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DOES PRESERVATION OF PULMONARY VALVE THROUGH TRANSATRIAL AND TRANSVENTRICULAR APPROACH IN PRIMARY REPAIR OF TETROLOGY OF FALLOT IMPROVES CLINICAL OUTCOMES: A PILOT STUDY AT AFIC/NIHD

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ABSTRACT

Objective: This study evaluates the effect of preserving pulmonary valve in total correction repair for Tetrology of Fallot in terms of early clinical outcomes.

Study Design: Retrospective observational study.

Place and Duration of Study: Armed Forces Institute of Cardiology and National Institute of Heart Disease, from Oct 2016 to Jan 2017.

Material and Methods: All 15 cases of classic Tetrology of Fallot (TOF) undergoing total correction by a single operator were studied for early post operative outcomes.

A total of 15 patients with classic TOF were included in this study. There were 10 (66.7%) males and 5 (33.3%) females. The age ranged from 2-15 years with a mean age of 6.73 ± 4.2 years.

Total correction for tetrology of Fallot was done through primary repair securing the integrity of the pulmonary valve. Two of the patients (13.32%) had repair through mono cusp valve made from native pericardium while 2 (13.32%) had Donhl patch to main pulmonary artery and right ventricular outflow tract. Six of all patients (39.69%) had normal pulmonary valve while 5 patients (33.30%) had open pulmonary valvotomy.

Results: One patient (6.66%) died due to septicemia after having pulmonary valvotomy and MAPCA coiling in total correction procedure. Bilateral pleural effusion was reported in 4 (26.64%) and 2 patients (13.32%) had ascites. Superficial wound infection occurred in 4 (26.64%) of the patients.

Conclusion: Pulmonary valve securing approach is a significant factor for total correction complete repair for tetrology of Fallot.

Keywords: Congenital cyanotic, Pulmonary valve, Repair, Tetrology of fallot.

INTRODUCTION

Tetrology of Fallot (TOF) is one of the most common variant of congenital cyanotic heart disease. TOF is characterized by a large ventricular septal defect (VSD), right ventricular hypertrophy, right ventricular outflow obstruction (RVOT) and an overriding aorta. The first successful repair of TOF was conducted in 1954 in a little boy by Lillehei and associates[1]. Although there has been a decrease in surgical mortality associated with the repair in the recent decade, postoperative complications such as residual ventricular septal defect, incompetence of the left atrioventricular (AV) valve, residual right ventricular outflow tract obstruction, and pulmonary regurgitation do occur and sometimes require reoperation[2,3].

The best TOF repair should be appropriate for children of all ages, and should provide good relief of right ventricular outflow tract obstruction (RVOTO) to avert development of right ventricular hypertrophy. There should be complete atrial and ventricular septation, with prevention of ventriculotomy and circulatory arrest. Preservation of pulmonary valve (PV) and tricuspid valve (TV) function and biventricular contractility would also be considered elementary, along with minimal early mortality and morbidity. In the present era, in which the immediate outcome of TOF repair is good employing various surgical strategies, the goal of

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treatment should include the averting of long-term complications and a decreased possibility of early and late reoperations. A good neuro-developmental and functional status and quality of life could complete the expectations[4].

The principal aim of our study was to evaluate the transatrial and transventricular approaches for the primary repair of TOF by securing pulmonary valve in young children and evaluating their short term outcomes in a tertiary care cardiac health facility.

MATERIAL AND METHODS

The study was conducted from October 2016 to January 2017. This study was approved by the Institutional Ethical Review Board of AFIC/NIHD. For this study, patients with classic TOF but without important complicated features were selected. Such patients were considered to be those who underwent repair without using a valved extracardiac conduit or an orthotopically inserted pulmonary valve substitute.

All patients were diagnosed by echocardiography. Cardiac catheterization and angiography was done in which infundibular and pulmunory valvular stenosis was evaluated along with peri-membranous ventricular septal depect (PMVSD). The other variables included transpulmonary gradient, size of pulmonary valve, VSD type and LV size suitable for biventricular repair. The McGoon ratio was calculated. Patients with a McGoon ratio of <1.2 were excluded. Infants and neonates were also excluded from the study.

Patients undergoing a two-stage operation and the abnormal coronary artery course (double-left anterior descending branches, preventing a transventricular approach to repair TOF) were also excluded.

Complete repair was done with the technique of transatrial, transventricular approach VSD closure in 12 (80%) of cases while in 3 (20%) cases transventricular approach was done.

Table: Demographic and clinical characteristics.

