Res* . 2018;229:134-144. *Evid Pract*. 2019;110(325):325–30.
6. Andoni GL, Ugoustides JGA, Uarracino FG, Antini FS, Onschab MP, Asero DP, et al. Mortality reduction in cardiac anesthesia and intensive. *Acta Anaesthesiol Scand* 2011; 2011;4(259):259–66.
7. Benavidez OJ, Gauvreau K, Nido P Del, Bacha E, Jenkins KJ. Complications and Risk Factors for Mortality During Congenital Heart Surgery Admissions. *Soc Thorac Surg*. 2013;84(147):147–55.
8. Pasquali SK, He X, Jacobs JP, Jacobs ML, Brien SMO, Gaynor JW. Evaluation of Failure to Rescue as a Quality Metric in Pediatric Heart Surgery : An Analysis of The STS Congenital Heart Surgery Database. 2015;
9. Kansy A, Tobota Z, Maruszewski P. Analysis of 14 , 843 Neonatal Congenital Heart Surgical Procedures in the European Association for. *ATS* [Internet]. 2017;89(4):1255–9. Available from: <http://dx.doi.org/10.1016/j.athoracsur.2010.01.003>
10. Rocco PRM, Ph D, Schultz MJ, Ph D, Pelosi P, Abreu MG De, et al. Intraoperative Protective Mechanical Ventilation for Prevention of Postoperative Pulmonary Complications. 2017;(3):692–713.
11. Abdulrahman N, Yahya A, Ali A, Bin H, Abdelmouz M, Ali N, et al. Heart Disease in Infants . An Experience From Tertiary. 2021;33(4).
12. Debel FA, Zekarias B, Centella T, Tekleab AM. Immediate outcome following valve surgery for rheumatic heart disease: The first local experience from Ethiopia. *Cardiol Young*. 2020;
13. Suominen P, Palo R, Sairanen H, Olkkola KT, Räsänen J. Perioperative determinants and outcome of cardiopulmonary arrest in children after heart surgery. *Eur J Cardio-thoracic*

- Surg. 2015;19(2):127–34.
14. Lan Y, Lee JCR, Wetzel G. Postoperative arrhythmia. Lippincott Williams & Wilkins. 2015;18(73):73–8.
 15. Mirzaei M, Sepahvand E, Koshkaki AR. Evaluation of Complications of Heart Surgery in Children With Congenital Heart Disease at Dena Hospital of Shiraz Evaluation of Complications of Heart Surgery in Children With Congenital Heart Disease at Dena Hospital of Shiraz. 2016;(February).
 16. Arslanoğlu E, Kara KA, Yiğit F, Arkan C, Uslu U, Şavluk ÖF, et al. Neurological complications after pediatric cardiac surgery. *Cardiothorac Surg*. 2021;29(1):1–10.
 17. Borges DL, Sousa LRT, Silva RT, Gomes HC da R, Ferreira FMM, Lima WL, et al. Pulmonary complications in pediatric cardiac surgery at a university hospital. *Brazilian J Cardiovasc Surg*. 2010;25(2):234–7.
 18. Roberson ML, Egberg MD, Strassle PD, Phillips R. Jo l P re. *J Pediatr Surg* [Internet]. 2020;3(1):1–6. Available from: <https://doi.org/10.1016/j.jpedsurg.2020.10.001>
 19. Campisano M, Celani C, Franceschini A, Pires Marafon D, Federici S, Brancaccio G, et al. Incidence and predictors of pericardial effusion following surgical closure of atrial septal defect in children: A single center experience. *Front Pediatr*. 2022;10(August):1–8.
 20. Gupta P, Jacobs JP, Pasquali SK, Hill KD, Gaynor JW, Brien SMO, et al. HHS Public Access. HHS Public Access. 2015;c(6):2138–44.
 21. Roques F, Nashef SAM, Michel P, Gauducheau E, De Vincentiis C, Baudet E, et al. Risk factors and outcome in European cardiac surgery: Analysis of the EuroSCORE multinational database of 19030 patients. *Eur J Cardio-thoracic Surg*. 2015;15(6):816–23.
 22. Matthews CR, Madison M, Timsina LR, Namburi N, Faiza Z, Lee LS. Impact of time between diagnosis to treatment in Acute Type A Aortic Dissection. *Sci Rep* [Internet]. 2021;11(1):1–8. Available from: <https://doi.org/10.1038/s41598-021-83180-6>
 23. Waljee JF, Ohye RG. Surgeon Experience and Outcomes : An Age Old Question. :1–2.
 24. Colson PH, Gaudard P, Fellahi J, Bertet H. Active Bleeding after Cardiac Surgery : A Prospective Observational Multicenter Study. 2016;1–14.
 25. Bercovitz, R. S., et al. Validation of a definition of excessive postoperative bleeding *J Thorac Cardiovasc Surg*. 2018; 155(5): 2112-2124.e2112.

