



A STUDY OF INTRACARDIAC REPAIR AND EFFECT OF TRANSANNULAR PATCHING ON RIGHT VENTRICULAR FUNCTION IN ADULT TETRALOGY OF FALLOT PATIENTS

Dr. R. Meenakshisundaram	MS, Mch, Formerly Senior Asst Professor Dept. Of Cardiothoracic Surgery, Madras Medical College Madras
Dr. Josephrajan*	MS, Mch, Director & Professor Dept. Of Cardiothoracic Surgery Madras Medical College, Madras *Corresponding Author
Dr. Shivanraj	MS, Mch, Senior Asst Professor Dept. Of Cardiothoracic Surgery Madras Medical College, Madras

ABSTRACT

This study is a hospital based retrospective and prospective analysis in a teaching hospital

AIMS AND OBJECTIVES 1.To study the efficacy of total correction in the adult TOF patients 2.To study the effect of repair on the right ventricular function 3.To study the clinical status of patients and analyse the hemodynamic data in the postoperative period.

MATERIALS AND METHODS Our study is a five year followup study of adult Tetralogy of Fallot patients who underwent surgery between August 2006 and July 2012.76 patients underwent intracardiac repair with or without transannular patching in the Department of Cardiothoracic Surgery, Government General Hospital, Chennai. We made a prospective study between Jan2014 to Jan2019 to assess the outcome of surgical correction in the study population during the study period. We made an assessment of postoperative improvement of symptomatology and exercise tolerance. We made a periodic assessment of ventricular function and development of pulmonary regurgitation and residual pulmonary stenosis by echocardiography.

CONCLUSIONS Transatrial repair is associated with a favorable outcome with lower mortality and morbidity. Patients have significant improvement in the quality of life and symptomatology.

KEYWORDS : Adult Tetralogy Of Fallot, Transtrial Repair, Transannular Patching, Rv Dysfunction

INTRODUCTION

Tetralogy of fallot is the most common congenital cyanotic heart disease. It constitutes about 10% of all congenital heart diseases. Current surgical management of TOF involves total correction in a single stage in the first six months of life. There are also adults who underwent palliative shunts in the childhood but never underwent the corrective procedure. In addition, in our part of the country a considerable number patients with well balanced TOF defect and adequate pulmonary stenosis to protect the pulmonary vasculature, will reach adulthood without any surgical intervention. The first successful repair was performed by Lillehei and Varco in 1954 using controlled cross circulation. Kirklin reported the first repair using a pump oxygenator. Kirklin and others made important contributions to the surgical correction in the form of timing of operative repair, the indications for transannular patching to relieve Right Ventricular Outflow Tract (RVOT) obstruction and the use of grafts to reconstruct the RVOT. Today surgical repair beyond infancy is an exception rather than the rule. The poor natural history indicates that hemodynamic impairment in the survivors to adulthood may indicate the less severe spectrum of TOF. Surgery after long standing cyanosis in these subgroup of cases has caused controversy although several recent studies show better long term outcomes following surgery in this subset. This study presents a five year followup of adult patients undergoing total correction for TOF in our institution.

MATERIALS AND METHODS

Our study is a retrospective and five year followup study of adult Tetralogy of Fallot patients who underwent surgery between August 2006 and July 2012, 84 patients were admitted in the Department of Cardiothoracic Surgery, GGH, Chennai, with a diagnosis of TOF. Of them 76 underwent intracardiac repair with or without transannular patching in the Department of Cardiothoracic Surgery, Government General Hospital, Chennai. We made a prospective study to assess the outcome of surgical correction in the study population during the study period and also reviewed the patients demographics, clinical status, morphology of RVOT, the different techniques used in the repair. We made an assessment of postoperative improvement of symptomatology and exercise

