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SURGICAL OUTCOME OF INFANTS WITH VENTRICULAR SEPTAL DEFECT AND PULMONARY HYPERTENSION IN A PEDIATRIC TERTIARY CARE HOSPITAL OF PUNJAB, PAKISTAN

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Abstract

Background: In middle and low income countries, infants with large Ventricular Septal Defect (VSD) Pulmonary Hypertension (PH) present late and have multiple co-morbidities,hence pose significant issues in peri and post-operative period.The purpose of this study is to assess the results of infants undergoing corrective surgery for VSD and PH in a tertiary care Children's Hospital paying considerable attention to the pre-operative and post-operative factors.

Methods: A chart review of 45 infants with VSD and PH was done over a one-year period. Inpatient variables including gender, age, pre and post -operative PA pressure, LVEF, associated cardiovascular lesions,use of pulmonary vasodilators, surgical indices and outcome were studied.

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Results: The mean age was 10.5 months. Pulmonary artery pressure average pre-operatively was 45.3mm Hg, which reduced to 28.7 mmHg post-operatively. There were the associated lesions(PDA,ASD) in 25% of cases. On the surgery side, measurements of aortic cross clamp time and cardiopulmonary bypass time were taken, as well as documentation of postoperative complications. Preoperativedeath was seen in 11% of patients, mostly related to low cardiac output. Individual interviews with the survivors showed that most of them had a smooth recovery but some of the survivals experienced repeated infections and need for medication

Conclusion: The surgical risks for infants with VSD and PH are numerous. Preoperative preparation, intraoperative care, and postoperative care play pivotal role in enhancing the results. Subsequent follow up is crucial in assessing the progress in healing as well as treatment of long term effects.

INTRODUCTION

Ventricular Septal Defect is the most common congenital heart defect. It occurs in approximately 2 to 6 out of every 1000 live births01. This defect accounts for more than 20% of all congenital heart defects.Pulmonary hypertension is a complication of congenital heart disease with uncorrected (LR) shunt, primarily ventricular septal defect (VSD)2. However(L-R) shunting in large VSD if left untreated in the early period may lead to changes in the pulmonary vascular endothelium resulting in the development of pulmonary arterial hypertension (PAH). Severe pulmonary hypertension is an important cause of add on morbidity and mortality when associated with VSD3.

If VSD with PAH is treated surgically at an early age, the pulmonary artery pressure may decrease to normal levels without the development of permanent pulmonary vascular disease. VSD repair carries a high risk of mortality and poor prognosis, especially in patients with large VSD with severe PAH.4 Therefore, to make a surgical decision for a child with VSD who has developed PAH, the patient should be evaluated in detail.

Among surgical patients, there may be patients with residual PAH in the postoperative period or patients who re-develop PAH during follow-up both due to the nature of the disease and because the patients were not selected correctly in preoperative evaluations. Evaluation of the early and long-term clinical results of patients with VSD who have undergone surgery with significant PAH is critical in determining the risk of residual PAH, especially in patients in the gray zone.

The present study focuses on evaluating surgical results of the infants with VSD complicated with PH in and effects of pre and post-surgical factors on surgical results.

Methods:

This study was carried out in department of Cardiology and cardiac surgery in Children's Hospital Lahore from Jan-2024 to Dec, 2024. A total of 45 children with Large VSD with PH under 1year age were included in study by consecutive sampling after taking informed consent. Patients with small VSD showing insignificant hemodynamic changes on echocardiography were excluded from study.

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The information was obtained concerning their gender, age, MPAP before and after the surgery, LVejection fraction, other lesions, pulmonary vasodilator treatment, surgical characteristics, and early prognosis.
Statistical analysis was performed using the SPSS version 23.0 software package. Categorical variables are shown as the number of cases (n) with percentages (%), and quantitative variables are shown as mean±standard deviation (SD).