Assurance of Principal Investigator

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the Investigator: - Yohannes Desta

Signature: _____

Date: _____

Approval of the Primary Advisor

Name of the primary advisor: - Sr. Altayework Mekonnen

Signature: _____

Date: _____

Approval of the Co-Advisor

Name of the co-adviser: - Sr. Tigist Tsegaye

Signature: _____

Date: _____

Approval of the Examiners

Name of the Examiner: -

Signature: _____

Date: _____

Information Sheet: (English version)

Study title—Determinants of cardiac surgery outcomes among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia, from May 2019-October 2022.

Purpose-- To assess determinants of cardiac surgery outcomes among children who underwent cardiac surgery at Cardiac centers, Addis Ababa Ethiopia, from May 2019-October 2022.

Procedure- To achieve the above objective, information that is necessary for the study will be taken from cardiac patient's records form.

Risk and /or Discomfort: Since the study will be conducted by taking appropriate information from medical charts, it will not inflict any harm on the patients. The name or any other identifying information will not be recorded on the questionnaire and all information will take from the chart will be kept strictly confidential and in a safe place. The information retrieved will only use for the study purpose.

Benefit- The research has no direct benefit for one whose document/ record will be included in this research. But the indirect benefit of the research for the participant and other clients in the program is clear. This is because if program planners are preparing predicted plans there will be a benefit for clients in the program of getting appropriate care and treatment services for cardiac patients underwent surgery to reduce complication. In all, the research work will have a paramount direct benefit for health care planners and managers since the study will be preliminary for other researchers.

Confidentiality-Since the study will be accomplished through reviewing of medical records, the individual patients will not be subjected to harm as great deal as the confidentiality is kept.

To keep confidentiality all collected data will be coded and locked in a separate room before being entered into the computer and names will not be included in the data collection format. At the data entry stage, the computer data was locked by password and the data will not be disclosed to any person other than the principal investigator. Since the study is a retrospective cohort; consent will be obtained from the responsible body in cardiac centers.

Right to refusal or withdraw-In behalf of the clients the center has all right to refuse to participate in this study and shall have stopping the process at any steps of the data collection process.

Contact address: If there is any questions or unclear idea any time about the study or the procedures, do not hesitate to contact and speak to principal investigator with cell phone number: 0919489011, 0911766985 or e-mail address johneymman2000@gmail.com

I have read this form and I comprehend and understand all condition stated above.

Are you willing to participate in this study?

1. No (say thank you)
2. Yes (continue interviewing)

Annex II: Quantitative English Version Checklist

Data collection checklist from chart review for children patients who underwent open cardiac surgery (this checklist is prepared from the results of literature I have used in the literature review).

Code: Date:

I. Socio demographic data

S.N	Question	Response	Remark
101	Age	1. _____ years	
102	Sex	1.male 2.female	
103	Residence	1.urban 2.rural	

II. Pre-operative characteristics

S.N	Question	Response	Remark
200	Patient presentation	1.Symptomatic 2.Asymptomatic	
201	Hct of patient		R. Range 37-44%
202	Creatinine level		R.R > 0.3-0.7mg/dl
203	Diagnosis		
204	Type of procedure		
205	Frequency of surgery	1. 1 st time 2. Redo	
206	Medical co-morbidity	1. Yes 2. No	

207	If yes, list them		
208	Duration frequency		

III. Characteristics related to intra-operative condition of the patient

S.N	Question	Response	Remark
301	Surgeon	Ethiopian Foreign	
302	Duration CPB		
303	Duration of procedure		
304	Blood loss	Yes No	
305	Vasopressor use	Yes No	
306	Cardiac arrest	Yes No	
307	Need for blood transfusion	Yes No	

III. Characteristics related to post-operative condition of the patient

S.N	Question	Response	Remark
401	Excessive Bleeding	1. ≥ 7 ml/kg/hr 2. < 7 ml/kg/hr	
402	Surgical site infection	Yes No	
403	Mortality	Yes No	
404	Neurologic dysfunction	Yes No	
405	Renal dysfunction or AKI	Yes No	
406	Pulmonary complication	Yes No	
407	Cure without major complication	Yes No	

408	Acute pulmonary disease	Yes No	
409	Extra cardiac arteriopathy	Yes No	
410	Diabetes mellitus	Yes No	
411	Hypertensive	Yes No	

IV. Facility related factors

S.N	Question	Response	Remark
502	Waiting time from diagnosis to time of surgery	2-5 days 5-7 days 7-10 days	

V. Nutrition status

S.N	Question	Response	Remark
601	Stunting	Yes No	
602	Wasting	Yes No	
603	Weight of child	1._____Kg/gram	