tolerance. We made a periodic assessment of ventricular function and development of pulmonary regurgitation and residual pulmonary stenosis by echocardiography. 9 patients died in the immediate postoperative period. 2 patients died during the followup. Sex distribution 44 patients were males. 32 patients were females. Age ranged from 11 to 27 years. The symptomatology of patients include exertional dyspnea, effort intolerance and bluish discoloration. Effort intolerance was the chief complaint in 65% of patients. Bluish discoloration was the chief complaint in 35% of cases. 10% gave a positive history of squatting. One patient gave a history of brain abscess. One patient had a BT shunt. The preoperative hematocrit ranged between 40% to 68%. Cyanosis was not seen in 5 patients. Three patients were having Down's syndrome. Preoperatively all patients were in sinus rhythm. Chest X-ray revealed left aortic arch in all patients. Preoperative echocardiography revealed Infundibular Pulmonary Stenosis (IPS) in 55% cases. Valvar Pulmonary Stenosis (VPS) and IPS in 45% cases. RVOT gradient was 55mmHg to 110mmHg. Catheterisation study was done in 30 patients. All patients had large subaortic VSD. All patients had preoperative evaluation of the size of pulmonary trunk, Right Pulmonary Artery (RPA), Left Pulmonary Artery (LPA), competency of pulmonary valve and coronary anatomy using CT pulmonary and coronary angiogram. Z value of the pulmonary annulus was identified preoperatively.

Surgical Procedure

After median sternotomy on table assessment of size of MPA, RPA, LPA was made. All patients underwent total correction under Cardio Pulmonary Bypass (CPB), moderate hypothermia and cold blood cardioplegia. After crossclamping, through transatrial approach after retracting the septal leaflet of the tricuspid valve, VSD identified and was closed with Goretex patch with interrupted mattress sutures. Adequate resection of the muscle bands in the infundibulum was done through atrial incision. MPA was also opened to assess the adequacy of resection. The required annulus size for the body surface was calculated based on the normograms and the corresponding size Hegar dilator was used to assess the adequacy of resection and the need for RVOT or transannular patching. Where necessary pulmonary annulus was incised to

achieve a relaxed dimension of 2-3mm larger than normal, RVOT/transannular patching was done with untreated autologous pericardium. Pulmonary monocusp valve was not used in our study. RVOT patch was used in 22 patients and transannular patch was used in 27 patients. Intraoperative measurement of RV/LV pressures before and after repair was done. RVOT pressures at the infundibulum and MPA before and after repair were measured and compared to detect any residual gradients and RVOTO. RV/LV pressure ratio was between 0.6 to 0.7. Length of crossclamp time ranged from 70-110 minutes and CPB time varied between 90-200 minutes. Postoperatively the duration of ICU stay, need for prolonged ventilatory support more than 48 hours and prolonged inotropic support were noted. Echocardiographic assessment of RV function and Pulmonary valve was done in the immediate postoperative period.

RESULTS AND ANALYSIS

The prospective evaluation of the patients was done by assessment of the clinical status and further investigations monthly for the first one year followed by every three months thereafter. During the followup assessment of the RV function and competency of pulmonary valve, RV dimensions, tricuspid insufficiency by periodic echocardiography. The echocardiographic evaluation of RV function was by Doppler imaging of the tricuspid annulus. The degree of pulmonary insufficiency or residual stenosis was assessed by a combination of qualitative and quantitative methods. Echocardiographic data were categorized as follows. RV dimension was categorized as normal RV or dilated RV. Pulmonary regurgitation was categorized as mild, moderate, severe. Right ventricular function was recorded as RVEF. Right ventricular dysfunction and pulmonary valve insufficiency slowly develop after repair of tetralogy of Fallot and become present in almost all patients to some degree. There were no reoperations during the study period. 19 patients required prolonged ventilation for more than 48 hours and prolonged inotropic support. Four patients underwent reexploration for bleeding. Two patients reexplored under suspicion of cardiac tamponade. On followup 38 patients were in class 1, 28 patients were in class 2. 12 patients had mild to moderate PR, 16 had moderate PR, 4 severe PR in echocardiography. All patients were in sinus rhythm. 2 patients had residual insignificant shunts. 13 patients had residual RVOT obstruction. The free pulmonary regurgitation associated with a transannular patch is thought to cause ventricular dilation and hamper ventricular function, especially during exercise. The results of our study show no significant difference in effort tolerance or significant difference in operative mortality and morbidity postoperatively between patients receiving a transannular patch /RVOT patch and those without a patch. The studies on long term outcomes after total correction in adult TOF patients are limited. There was no difference in RV Ejection Fraction between patients receiving transannular patch and those without a patch. All of our patients were in sinus rhythm during the period of study. No arrhythmias were noted. All patients were taking Digoxin and Diuretics. Prehospital and Followup echo revealed no significant shunts, but residual RVOTO was found in 13 patients. RVOT GRADIENT was 205mmHg. Overall RV and LV functions were preserved. 8 patients had mild to moderate LV dysfunction in the immediate postoperative period. One patient was readmitted one year later with severe RV dysfunction and severe PR, severe ascites and poor general condition. He failed to improve with medical management and died. The surgical correction of Tetralogy of Fallot has come a long way since 50 years. The objective of surgery at present is total correction at the age of 4 to 6 months. Despite the current shift in surgical strategy a significant number of patients present in the adulthood for surgery. Delayed presentation for surgery may be due to milder form of disease or delayed diagnosis or inaffordability of the patients for surgery. The management of adult TOF is a challenge because of the chronic hypoxia and patient is vulnerable to myocardial, neurologic, coagulation problems. Older age is also considered as an incremental risk factor for surgery, operative mortality and long term survival. In this context our study shows a considerable improvement in patient symptomatology