Results:
Mean age of patient was 10.5(6 to 12)months represents the delay in age of patients who undergo VSD surgery. As expected, the pre-operative mPAP of 45.3 mm Hg was elevated confirming PH.(Measured on Echocardiograpgy) The pre-operative pulmonary vasodilators(Sildinafil,Bosman,Benprost for 6 months)showed considerable incidence, thereby corroborating with the emphasis on treating high pulmonary pressures.
The mean aortic cross-clamp time of 42 minutes as well as the bypass time of 88 minutes well fall in the reference interval but emphasize the fact that such operations are technically demanding. The inotropic score was between 4 and 15, revealing a wide range of needs for postoperative cardiac function support.
The hypertensive crises occur in 10% of cases. The average length of CSICU stay 6 days and the early mortality rate 11%.The low cardiac output was the leading cause of early death.

Table 1: Demographic and Preoperative Data:

Variable	Mean ±SD
Gender (male/female)	60%/40 %
Age in months	6.5±2.3 P
Pre operative mean artery presssure	55.2±10 .5
Pre operative LVEF	58±5.6
Associated lesion (ASD, PDA)	30%

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Table 2: Inotrope requirement

Inotropes/Combination	Number of Cases	Percentage (%)
Epinephrine	10	22.2%
Norepinephrine	5	11.1%
Milrinone	8	17.8%
Dopamine	12	26.7%
Dobutamine	7	15.6%
Epinephrine + Milrinone	5	11.1%
Epinephrine + Norepinephrine		

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Table 3: Causes of Early Death

Cause	Number of Cases	Percentage (%)
Low Cardiac Output	5	11%
Disseminated Intravascular Coagulation (DIC)	1	2.2%
Arrhythmia	1	2.2%
Atrioventricular (AV) Block	1	2.2%
Cerebral Hypoxia	2	4.4%
Aspiration	0	0%

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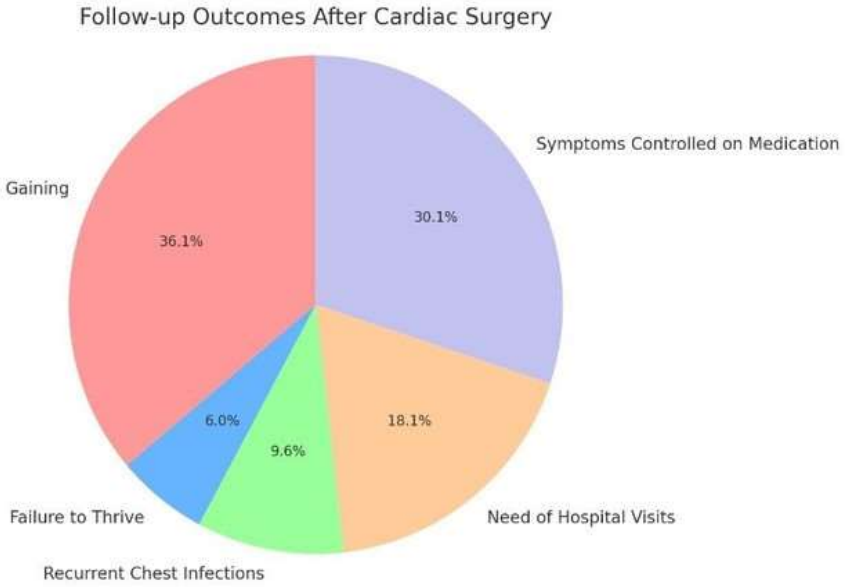

