Original Article: Results of Cardiac Surgeries in Pediatric Requiring Cardiac Surgery Hospitalized in the Intensive Care Unit

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ABSTRACT

Introduction: Our primary aim was to examine postoperative complications in cardiac surgery patients and their relationship to the use of cardiopulmonary resuscitation (CPB). A secondary aim was to evaluate the association of postoperative complications with outcome measures. **Material and Methods:** Single-institution observational study of consecutive cardiac surgery patients over 1 year. Five cardiac cases and 15 extracardiac cases were studied. CPB use, CPB parameters, demographics and Risk Adjusted Classification of Congenital Cardiac Surgery (RACHS-1) levels were evaluated as complication risk factors. Outcomes examined included duration of mechanical ventilation, length of stay in pediatric hospital, length of stay, and mortality. **Results:** Logistic regression analysis, after adjusting for age, sex, prior sternotomy, and RACHS-1 level, provided insufficient evidence for an association between CPB support and the incidence of cardiovascular or extracardiac problems. For patients receiving CPB, longer duration of CPB, higher RACHS-1 levels, and lower CPB temperature were associated with more cardiovascular events (P < .01). Longer CPB duration and higher RACHS-1 levels were associated with more cardiovascular complications (P = .006). Postoperative complications were associated with longer ventilator time, longer pediatric heart failure hospital stay, longer hospital stay, and death (P < .01). **Conclusion:** Postoperative complications occurred in 43% of pediatric cardiac procedures with and without CPB. Complications include longer use of ventilators, pediatric heart failure and hospital stay, and increased mortality.

Introduction

Cardiovascular disease is one of the most important threats to human health, so that the prevalence of heart disease in the United States is about 17 million patients per year, of which about 11 million are coronary heart disease, 5 million valvular lesions and One million congenital heart defects (Figure 1).

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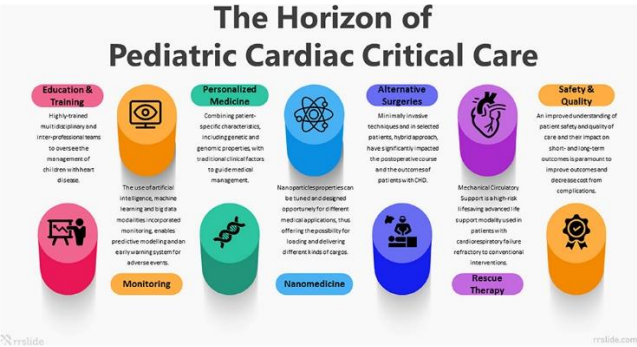

Figure 1: Pediatric heart surgery and Critical Care

About one million of these require catheterization and angiography each year, and 500,000 undergo heart surgery [1-3]. Every year, more than 3 million patients need anesthesia for heart disease [4]. In the United States, 250,000 open-heart surgeries are performed annually using a cardiopulmonary pump (CPB), about 6 percent of which are in children. Child mortality due to congenital heart defects has increased from 2.7 to 7.7 percent (Figure 2) [5].

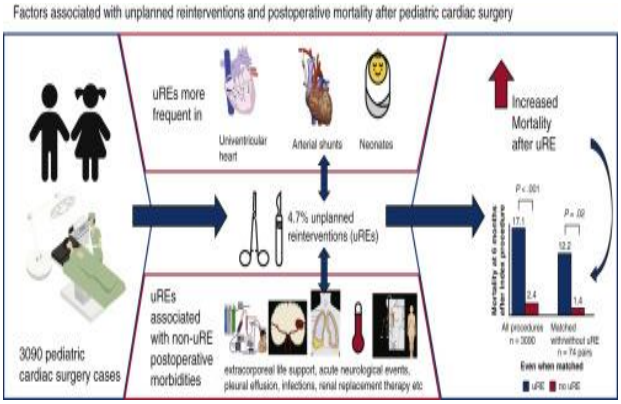

Figure 2: Risk Factor for pediatric heart Surgery

Which was probably due to heart surgery at an early age. The prevalence of congenital heart defects is about 6-8 per thousand live births, more than half of which require medical treatment or surgery during the first year of life [3]. With the advancement of technology since ancient times, significant changes have been made in the field of correction of congenital heart defects with surgery, so that in developed countries [4], the mortality rate has decreased significantly. In this regard, studies conducted in our country are limited [5]. In the present study, the quality and quantity of heart surgeries in cardiac abnormalities, congenital malformations and resulting mortality in one of the important centers of cardiovascular surgery have been studied [6-8].