with lower mortality and morbidity. Our hospital mortality is 16%. It was comparable with other studies whose mortality rates are as in class 1, 5 patients in class 2 and one patient in class 3 on followup of 46 patients. Atik et al showed one patient in class 1, 10 patients in class 2 and one patient in class 3 on followup. The preoperative mean RVOT gradient was 55-110 mmHg in our series. Atik et al 40-140mmHg, Adil Sadik et al SCTIMS 50-130 mmHg. Intraoperative RV/LV pressure ratio after repair was 0.6-0.7. Adil Sadik et al showed 0.60.2.

The cause of death was low cardiac output and multiorgan dysfunction syndrome in 6 patients. 3 had postoperative bleeding. 40% patients had perioperative morbidity like prolonged ventilation and inotropic support, wound infection, elevated renal parameters. 3 patients required readmission due to Right heart failure. One patient died during followup. There were no reoperations in the study period. Postoperative and followup echocardiographic evaluation showed no residual VSD. Residual stenosis seen in 6 patients. Adil Sadik SCTIMS showed 3 cases of residual RVOTO in 39 patients. Mild to moderate PR was seen in 14 patients. Adil sadiq et al SCTIMS, study showed mild to moderate PR in 45 out of 54 patients. Atik et al showed mild to moderate PR in 9 of 39 patients. Transannular/RVOT follows, Adil sadiq et al, SCTIMS show mortality rate of 7%, Atik et al 5%, Ditterech et al 16%.

9 of our patients were in class 1, 10 in class 2 and 4 in class 3 postoperatively and on followup. Adil Sadik et al showed 40 patients patch was used in 22 of 39 patients in our study. Atik et al used patch in 17 of 39 patients. Adil sadiq et al used patch in 44 of 58 patients.

All patients were in sinus rhythm. RV dysfunction was found in 13 of 39 patients (38%). Atik et al series and our series showed preserved RV function. This may be attributed to the short duration of follow up in this study. Residual RVOTO was noted in 13 of 78 patients in our study. Bacha et al showed RVOTO in 8 of 57 patients. Adil sadiq et al showed 3 of 39 patients.

19 of our patients were in class 1, 10 in class 2 and 4 in class 3 on followup. None of the patients were cyanotic.

COMPARATIVE ANALYSIS

TABLE - 1

Parameters	Our series	Atik et al	Adil Sadik et al	Ditterech et al
RVOT gradient	55-110mmHg	40-140mmHg	53-130mmHg	-
Hospital mortality	16%	5%	7%	16%
RVOT/Transannular patching	47	17	44	9
Residual RVOT obstruction	13	3	-	-
RV/LV pressure ratio post repair	0.6-0.7	0.6±0.2	-	-
Total	76	39	88	19

CONCLUSIONS

The management of adult tetralogy is a surgical challenge due to the chronic multisystem cellular hypoxia and compensatory polycythemia, which predispose these patients to myocardial, neurologic, hematologic, and coagulation problems, as well as those related to the development of pulmonary collaterals. The hypertrophied and fibrotic right ventricular myocardium is prone to myocardial dysfunction and to ventricular arrhythmias. Transatrial repair is associated with a favorable outcome with lower mortality and morbidity. Patients have significant improvement in the quality of life and symptomatology. The need for reintervention remained very low and residual lesions requiring surgery like pulmonary valve replacement were not seen in the early followup. The major limitation in the study is the shorter period of observation and study confined to a single centre. A longer followup as is done other

comparable studies may throw light upon the long term effects of the surgical correction. It may be concluded that total single stage correction of TOF in adults may be undertaken with lower mortality, morbidity and significant improvement in functional status.

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