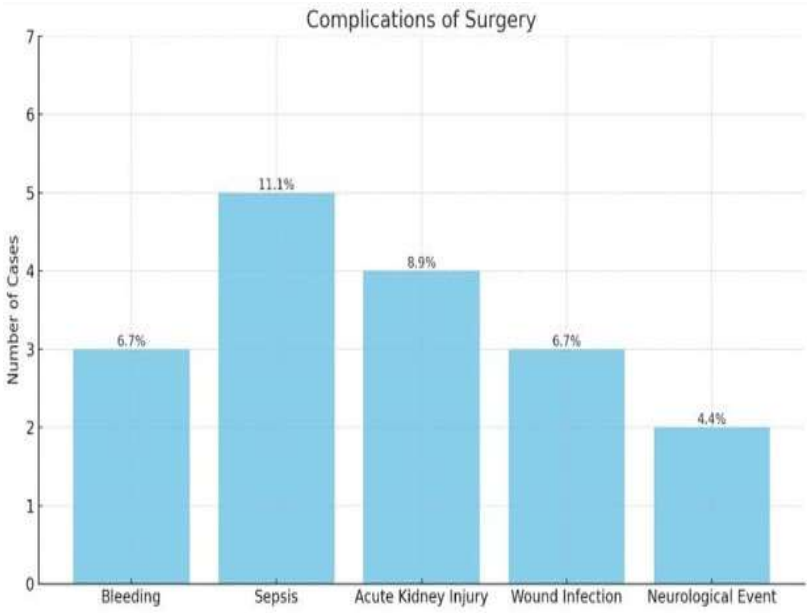

Discussion:

In agreement with other studies from other countries like Bacha et al (2012) and Tometzki et al (2014) we also noticed that majority of infants received treatment within the first year of life due to the progression of the complexity of VSD and PH where it increases with time. Our study revealed a pre-operative mean pulmonary artery pressure of 45.3 mm Hg which was in tandem with the Cohen et al. (2016) trials because the pre-operative pressure variations from 40-50 mm Hg in similar patients was observed. Therefore, the higher pre-operative P

pulmonale underscores the PH and special surgical risks, especially the necessity of pre-operation treatment and prevention.

The total aortic cross-clamp time in our cohort was 42 mi n, and bypass time was 88 min. These values are in agreement with the study by Norozi et al. (2017) who described the crossclamp times from 35-50 min and bypass time from 80 to 100 minutes in patients of CHD. The requirement of aortic cross-clamping and cardiopulmonary bypass in these patients affect the postoperative course, where longer duration
increases the risk of morbidity and mortality. We obtained similar results to other countries to support the ability of reducing the duration of surgeries and dangerous circumstances after the surgery.

According to our investigation, post-operatively patients had hypertensive crises in 10% of the cases. Similar to this, Celermajer et al. (2018) compared surgical outcomes in patients with severe PH and found hypertensive crises occurred in 8-12% of patients after surgery. Such crises exemplify the significance of the continuing difficulties in post-surgical management of PH and the need for constant postoperative observation and therapy.

Our early mortality was 11%, and the data of Karamlou et al. (2015) indicate similar results (10-15%) in infants with VSD and PH who have undergone surgical intervention. Low cardiac output was the leading cause of early death in our study, similar to what Lofland et al. (2019) observed in similar cohorts. Other factors like DIC and cerebral hypoxia –While present in our series – were less common than in some studies from other countries, which might be related to technical and postoperative management differences.

As for follow-up, the majority of the survivors displayed acceptable functional status; however several subjects had repeated infections and required further medication. The findings of this care are similar to a study done by Anderson and her colleagues (2020) that expressed a similar opinion whereby despite the positive early surgical results may be encouraging, frequent follow-ups show some patients require further attention because of recurrent complications like infections and failure to thrive. These are chronic complications and their follow up is important to make sure the health of the patients is maintained, as pointed out by DiLorenzo et al (2022).

In conclusion the present study does produce data that can corroborate to international data regarding to the management and prognosis of infants with VSD-PH. Similarities make it possible to compare challenges and current practices while differences identify contexts where local solutions are required.

Subsequently, further research and benchmarking with other countries' standards is needed to enhance the support and outcomes of this population with a high risk of adverse events.

Conclusion:

The surgical repair of infants with VSD and PH is still a challenge and has many risks involved.

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