Material and Methods

Study design: This study is a retrospective cohort that was performed by examining the surgical information of children who underwent surgery in Shahid Madani Hospital (Tabriz University of Medical Sciences) who underwent surgery during 2010 to 2016. The sampling method in this study was census.

Inclusion and exclusion criteria: Inclusion criteria included children with congenital heart defects, age less than 6 years and completed

files, and exclusion criteria also included children with a history of multiple surgeries, children older than 6 years and The files with information were incomplete.

Methodology: This is a descriptive and retrospective study. The total number of patients studied is about 400 patients in the pediatric intensive care unit of Shahid Madani Heart Hospital and underwent surgery. Of these, about 100 patients (72 patients operated on in the first ten years and 18 patients operated on in the second ten years) were randomly selected by drawing lots as a sample. The method of data collection was by completing a questionnaire and referring to patients' files. Data were analyzed using descriptive statistical methods in the form of ratios, means, graphs and tables.

Data analysis: Data were entered into SPSS software (version 25) and parametric tests and parametric bread were used to compare data.

Ethical considerations: This study was conducted after approval by the ethics committee of Tabriz University of Medical Sciences. Since this study was a retrospective study, there was no need to obtain informed consent from the participants.

Results

The age range of patients in both groups varied from one day to 18 years. The highest age of surgery in both groups (first ten years and second ten years) was 12-7 years and 44.5% and 53%, respectively. The most common type of surgery was PDA amputation in both groups. The only significant difference in the first ten years is mitral valve repair and replacement, which has a significant decrease in the second ten years. There is a slight increase in the use of a cardiopulmonary pump (CPB) in the second ten years compared to the first ten years(Figure 3).

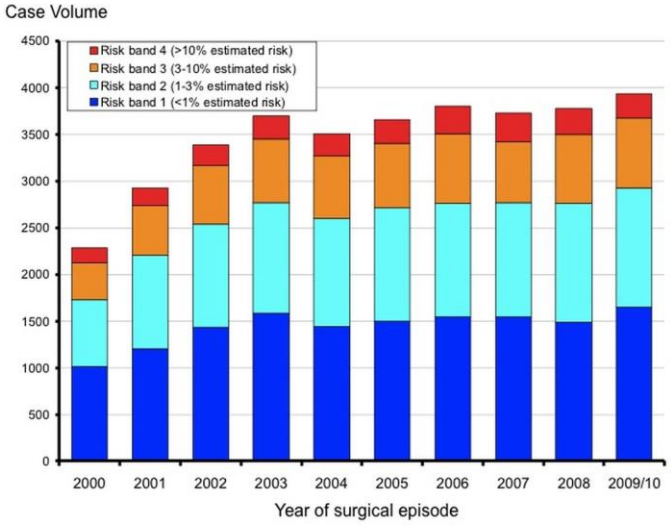

Figure 3: Survival Rate in ICU after Cardiac Surgery in pediatric

Most deaths in the first ten years were due to complete correction of follow-up tetralogy, followed by repair and replacement of mitral valve, and in the second ten years, most deaths were due to systemic pulmonary shunting, followed by complete correction of follow-up tetralogy. Overall mortality in the second ten years is about 2% lower than in the first ten years(Figure 4).

