

Early Diagnosis by Clinical, X-ray, and Echo Study and Surgical Total Correction of Tetralogy of Fallot

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ABSTRACT

Background Tetralogy of Fallot is a congenital heart defect that occurs at birth. It involves a combination of four heart abnormalities that cause affects into the structure and function of the heart.

Objective Our study aimed to assess surgical outcomes of total correction patients who have TOF.

Patients and methods Our paper was conducted a cross-sectional study to determine surgical outcomes for patients who had undergone in total correction surgery for patients with TOF in different hospitals in Iraq between 16th March 2022 and 26th May 2023. Data was analysed using the SPSS program for 110 cases–55 children and 55 adults–based on age, sex, weight, BMI, and symptoms.

Results and discussions: Demographic outcomes showed that children had a higher number of cases compared to adults, with children at (7.2 ± 2.7) and adults at (21.27 ± 1.96) . Atrial septal defect was found to be the most prevalent condition in both age groups, with a rate of 29.1% in children and a high rate of cases observed in hospital settings with a percentage of 32.7%. The study compared the outcomes of children and adults and found that Cyanosis had the highest rate of symptomatic cases, accounting for 36.4% of cases in both children and adults. The data indicated that 94.5% of children received intraoperative blood products, compared to 63.6% of adults. Furthermore, 81.8% of children were administered PRBC compared to 63.6% of adults. In terms of FFP, 76.4% of children were given it, while only 58.2% of adults received it.

Similarly, 72.7% of children were given platelets compared to 47.3% of adults. To further our understanding of outcomes, we evaluated post-operative complications in patients with TOF. Our findings indicate that children experienced more complications than adults after surgery, with a rate of 43.6% in children compared to 25.5% in adults. Pulmonary regurgitation was found to be a prevalent factor after surgery, with a rate of 11 (20%) in children and 5 (9.1%) in adults.

Conclusions: Our study indicated an increased rate of postoperative complications in children compared to adults. Complications were identified in both children (43.6%) and adults (25.5%), with low cardiac output syndrome and pulmonary regurgitation being the most common.

KEYWORDS: X-RAY, Tetralogy of Fallot; complications; Low cardiac output; Pulmonary regurgitation

INTRODUCTION

Tetralogy of Fallot is a prevalent and severe cyanogenic congenital cardiac disease. It constitutes 5% of all cases of congenital cardiac disorders and refers to a malformation in the growth of the "infundibular septum," a structure situated between the ventricles. This anomaly disrupts the typical blood flow within the heart [1,2,3].

Tetralogy of Fallot represents 3.5 to 8% of congenital cardiac defects, affecting approximately 1 in 2,400 births. It is characterized by a set of four cardiac abnormalities: overriding aorta, pulmonary stenosis, ventricular septal defect, and right ventricular hypertrophy. Enter the clinical symptoms that occur simultaneously in the hospital and psychomotor, as well as the symptoms of chronic hypoxia, including acropachy. The diagnosis and treatment of the chronic hypoxia condition, poor patient health, pain, blood pressure, and thrombosis pain in various organs are important for improving overall health. It is crucial to avoid potential complications [4,5,6,7,8].

Tetralogy of Fallot is a congenital heart defect that can cause cardiac insufficiency, causing cyanosis in children. X-rays can identify abnormalities like infundibular stenosis and pulmonary branches. Advanced imaging methods are needed for accurate diagnosis and treatment. Patients have surgical and medicinal therapies, and a mortality rate of less than 5% is reported [9,10,11].

Postoperative X-ray findings in tetralogy of Fallot (TOF) may encompass right ventricular late gadolinium enhancement, surgical fibrosis, and structural alterations. These modifications can have an effect on clinical results, the time and methods of intervention, rates of survival, and the replacement of the pulmonary valve. Prolonged monitoring can uncover right ventricular hypertrophy, impaired function, fibrosis, and irregular heart rhythms, which can affect physical endurance and increase the likelihood of sudden cardiac death [12,13,14].

Besides that, there are three basic approaches to surgical therapy of TOF. Total corrective surgery or main open-heart surgery are the alternative options. TOF operation mortality is dropping drastically. Because of its early detection and treatment in infancy, untreated TOF is growing rarer in wealthy nations. [15,16,17]

Unrepaired TOF patients, on the other hand, have a short natural history, including 25% dying before the age of one, 40% dying before the age of three, and a staggering 70% dying before the age of ten. Early mortality in adults and children averaged 7.55% [18], which is about the same as in children. The proportion of early death among adults and children was 7.55%, virtually the same as in both age categories, where mortality was just 3.1% [18]. This paper was contributed to assess surgical total correction outcomes for patients with TOF.

