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Cardiology

SURGICAL MANAGEMENT OF ADULT TETRALOGY- A TEN YEAR SURGICAL EXPERIENCE

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KEYWORDS :

INTRODUCTION

In the recent years there has been a considerable increase in adult patients with congenital heart disease as a result of the success made in cardiac surgery during the last 30 to 40 years. Among these patients Tetralogy of Fallot (TOF)is a frequent diagnosis.

In those who live beyond infancy it is one of the most common forms of congenital heart disease[1,2,3]. In TOF unless the natural history of the disease is modified by surgical intervention, only about 25% of the subjects live beyond 10 years of age [2]. TOF in adults represents a special subset of patients with peculiar problems namely the effects of prolonged cyanosis, polycythemia, coagulation defects, development of collaterals, secondary myocardial dysfunction and morphological and physiological consequence of previous palliative surgery[3].

Tetralogy of Fallot with its 4 components viz subpulmonary infundibular stenosis, ventricular septal defect, an aorta that overrides the VSD by less than 50% of its diameter, and right ventricular hypertrophy[4] with varying levels of severity and morphological spectrum . The most extreme form is pulmonary atresia with VSD. The single and large VSD is usually in the subaortic position. The pulmonary valve is often small and stenotic. Pulmonary artery anomalies are frequent and include hypoplasia and stenosis. Pulmonary artery hypoplasia may involve the pulmonary trunk or the branch pulmonary arteries. Occasionally, the pulmonary artery is absent, most often on the left side. Common associated anomalies include secundum ASD, AV canal defects (usually in a patient with Down syndrome), and a right aortic arch in approximately 25% of cases [1]. Coronary artery anomalies also occur, most commonly with a left anterior descending coronary artery arising from the right coronary artery and crossing the RVOT (approx.3% of cases)[1].

Sex distribution is approximately equal and malformation recurs in families, has been reported in siblings and in parents. Birth weight tends to be lower than normal, and growth and development are retarded [2, 5].

The clinical course in early infancy is often benign. Mild to moderate neonatal cyanosis tends to increase, but cyanosis may be delayed for months. Its appearance is related to increased oxygen requirements of the growing infant rather than to progressive obstruction to right ventricular outflow [2].Few patients remain acyanotic after the first several years of life, and by 5 years of age, the majority of the children are conspicuously cyanotic and symptomatic with cyanosis closely coupled to the severity of pulmonary stenosis[1,2,5,6].

TOF is essentially managed surgically, palliative in the form of various shunts or curative by various corrective surgeries. We hereby describe our experience in the management of Adult Tetralogy aged 12 years and above and present results of our retrospective analysis of patients operated upon during a 10 year period.

METHODS AND MATERIALS

We tried to review our experience in patients with TOF aged above 12 years operated at our center from January 1998 to December 2009 with emphasis on morbidity and mortality associated with surgery in adulthood and quality of life post repair.

A total of 74 patients, 12 years of age and above with a diagnosis of TOF were operated up on at our institute between January 1998 and December 2009. A retrospective review of the hospital inpatient and outpatient charts for the age, sex, weight, presence of associated conditions, presenting symptoms, preoperative NYHA class, preoperative risk factors, echocardiogram reports, cardiac catheterization reports and operative details including time of aortic cross clamp, cardio-pulmonary bypass time, post-operative need for inotropes, ventilation, post-operative complications, post-operative follow up etc. was performed . Only patients with an anatomy typical of TOF were included in the study. 49 % of the patients were below the age of 20 and only 18% in the study group were above 30 years. 74 patients underwent surgery for Adult Tetralogy. All patients underwent either total correction (n=65) or palliation (n=9). There were 52 males and 22 females. Age of the patients ranged from 12 years to 49 years. There was a definite male preponderance in our study group.52 patients were males and 22 patients were females. The mean body weight of the patients in our study was 43.04+/-43.0405 and the body surface area ranged from0.85 to 1.88 with a mean of 1.34+/- 0.18.

Routine antibiotic protocol of the institution was followed in all patients. Ketamine and Fentanyl were used during induction and non-depolarizing muscle relaxant (Vecuronium / Atracurium) was used for neuromuscular blockade. Anesthesia was maintained with O2, air, and inhalation anesthetics. Fentanyl (5-10 microgram /kg) and Morphine (0-1-0.5mg) were given before going on pump in order to maintain sedation and analgesia.

For CPB, Polystan, Affinity, Capiox oxygenators were used in our patients. The prime volume in the oxygenator was 1200ml (700ML-Ringer lactate solution and 500ml-Haesteril).Standard aortic (William Harvey special cannulae, Bard cardiopulmonary division, Model no: 1863SP) and venous cannulas (William Harvey special cannulae, Bard cardiopulmonary division, Model no: 007727 for SVC and Model no: 00772 sa8 for IVC) were used for all patients based on body weight. Pump flow was maintained between 125-150ml/kg/mt, and blood gases were adjusted according to the pH stat strategy. During initiation of CPB mannitol (0.5g/kg) and sodium bicarbonate (1ml/kg) were given. After initiation of CPB, moderate hypothermia (28-32 deg C) was induced and aorta was cross clamped. Heart was arrested by giving cold blood cardioplegia (Mod St. Thomas cardioplegia sol with procaine) through the aortic root. Ice slush was used for myocardial protection after cardiac arrest. The left side of the heart was vented through a surgically created ASD. The same dose of mannitol and sodium bicarbonate were given during rewarming. When rectal temperatures reach 36deg C, the patients were weaned off bypass.

