TOTAL CORRECTION OF TETROLOGY OF FALLOT WITH HYPOPLASTIC MAIN PULMONARY ARTERY USING PERICARDIAL BAFFLE (PATCH): EARLY HOSPITAL RESULTS

Riffat Tanveer Arif-ur-Rehman Khan Akhtar Hussain Tariq Azam Siddiqi Fazle Rabbi Salman-ur-Rehman Sohayb Asad Awan

ABSTRACT

OBJECTIVE: To evaluate the efficacy of pericardial baffle (patch) for reconstruction of hypoplastic main pulmonary artery in patients of tetrollogy of fallot during total correction.

DESIGN: Quasi experimental study.

PLACE AND DURATION OF STUDY: Department of Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Karachi.from Jan 2007 to July 2007.

PATIENTS AND METHODS: A total of 35 patients with age between 03 to 14 years with diagnosis of tetrollogy of fallot with hypoplastic main pulmonary artery undergoing total correction were selected. Pre-operative echocardiographyand cardiac catheterization were done to note Postoperative echocardiography was done on first and 2nd postoperative day and pressure gradient across right ventricle outflow tract (mmHg) and residual VSD were noted.

RESULTS: Thirty-five patients(n=35) were included in the analysis.These results showed that total correction of tetrology of fallot with hypoplastic main pulmonary artery using pericardial baffle (patch) resulted insignificant improvement in the pressure gradient across right ventricular out flow. A gradient of 15-22 mm of Hg was noted in five patients. Mortality was 17.1% patients (6 patients). Comparision of pre-operative and postoperative echocardiographic data revealed early improvement in pressure gradient across right ventricle outflow tract.

CONCLUSION: Total correction of tetrology of fallot with hypoplastic main pulmonary artery using pericardial baffle (patch) improves early pressure gradient across right ventricle outflow tract (mmHg).

Key Words:Early results. TOF.Hypoplastic main pulmonary artery. Pericardial baffle.

INTRODUCTION

Tetralogy of Fallot consists of a right ventricular outflow tract obstruction, a malaligned ventricular septal defect, an overriding of aorta, and right ventricular hypertrophy.[1] Marked pulmonary artery hypoplasia occurs uncommonly in patients with TOF and pulmonary stenosis.[4] Hypoplastic main pulmonary artery can be reconstructed with the use of homo graft, contegra graft and synthetic graft, but due to non availability of homo grafts and high cost of contegra and synthetic grafts, we started to use pericardial patch of the patient to reconstruct the hypoplastic main pulmonary artery.

We planned this study in patients of tetrollogy of fallot with hypoplastic main pulmonary artery during total correction. Objective was to evaluate the efficacy of pericardial baffle for reconstruction of hypoplastic main pulmonary artery in patients of tetrollogy of fallot during total correction.

DISCUSSION

Tetralogy of Fallot (TOF) was first described by Niels Stensen in 1672. In 1888 Etienne Fallot described its 4 anatomical characteristics.

Normal conal septum contributes to the formation of anterior leaflet of tricuspid valve. TOF is the result of anterior malalignment of the conal septum, so leads to clinical combination of VSD, pulmonary stenosis and an overriding of aorta. Anterior and superior dis-

* *Address for correspondence:*
Department of Cardiac Surgery,
National Institute of Cardiovascular Diseases
Karachi.

placement of the crista supraventricularis causes narrowing of the developing right ventricular outflow tract. A ventricular septal defect and an overriding aorta are the consequences of the septal displacement. The large ventricular septal defect equalizes right ventricular and left ventricular pressures, resulting in persistent of right ventricular hypertrophy*(The development of right ventricular hypertrophy is a result of progressive right heart failure arising from this combination and it can be minimized or even treated by early surgical repair).* Right-to-left shunting varies with the degree of pulmonary outflow tract obstruction, but it is progressive.[2, 3] It is present when McGoon ratio (diameter of right pulmonary artery plus that of left divided by diameter of descending aorta at the level of diaphragm) is less than 1.2(5). This value corresponds to a Nakata index(the combined cross-sectional area of the branch pulmonary arteries per square meter) of approximately 70(6). Children with small ratios are poor candidates for complete repair because of the inability of the small pulmonary arteries to adequately handle the increased blood flow after complete repair. A systemic- pulmonary artery shunt is placed in children with small pulmonary arteries until the arteries grow to a sufficient size to allow corrective surgery.