PATIENTS AND METHODS

Our paper was conducted a cross-sectional study to determine surgical outcomes for patients who underwent total correction surgery for tetralogy of Fallot different hospitals in Iraq between 16th March 2022 and 26th May 2023. Data was analysed using the SPSS program for 110 cases–55 children and 55 adults–based on age, sex, weight, BMI, and symptoms.

The methodology was developed to compare baseline characteristics between children aged between 3 and 16 years, and Children had a BMI range of 14-24 kg/m² where

The paper conducted a cross-sectional study to assess surgical outcomes of total correction patients with tetralogy of Fallot (TOF) in different hospitals.

The study assessed surgical outcomes based on age, sex, weight, BMI, symptoms, early diagnosis, and Demographic outcomes were compared between children and adults, and the prevalence of different conditions and symptoms was analyzed where Post-operative complications in patients with TOF were evaluated, including the prevalence of complications in children and adults and The study also compared the use of intraoperative blood products, such as PRBC, FFP, and platelets, between children and adults.

Echocardiography, MDCT, MRI, and X-rays are employed for the diagnosis and assessment of tetralogy of Fallot. These approaches facilitate precise diagnosis and evaluation of the intricate anatomy of the problem, provide guidance for surgical procedures, and monitor postoperative results, finally assisting in achieving complete correction of the condition.

RESULTS

Table 1- General characteristics of study 110 patients

Variable	N (f)
Age	
5-8	40 (36.6)
9-12	30 (27.2)
13-16	40 (36.6)
BMI	
14-17 kg/m ²	39 (35.4)
18-21 kg/m ²	60 (54.5)
21-24 kg/m ²	11 (10)
Sex	
Male	70 (63.6)
Female	40 (36.6)
Symptoms	
Clubbing of fingers and toes	32 (29.09)
Cyanosis	33 (30)

Dyspnea	20 (18.1)
Heart murmur	40 (36.3)
Syncope	60 (54.4)
Arrhythmia	
Yes	40 (36.6)
No	70 (63.6)

Fig 1- Chest X-ray diagnosis for patients with tetralogy of Fallot

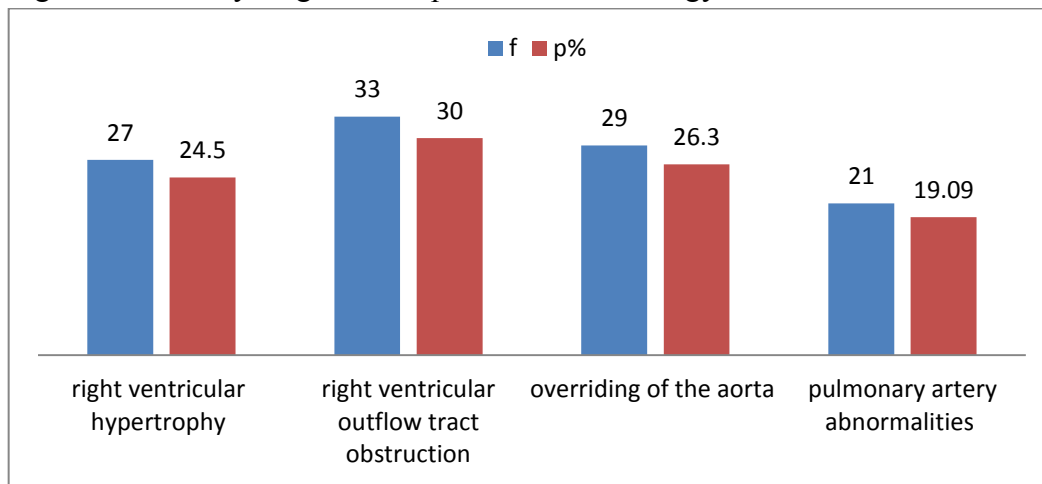


Table 2: Surgical outcomes of patients with tetralogy of Fallot during corrective surgery patients.

