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Postoperative Complications Following Total Surgical Correction of Tetralogy of Fallot: A Retrospective Cross-Sectional Study.

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Abstract

Background: Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart defect. Total surgical correction remains the definitive treatment. Despite improvements in surgical techniques, postoperative complications are still reported and vary in severity. Understanding these complications is crucial for improving surgical outcomes and postoperative care. To determine the frequency and types of in-hospital postoperative complications following total surgical correction of Tetralogy of Fallot.

Methodology: This retrospective cross-sectional study was conducted at the Department of Cardiovascular Surgery, Lady Reading Hospital, Peshawar, from January 2010 to December 2020. A total of 150 patients who underwent complete surgical correction for TOF were included using non-probability consecutive sampling. Patients aged 3 to 25 years of both genders were enrolled. Data were collected from hospital records and analyzed using SPSS version 20.

Results: A total of 150 patients were included, with a mean age of 6.5 ± 2.9 years (range: 3–25 years). Males constituted 60% (n = 90) of the study population. Isolated TOF was present in 55% of the patients, while 45% had associated anomalies, such as patent foramen ovale (PFO), atrial septal defect (ASD), patent ductus arteriosus (PDA), right-sided aortic arch, and left superior vena cava (SVC). The most frequently observed postoperative complications included heart failure (12%), postoperative bleeding, and conduction abnormalities. Complete heart block, the most common conduction disturbance, was observed in 5 cases (3.3%). Pleural effusion and pneumothorax were also documented but occurred less frequently.

Conclusion: Postoperative complications following total correction of Tetralogy of Fallot are not uncommon. The most frequently observed complications in this study were bleeding, heart failure, complete heart block, and pneumothorax. Early identification and management of these complications are essential to improving patient outcomes.

Keywords

Tetralogy of Fallot, Postoperative Complications, Heart Block, Heart Failure.

Introduction

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart defect, with an estimated incidence of approximately 3 per 10,000 live births. It accounts for 5–7% of all congenital heart diseases[1,2]. Anatomically, TOF comprises four key cardiac anomalies: a ventricular septal defect (VSD), overriding of the aorta, right ventricular hypertrophy, and right ventricular outflow tract obstruction[3].

The first successful surgical repair of TOF was performed by Lillehei et al., in 1954, marking a significant milestone in congenital heart surgery[4]. Initially, there were two main schools of thought regarding the optimal timing and strategy for TOF repair. One favored primary early repair during infancy[5,6], while the other advocated a two-stage approach, citing concerns over high perioperative mortality associated with early complete correction[7,8]. Traditionally, the two-stage strategy involved an initial palliative systemic-to-pulmonary shunt commonly the Blalock–Taussig (BT) shunt followed by total corrective surgery around the age of 3–5 years, involving VSD closure and resection of the RV outflow tract[2,3].

However, since the early 1990s, accumulating evidence has supported the safety and efficacy of early primary repair, with several studies demonstrating superior long-term outcomes compared to the staged approach[9,10]. Current guidelines now recommend early single-stage total correction, ideally between 3 to 6 months of age, or even earlier in symptomatic patients[11].

Surgically, the traditional transventricular approach used for resecting RV outflow tract obstruction is increasingly being replaced by the transatrial–transpulmonary approach. This alternative route involves resection through the right atrium and pulmonary artery, leading to shorter operative times and reduced risk of postoperative arrhythmias, right ventricular dysfunction, and ventricular aneurysm formation[12].

While the overall outcomes of total TOF repair are favorable, postoperative complications do occur. Kim et al. reported pleural effusion (5.2%), complete heart block (1.2%), pneumonia (0.9%), postoperative bleeding (0.9%), pericardial effusion (0.3%), and renal failure (0.3%) as notable complications following total correction[13].

The objective of this study was to evaluate in-hospital complications following total surgical correction of Tetralogy of Fallot. This research aims to generate local data that may help cardiac surgical teams recognize, anticipate, and manage these complications more effectively, thereby improving patient outcomes.

Methodology

This retrospective cross-sectional study was conducted at the Department of Cardiovascular Surgery, Lady Reading Hospital, Peshawar, covering the period from January 2010 to December 2020.

A total of 150 patients were included using non-probability consecutive sampling. Inclusion criteria comprised all patients aged between 3 and 25 years, of either gender, who were diagnosed with Tetralogy of Fallot (TOF) and underwent total surgical correction during the study period. The diagnosis of TOF was confirmed through echocardiography and surgical findings. Exclusion criteria comprised of patients with incomplete medical records, those who underwent only palliative procedures (e.g., Blalock-Taussig shunt), and those with associated complex congenital cardiac anomalies other than TOF.

Patient data were collected from ward records and hospital archives using a structured proforma specifically designed for the study. The information included demographic details (age and gender), clinical characteristics, associated anomalies, and postoperative complications. Data collection was performed by trained medical officers under the supervision of a senior resident to ensure accuracy and reduce bias.

Data were entered and analyzed using SPSS version 20. Descriptive statistics were applied: mean ± standard deviation (SD) was calculated for

continuous variables such as age, and frequencies and percentages were computed for categorical variables such as gender and types of complications. Results were presented in the form of tables and graphs.

Ethical approval for this study was obtained from the Institutional Review Board of Lady Reading Hospital.