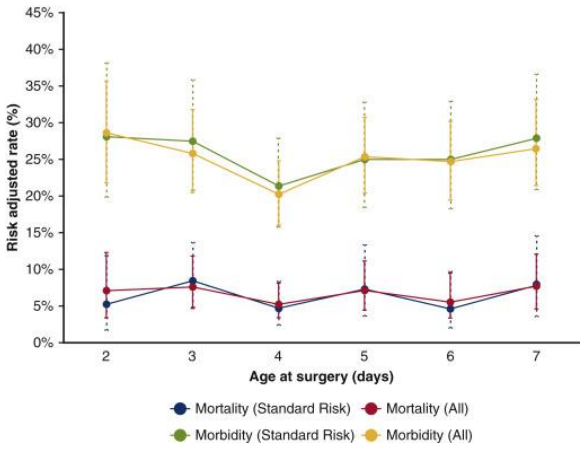

Figure 4: Survival Rate in ICU after Cardiac Surgery in pediatric

Discussion

In this study, in both groups (first ten years and second ten years), the age range of most operated patients was between 12-7 years old, which seems to be related to how patients are selected for surgery, especially using a cardiopulmonary pump [9-11]. In developed countries, the operating age of most patients is in the infant range [6]. Cardiopulmonary pump use in the first ten years and the second ten years was 55% and 60%, respectively, which had a slight increase in the second ten years [12-14]. Cardiac surgery in the advanced centers of the world is mostly with complete correction of congenital heart malformations [7]. For this reason, there is a need to use a cardiopulmonary pump in most heart surgeries [15-17]. Findings of research in both decades showed that PDA ligation was the most common type of surgery (23% and 6821%) which was performed in the first ten years of 70% and in the second ten years of 85% of cases in the age group of 12-3 years [18-20]. The age of PDA closure surgery in developed countries is during infancy. PDA closure did not cause significant mortality in the first and second ten years [21-23]. In the study of researchers and colleagues (1999), the mortality due to PDA ligation by surgery was reported to be zero percent after 1967. Complete tetralogy of Fallot surgery in the first and second ten years was 13 percent and 16.5 percent of patients, respectively. The operation was performed in 70% and 65% of cases at the age of 12-7 years, respectively [8].

In a study by researchers and colleagues, the appropriate age for tetralogy of Fallot surgery is less than one year [24-26]. Mortality due to complete tetralogy correction of Fallot was 13% in the first ten years and about 6% in the second ten years. In a study by researchers and colleagues (1998), the mortality of patients with Fallot tetralogy after 1990 was 2.1% in one-stage repair, 1.8% in multistage repair, and 0% in palliative surgery, respectively [27-29]. VSD closure surgery in ten The first and second years accounted for about 8% of operated patients. Surgery in 80% of the first group and 90% of the second group was 12-3 years old [9]. As we know, VSD is the most common congenital heart malformation and the reason for the low number of VSD closure surgeries in this study can be due to spontaneous closure of most VSDs under 2 years, the appropriate age for VSD closure surgery is about 2 years old [30-32]. VSD mortality was 10 percent in the first ten years and 5 percent in the second ten years. Researchers and colleagues have found a significant reduction in mortality (0.6% instead of 2.8%) between 1996-1991 compared to 1990-1976 [10].

ASD closure surgery in the first ten years and the second ten years were 6% and 8%, respectively.

Surgery was performed in most patients with ASD in both groups at the age of 12-7 years [33-35]. The appropriate age for ASD surgery is about 4-2 years old. Mortality from ASD closure was 2% in the first ten years and zero in the second ten years [36-38]. Today, in most advanced centers of the world, its mortality is reported to be zero percent [11].

Systemic pulmonary shunt surgery in both groups accounted for 13% and 12.5% of the patients, respectively [39-41]. The age of surgery in 76% of patients in the first ten years was 6-1 years and in 75% of patients in the second ten years was 12-3 years [42-44]. This operation was mostly performed in patients with cyanotic and cardiac complex for whom complete recovery was not possible [45-47]. According to researchers and colleagues (1995), the age of systemic shunt surgery for pulmonary disease is about infancy [48-50]. Mortality from shunt surgery was 4% in the first ten years and 15% in the second ten years [51-53]. It should be noted that the number of deaths due to congenital heart defects in the United States in 10 years (1989-1979) was about 26319 cases [12].

Concussion

This statistic is related to the total population of patients with congenital heart defects in this country and in our country there are no accurate statistics on the total number of deaths from congenital heart defects and the statistics of this study are related to patients who underwent surgery during 10 The year is in this center. In the end, it is hoped that in the near future we will see surgery to completely correct congenital heart defects at ideal ages along with planning to reduce patient mortality in the country.

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