	F, Children	P (%)	F, Adults	P (%)
No. of patients receiving intraoperative blood products				
Yes	52	94.5	35	63.6
No	3	5.5	20	36.4
No. of patients receiving PRBC				
Yes	45	81.8	63.6	63.6
No	10	18.2	36.4	36.4
No. of patients receiving FFP				
Yes	42	76.4	32	58.2

No	13	23.6	23	41.8
No. of patients receiving platelets				
Yes	40	72.7	26	47.3
No	15	27.3	29	52.7
Number of patients receiving red blood cells				
Yes	20	18.18	30	27.2
No	35	31.8	25	22.7

Fig 2- Assessment outcomes of patients according to Preoperative hemoglobin levels

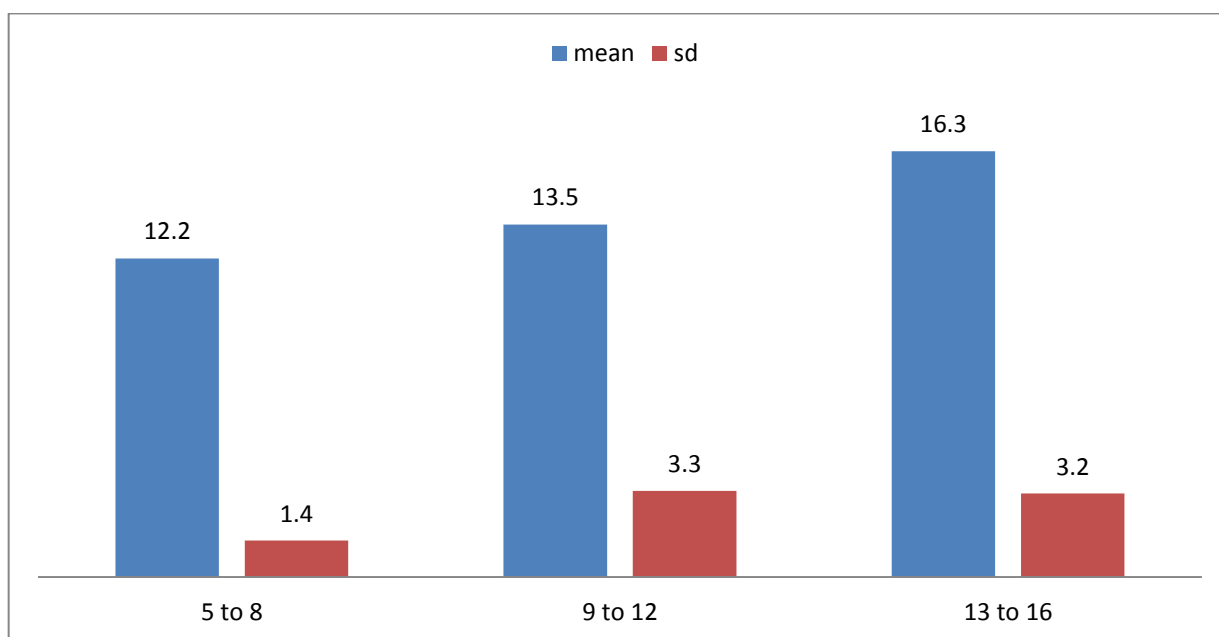


Table 3- Evaluation of complications according to early and late diagnosis

Variable	Early (80)	Late (30)
mortality	3 (3.7)	5 (16.6)
Respiratory complications	20 (25)	15 (50)
Bleeding after surgery	7 (8.75)	5 (16.6)

Table 4- Explain the frequency and percentage of patients according to complication.

Variable	Early (20)	Late (15)
Respiratory insufficiency	5	4
Cardiac tamponade	3	3
Congestive heart failure	4	3
Wound infection	2	3
Low cardiac output	6	2
Total	20 (25%)	15 (50%)

Table 5-ICU admission of patients according to age

Variable	Mean \pm SD (hour)
5-8	85 \pm 5.5
9-12	79 \pm 4.3
13-16	76 \pm 6.1

Table 6- Logistic regression to analysis the risk factor of the study

Variable	Risk factor	Range
Early diagnosis	1.1	0.7-1.4
Late diagnosis	3.7	2.3-6.4
Age	2.5	1.6-4.5
Sex		
Male	2.2	1.5-3.3
Female	2.7	1.9-4.4
Low cardiac output	3.1	2.6-5.1
Congestive heart failure	1.7	1.42-4.8
Clubbing of fingers and toes	2.1	1.687-3.87

Table 7- Correlation between type of diagnosis and outcomes

Variable	Early diagnosis	Fewer complications	Increased complications
R correlation	1:0	+0.22	-0.948
Sig	--	0.066	<0.01
N	35	20 (25%)	15 (50%)

DISCUSSION

In this study, 110 patients were collected and divided into three age groups ranging from five to 16 years. The most common age group in this study was from five to eight years for 40 patients with (36.6) years.