The mortality rates for untreated tetralogy of Fallot are progressive with patient age.Surgical treatment has greatly improved the prognosis because of the introduction of palliative shunts and corrective surgery (6).Surgical treatment options for TOF are shunt procedure and total correction. Corrective surgery widens the narrowed pulmonary valve, and the ventricular septal defect is closed.

Palliative and corrective surgery are the primary treatments for TOF. Interventional procedures have a supportive role. Balloon angioplasty performed to enlarge the pulmonary outflow tract can sufficiently improve the pulmonary circulation and allow surgery to be delayed until the infant grows large enough to improve the surgical risk. In the treatment of postoperative pulmonary arterial stenosis treatment in children, balloon angioplasty and stent placement are becoming increasingly important. In selective patient embolisation of systemic collateral arteries improve pulmonary arterial flow and development. Corrective surgery widens the narrowed pulmonary valve, and the ventricular septal defect is closed. Hypoplastic main pulmonary artery can be reconstructed with the use of homograft, contegragraft, synthetic graft and pericardial patch.

Current surgical techniques greatly improve the hemodyanmic function of the defective hearts, but does not completely correct the defect. As patients with repaired TOF often have a leaky pulmonary valve, some degree of residual right ventricular outflow tract stenosis, and damage to the electrical system of the heart from the surgical incisions. Operative risk is approximately 3% and is unaffected by age at repair. Patients who have undergone total repair of TOF often have good or excellent cardiac function after operation with some to no exercise intolerance and have the potential to lead normal lives.

Late outcome following repair of TOF is excellent with normal exercise capabilities well into adult life. Long-term studies show that these patients are at risk for sudden cardiac death and heart failure. Therefore long-term follow-up by a cardiologist is required to monitor these risks and to take any action, such as interventional procedures or re-operation, if necessary. Antibiotic prophylaxis is indicated during dental treatment to prevent infective endocarditis.

The mortality rates for untreated TOF are progressive with patient age. Surgical treatment has greatly improved the prognosis because of the introduction of palliative shunts and corrective surgery.[4] The first total repair of TOF was done by C.Walton Lillehe. Definitive repair involves the following: Right ventriculotomy, closure of VSD with a patch, excision of obstructing right ventricular outflow tract muscle or bundle and reconstruction of RVOT. Surgery to repair the defects in the heart is always performed relatively early in life. The age of child at operation and the kind of operation will depend on the child's symptoms and the precise anatomy of the defect. Generally, repair is performed on babies with TOF around 4 to 6 months of age or sooner if spells occur. If baby has a spell, repair is then done at that time no matter the baby's age.[7,8,9]

Studies on the effect of total correction of tetrology of fallot with hypoplastic main pulmonary artery using pericardial baffle (patch) with regard to Pakistani population is not avail-

able in the literature. This study was, therefore, planned to determine the early effects of correction of tetrology of fallot with hypoplastic main pulmonary artery with use of pericardial baffle (patch) in local Pakistani population undergoing surgery for proven tetrology of fallot with hypoplastic main pulmonary artery.

PATIENTS AND METHODS

This was a Quasi experimental study done at the Department of Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD), Karachi. This study was carried out over a period of six months from.from Jan 2007 to July 2007. Thirty-five male patients (children) with age between 03 to 14 years with proven tetrollogy of fallot with hypoplastic main pulmonary artery were selected. The criteria for inclusion in the study were; male patients, age between 03 to 14 years, presence of preoperative tetrollogy of fallot with hypoplastic main pulmonary artery, normal right and left pulmonary arteries, diagnosed on echocardiography, admitted through ward. The criteria for exclusion from the study were: patients with other associated cardiac abnormalities, patients with branch pulmonary artery stenosis, patients with left anterior descending coronary artery arising from right coronary artery as continuation of conus branch.