S No.	Variables	N (%)
1.	Age (Mean ± SD)	6.73 ± 4.2
2.	Gender N (%)	Male 10(66.7%) Female 5(33.3%)
3.	Weight (Mean ± SD)	14.6 ± 11.27
4.	Cyanotic spell history (Mean ± SD)	13 (86.6%)
5.	Pre op RV-PA mean gradient (mmHg) (Mean ± SD)	79.33 ± 10.2
6.	NYHA III-IV N (%)	9 (60%)
7.	Mc Goon ratio (Mean ± SD)	1.61 ± 0.29
8.	Arrhythmias	2 (13.3%)
9.	MAPCA coiling	1 (6.7%)
10.	Previous BT shunt	1 (6.7%)
11.	Pulmonary valve status Normal Stenosis	 6 (40%) 9 (60%)
12.	Operative Technique Two patch Pulmonary valvotomy Monocusp patch ROVOTO patch Infundibulectomy	 2 (13.3%) 5 (33.3%) 2 (13.3%) 1 (6.7%) 5 (33.3%)
13.	Bypass time (min) (Mean ± SD)	103.8 ± 30.6
14.	Cross clamp time (min) (Mean ± SD)	71.08 ± 31.3

Open pulmonary valvatomy was done in 5 (33.3%) cases while pulmonary valve was normal in 6 (40.0%) of the patients. Monocusp valve designed from normal pericardium was applied in pulmonary valve stenosis when pulmonary valve size was not adequate for age and weight despite valvotomy. When main pulmonary artery

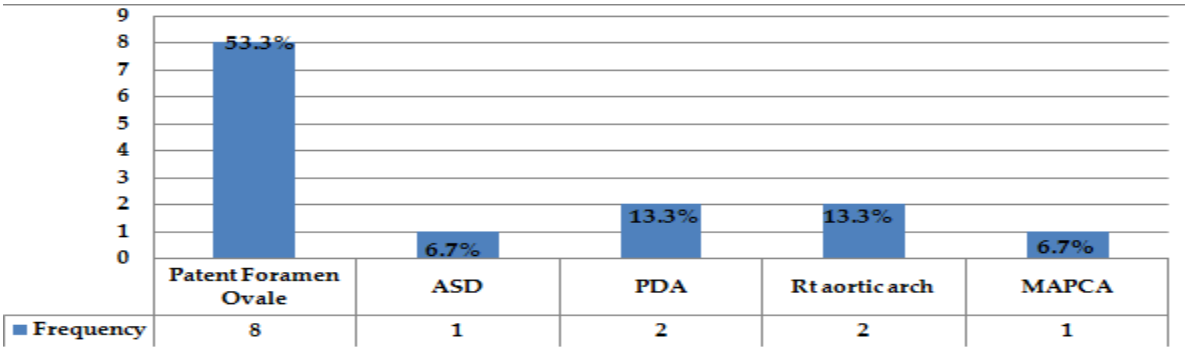

Figure-1: Associated congenital cardiac features.

was fibrotic two patch technique was done for right ventriculotomy and main pulmonary artery.

All complete repairs were performed after standard median sternotomy using a cardiopulmonary bypass with moderate systemic hypothermia (25-28°C). The patent ductus arteriosus was repaired before cross-clamping the ascending aorta to prevent lung perfusion. Antegrade cold blood cardioplegia was used for myocardial protection.

The transatrial & transventricular surgical approach was used. Visualization of the VSD was usually adequate through the tricuspid valve and was even easier after division and resection of the obstructing muscle bundles. If visualization of the VSD through the transatrial route was not adequate, a longitudinal incision was made in the right ventricular outflow, a few millimeters away from the pulmonary valve. The obstructing muscles in the RVOT were excised until the VSD could be detected clearly. Synthetic patch (Bard Sauvage filamentous knitted polyster fabric patch) was cut to the appropriate size, usually equal to the diameter of the mid ascending aorta. It was then sutured to the right side of the septum with a interrupted suture technique, with 5-0 Prolene suture on pledgets. In the region of the bundle of His, it was safer to place the sutures in the base of the tricuspid valve leaflet. Particularly in case of a very thin tissue, extra pledgeted sutures were used.

In case of a proximal narrowing in one of the individual pulmonary arteries, the incision was continued across the stenotic part. When making the incision through the pulmonary valvular annulus, an attempt at cusp preservation by making the incision through the commisure of the cusp was done. A monocusp constructed of autologus pericardium was used in these cases to preserve the function of the pulmonic valve. To assess the adequacy of the RVOT, Hegar's dilators were introduced through RVOT to assess adequacy based on normalized sizes according to for body surface area. RV/LV pressure ratio was measured by direct RV puncture to rule out any significant residual outflow tract obstruction. For a postrepair ratio of <0.7, the RVOT appeared to be reconstructed adequately. Pulmonary annulus was enlarged by a glutaraldehyde-treated autologous pericardial patch when necessary. Transesophageal echocardiography was used to evaluate the surgical result immediately.