Patients were distributed according to gender, and the prevalence of male pediatric patients was found to be greater than females in this study.

Tetralogy of Fallot, a congenital heart defect, presents with a range of symptoms and variations. In adults, it can manifest as chest pain, congestive heart failure, and distinct electrocardiographic features and. A rare variant, tetralogy of Fallot with absent pulmonary valve syndrome, is associated with severe pulmonary insufficiency and respiratory symptoms where the syndrome has also been linked to other conditions, such as Ehlers-Danlos syndrome and macrocephaly-capillary malformation syndrome.

Chest X-ray diagnosis plays a crucial role in identifying Tetralogy of Fallot (TOF), and its variants were reported in previous studies where TOF was diagnosed based on chest X-ray findings, including an enlarged right ventricle. However, it highlighted the superior diagnostic accuracy of 64-slice spiral CT in identifying TOF, especially in detecting coronary anomalies and pulmonary artery stenosis. This suggests that while chest X-rays can provide initial indications of TOF, advanced imaging techniques like CT may be more reliable for a definitive diagnosis [19,20].

Our study analyzed the surgical outcomes of patients who underwent corrective surgery for tetralogy of Fallot. The data indicated that 94.5% of children received intraoperative blood products, compared to 63.6% of adults. Furthermore, 81.8% of children were administered PRBC compared to 63.6% of adults. In terms of FFP, 76.4% of children were given it, while only 58.2% of adults received it. Similarly, 72.7% of children were given platelets compared to 47.3% of adults. To further our understanding of outcomes, we evaluated post-operative complications in patients with TOF. Our findings indicate that children experienced more complications than adults after surgery, with a rate of 43.6% in children compared to 25.5% in adults. Pulmonary regurgitation was found to be a prevalent factor after surgery, with a rate of 11 (20%) in children and 5 (9.1%) in adults.

The evaluation of consequences in tetralogy of Fallot is contingent upon the diagnosis, whereby prompt identification diminishes the likelihood of arrhythmias and sudden death, whereas delayed diagnosis can result in grave complications. Preoperative and postoperative radiologic assessment can evaluate the efficacy of the surgical intervention.

The abstracts are deficient in providing data regarding the frequencies of early and late diagnosis of tetralogy of Fallot (TOF). Research indicates that adult patients with TOF experience limited instances of early sickness and death. However, certain clinical factors and preoperative testing can help predict potential challenges after surgery. The mortality and morbidity rates are low when complete surgical repair is postponed, even in situations where it is not feasible to do proper pulmonary valve-sparing surgery and TF causes low oxygen levels in the blood, which can cause your baby's skin to appear bluish-purple (cyanosis). This coloring usually gets worse when your baby gets upset. Another common sign of TF is a heart murmur. A heart murmur is an extra or unusual noise that your doctor may hear while listening [21].

Regarding the management of TF, state that primary surgical repair of tetralogy of Fallot is the standard treatment technique and is applied safely in all age groups, including newborns. Medical centers in developed countries perform total correction with low mortality rates, while mortality rates in developing countries are higher at 6.9 - 15.3% [22,23].

CONCLUSION

Timely identification and complete surgical rectification of tetralogy of Fallot (TOF) offer several advantages, such as enhanced patient prognosis, decreased postoperative complications, and improved left ventricular morphological and functional parameters. Early surgical intervention in paediatric patients with low body weight is both safe and successful, demonstrating a minimal mortality rate and resulting in improved long-term prognosis.

Postoperative complications following tetralogy of Fallot (TOF) surgery encompass re-opening of the surgical site, re-intubation, extended use of mechanical ventilation, death, and pulmonary valve regurgitation. Additional risks encompass arrhythmias, dialysis, hepatic impairment, respiratory failure, infection, repeat surgery, cardiac arrest, and mechanical circulatory support. Approximately 30% of adult patients experience early problems.

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