All TC (total correction) operations were done under general anesthesia with standard technique and continuous monitoring of Electrocardiography (ECG), arterial pressure, central venous pressure and arterial saturations. Dacron patch was used for VSD closure.Pericardial patch was used for reconstruction of right ventricular ouyflow tract and hypoplastic main pulmonary artery.
Patient were kept in Intensive Care Unit (ICU) for approximately 48/72 hours postoperatively and then shifted to the ward.

Pre-operative and postoperative echocardiography was done by the same experienced echo cardiographer. Postoperative echocardiography was done on first and 2nd postoperative day.Guidelines provided by the American Society of Echocardiography(ASE) were followed while documenting pressure gradient across right ventricle outflow tract (mmHg) and residual VSD. Tissue Harmonic Imaging(THI) was used. Ejection fraction(E.F) were also noted. Comparison was done between findings of pre-operative and postoperative echocardiographic documented reports.

Data analysis was performed through SPSS version 10.Qualitative data including sex,NYHA functional class, risk factors, drug history, ECG finding, x-ray finding, echiocardiographic findings (pulmonary valve, VSD and ASD) will be presented by frequency and percentage; chi-square test will be applied to compare the proportions of these variables at $p<0.05$ level of significance. Age will be presented by mean +/- SD.

Mean and standard deviation were computed for quantitative variables like ejection fraction(%), left ventricular end diastolic dimension(mm),pressure gradient across right ventricular outflow(mm Hg) and right ventricular hypertrophy(mm) for pre and post operative echocardiographic finding.

Mean and SD were also be computed for age. Pair-t-test were used to compare mean difference pre and post operative observation for ejection fraction(%),left ventricular end diastolic dimension(mm),pressure gradient across right ventricular outflow(mm Hg) and right ventricular hypertrophy(mm). pd"0.05 was considered level of significant.

RESULTS

In a 06 months period between Jan 2007 to July 2007, 35 patients undering total correction with pre-operative tetrology of fallot with hypoplastic main pulmonary artery were selected for the study. Age ranged between 3-14 years (median age 9 years).

All patients underwent surgery on cardiopulmonary bypass. Systemic cooling down to a body temperature of 28æ%C was used. Topical cooling with cold saline to complement this was employed in all the patients.

The mean cardiopulmonary bypass time was 78 minutes and mean aortic cross clamp time was 41minutes All the (100%) patients had right ventricular tract outflow tract and main pulmonary artery reconstruction with pericardial patch.

There was no significant difference between pre- and postoperative left ventricular ejection fraction (LVEF) echocardiography findings. The average gradient at RVOT level was 87

(SD mean ±30) mm Hg. After surgery it drop down to 12 (SD mean ±06) mm Hg in 29 patients and 21 (SD mean ±08) mm Hg in 6 patients.

Out of these patients, -(%) died, -of which had-, which resulted in loss of cerebral function and were unable to wake up postoperatively. Two patients who had preoperative – died on the 5th vpostoperative day. One of the patientswho expired on the operation day was –and developed intractable arrhythmias. Another patient had develop ed temponade due to postoperative bleeding which was not dected and the patient died within 24 hours postoperatively and one patient was unable to wean off from ventilator and died on the 4th postoperative day due to respiratory failure.

Total correction is a treatment of choice for patients with tetarology of fallot.

During postoperative echocardiography it was painful for vpatients to change posture and to have images by surface echocardiography from anterior chest wall close to the wound, which may have affected the echocardiographyresults.

CONCLUSION

Reconstruction of right ventricular outflow tract and hypoplastic main pulmonary artery with pericardial patch improves early pressure gradient across right ventricle outflow tract (mm Hg). This method may be a safe alternative to use of homograft or bovine, vein graft, during RV outflow reconstructions in patients of TOF with hypoplastic MPA.

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