The major aorto-pulmonary collateral arteries were evaluated by the doctor and coil embolization was performed. The patients in the study were observed during their postoperative stay in the ICU and the post operative ward.

RESULTS

A total no 15 patients were included in this study. There were 10 (66.7%) males and 5 (33.3%)

females (table). The age ranges from 2-15 years with a mean age of 6.73 ± 4.2. There was a history of cyanotic spell in 13 (86.6%) of the patients. Nine patients (60.0%) had dyspnea NYHA class III-IV. Mean McGoon ratio was 1.61 ± 0.29 (fig-1).

The tetrology of fallot surgery was done through primary repair securing the integrity of the pulmonary valve. 2 (13.32%) of the patients had repair through mono cusp valve made from native pericardium while 2 (13.32%) patients had Donhl patch to main pulmonary artery and Rt ventricular outflow tract. 6 (40.0%) of all patients had normal Pulmonary valve while 5 (33.30%) patients had open pulmonary valvotomy. One patient (6.66%) died due to septicemia after lung collapse and hemoptasis. Bilateral pleural effusion were reported in 4 patients (26.6%) and 2 patients (13.32%) developed as cities postoperatively. Superfacial wound infection occurred in 4 (26.6%) of the patients. In the postoperative phase all the patients were on ionotropic supports of Milrinone and Dopamine. Mean postoperative transpulmonary gradient was 25mmHg (fig-2).

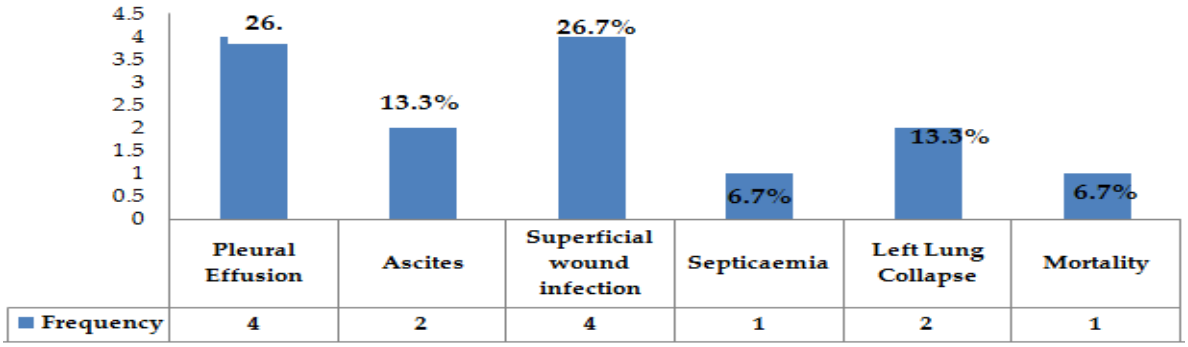

Figure-2: Postoperative outcomes of tetrology of fallot primary repair.

DISCUSSION

Tetrology of fallot is a well recognized congenital heart disease and involves the combination of ventricular septal defect, overriding aorta, right ventricular hypertrophy and pulmonary stenosis[5]. TOF has been known to exist for more than 100 years. The operative correction of TOF has been performed for more than 40 years[6]. Over the last decade despite improvement in the outcomes of surgical repair, certain issues remain under debate such as the optimal timing of surgery and the use of transatrial or a transventricular approach for the closure of VSD[7].

Right ventricular dysfunction is a significant cause of morbidity and mortality after surgical correction of tetrology of Fallot. Preservation of the right ventricular function by avoiding a right ventriculotomy and preserving function of the pulmonic valve helps in reducing postoperative outcomes[8]. Seliem etal demonstrated that among patients who underwent TOF repair before six months of age both right ventricular wall thickness and right ventricular hemodynamic function decreases significantly[9]. The total repair of TOF with transatrial transventricular approach for patients more than six months of age have mortality of 0-2%[1]. The group of the Great Ormond street documented that a total of 124 patients with transannular patch were significantly associated with RV and LV dysfunction[10]. The two patches above and below the annulus are preferable to a single patch crossing the annulus. This is according to the recommendations of the North Western university group, avoidance of a transannular patch (TAP) with the preservation of the pulmonary valve[10,11]. The preservation of pulmonary valve in case of complete AVSD / TOF has excellent long term results[3].

The present study documents the survival and clinical outcomes of 15 patients who underwent transatrial transventricular approach

for the repair of TOF with the preservation of pulmonary valve. The two patch technique and monocusp patch and pulmonary valvotomy have shown equivocal results. The morbidity in our study is attributed to local factors with only one case of mortality due to septicaemia.

Limitation of the study

This study had some limitations inherent to a single centre study. Due to small sample size, no comprehensive statistical analysis and inference could be drawn.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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