Results

A total of 150 patients underwent total correction for Tetralogy of Fallot. The mean age of the study population was 6.5 ± 2.9 years (range: 3–25 years). The majority were male (n = 90; 60%). Cyanosis was the most common presenting symptom, followed by clubbing and syncope. A history of Blalock-Taussig (BT) shunt was present in 30 (20%) patients. Baseline characteristics are summarized in Table 1.

Among the cohort, 82 patients (54.7%) had isolated TOF, while 68 (45.3%) had associated cardiac anomalies. The most frequent associated abnormalities were atrial septal defect (ASD), right-sided aortic arch, and patent ductus arteriosus (PDA). These are detailed in Table 2.

In terms of postoperative complications, heart failure (12%), postoperative bleeding (8%), and conduction abnormalities such as junctional rhythm and complete heart block were among the most common. Less frequent complications included pneumothorax, pleural effusion, renal failure, and neurological events. A full breakdown is provided in Table 3.

Table 1: Baseline Characteristics of the Study Population (N = 150).

Variables		N(%)
Gender	Male	90 (60)
	Female	60 (40)
Age (years); Mean ± SD		6.5 ± 2.9
Mean weight (kg); Mean ± SD		15.0 ± 7.0
Cyanosis		75 (50)
Clubbing		141 (94)
Syncope		15 (10)
Prior BT shunt		30 (20)

Table 2: Associated Cardiac Abnormalities in TOF Patients.

Abnormality	N(%)
No other abnormalities	82 (54.7)
Patent Ductus Arteriosus (PDA)	14 (9.3)
Patent Foramen Ovale (PFO)	5 (3.3)
Atrial Septal Defect (ASD)	19 (12.6)
Right-sided Aortic Arch	18 (12.0)
Left Superior Vena Cava (SVC)	5 (3.3)
Tricuspid Regurgitation	9 (6.0)

Table 3: Postoperative Complications After Total Correction.

Complications	N(%)
Postoperative bleeding	12 (8.0)
Junctional rhythm	18 (12.0)

Complete heart block	5 (3.3)
Premature ventricular contractions (PVCs)	6 (4.0)
Sinus bradycardia	2 (1.3)
Heart failure	18 (12.0)
Pneumothorax	7 (4.6)
Pleural effusion	6 (4.0)
Respiratory failure	5 (3.3)
Seizures (fits)	3 (2.0)
Renal failure	6 (4.0)
Fever	5 (3.3)
Others (Wound Infection, Delayed Extubation, Electrolyte Imbalances)	11 (7.3)

Discussion

This study was conducted at the Cardiovascular Surgery Unit of Lady Reading Hospital, the largest tertiary care hospital in the province. It serves as a referral center for patients across Khyber Pakhtunkhwa and neighboring Afghanistan. To the best of our knowledge, this is the first study from this institution focusing on postoperative complications following total correction for Tetralogy of Fallot (TOF).

Our findings demonstrate that postoperative complications are not uncommon, with bleeding, conduction abnormalities, heart failure, pleural effusion, pneumothorax, and renal failure being the most frequently observed.

Conduction abnormalities were notable among the complications. Patients exhibited various types of rhythm disturbances, including sinus bradycardia, junctional rhythm, and complete heart block (CHB). Due to its serious clinical implications, CHB is of particular concern. This condition often necessitates the placement of a permanent pacemaker, and meticulous care is required during surgery to avoid injury to the conduction pathways.

In our study, 3.3% of patients developed complete heart block postoperatively. This finding is consistent with several previous studies. Edwin et al.,[14] reported a 2.5% incidence of permanent postoperative CHB, while Hokanson et al.,[15] reported an incidence of 1.5%. Similarly, Harrison et al.,[16] observed CHB in 2% of their patients. These values are comparable to our findings and highlight that conduction disturbances remain a significant postoperative concern despite advances in surgical techniques.

Our findings indicated CHB (3.3%), bleeding (8%), heart failure (12%), pneumothorax (4%), and pleural effusion (4%). Hashemzadeh et al.,[17] also investigated various postoperative complications in TOF patients. They reported CHB in 3.9% of cases, postoperative bleeding in 10%, heart failure in 8%, pneumothorax in 1.9%, and pleural effusion in 2.9%. Furthermore, Kim et al., reported CHB in 1.2% of cases, pneumothorax in 0.9%, and pleural effusion in 5.2%[13], reflecting a similar pattern, though with slight variation due to differences in surgical techniques, patient characteristics, and perioperative care standards.

Our study underscores the importance of thorough preoperative evaluation, vigilant intraoperative technique, and comprehensive postoperative monitoring to minimize complications. Early detection and prompt management of issues such as arrhythmias, bleeding, or respiratory compromise are critical to improving outcomes and reducing morbidity and mortality following TOF repair.

Limitations

This study has several limitations. First, we only evaluated in-hospital postoperative complications following total correction for Tetralogy of Fallot. Complications that developed after hospital discharge were not assessed, potentially leading to underreporting of late-onset events. Second, the sample size of 150 patients is relatively small and may limit the generalizability of the findings. Third, at our center, total correction is rarely performed in

very young children or infants, which may impact the complication profile. Outcomes and complications might differ in institutions where early primary repair is routinely performed in infancy.

Conclusion

In this study, the most frequently observed postoperative complications following total surgical correction for Tetralogy of Fallot were bleeding, complete heart block, heart failure, and pneumothorax. Awareness of these common complications and early intervention strategies are essential for improving surgical outcomes and reducing morbidity.

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