SURGICAL TECHNIQUE

Midline sternotomy and pericardial patch was harvested in all patients.

In patients with previous shunt surgery the shunt was looped before systemic CPB commenced in all patients with aortobicaval cannulation with moderate hypothermia. MPA, RPA and LPA dissected beyond its bifurcation. The aorta was cross clamped and cold blood cardioplegia is given down the root (calculated dose of 20 ml/ kg). Topical ice cold saline was used for surface cooling. Repeated doses of cardioplegia were used to maintain the arrest. Right atriotomy was done. Surgical ASD was created to vent the left heart. Oblique right ventriculotomy is done avoiding any major coronary artery branches. The size of the pulmonary arteries are indexed to the full and half sizes according to the 'Z' value method and appropriate sized Hegar`s dilator passed across the pulmonary valve in to the main pulmonary artery and the two branch pulmonary arteries. Incision was extended across the annulus, on to the MPA, across the pulmonary valve, and on to the MPA beyond the valve depending on the extent of pulmonary valve stenosis. Only one cusp of the pulmonary valve is excised if needed. Hypertrophic infundibulum then excised. Ventricular septal defect was closed with a Dacron patch using interrupted pledgetted sutures. Cross clamp was released after deairing. Then RVOT was then widened with a pericardial patch on a beating heart.

In patients who underwent Rastelli operation, proximal end of the pulmonary artery was closed in 2 layers with 5-0 prolene, followed by Oblique right ventriculotomy, excision of the hypertrophied infundibulum .The VSD closure with Dacron patch. Then using pulmonary valved conduit (Bovine jugular -Contegra conduit), the distal end was sutured to the distal end of the transected PA followed by PFO closure and routine deairing. The proximal end was fashioned in such a way to anastomose to the right ventriculotomy site and then anastomosis carried out on beating heart. Two temporary epicardial pacing wires are placed on the RV surface. Inotropic support is started and patient weaned off bypass. .The RV pressure recorded and Protamine given for complete heparin reversal. Haemostasis and standard closure followed. The patient is then transferred to the ICU with endotracheal tube in place.

Postoperatively ventilation was accomplished with the Servo Ventilator (Siemens- Elema AB, Solna, Sweden) in all patients with endotracheal tube or nasotracheal tube (for small children). Patients were ventilated in the pressure controlled mode with a tidal volume of 6-8 ml/ kg. The minimum inspired oxygen fraction that provides acceptable arterial oxygen saturation was used (usually 50% of oxygen).

Inotropic dosage was adjusted according to the hemodynamic status and all the inotropes were usually continued till the time of extubation. Various inotropic agents used in our patients were Adrenaline, Calciumgluconate, Dopamine, and Dobutamine. All the inotropes gradually tapered, twelve hours after extubation if the patient was haemodynamically stable.

STATISTICALANALYSIS

Perioperative data were collected through retrospective review of hospital records. Outcome analysis included early mortality (defined as death during postoperative hospitalization) and morbidity, cardiopulmonary bypass time, aortic cross clamp time, Mean duration of ventilation, total number of days stay in hospital and postoperative follow up at the end of six months, 1 year, 5 years and 10years were also reviewed. Those who did not come for regular follow up were enquired about their status by postal letter and telephonic interview. Data are expressed as mean values, standard deviations, and range.

All study variables were summarized either using frequencies and percentages or using means and standard deviations. Bar and pie charts were obtained to represent percentages using Excel applications. Statistical processes were conducted with Epi info version3.5.1 for Windows package (EPI INFO is a trademark of the Centers for Disease Control and Prevention (CDC).)

RESULTS

The patients who presented to us with the diagnosis of Tetralogy were operated after thorough evaluation. The predominant symptom at presentation for the TOF in the adult patients was dyspnoea on exertion. Cyanosis was present in 65 patients (87.8%) & respiratory tract infections in 8(10.2%) patients. Initial palliative procedures were done in 6 patients. 4 patients had modified Blalock–Taussig shunt and one patient had a central shunt and one patient had Potts shunt at the age of 13 years.

At presentation 2patients were in NYHA class I, 64 patients in NYHA Class II and 8 patients in NYHA Class III

On clinical examination 70 patients had cyanosis and all patients had clubbing of these 22 patients had grade III clubbing. Electrocardiogram showed all patients to be in normal sinus rhythm with 14.9% having incomplete Right bundle branch block .Preoperative cardiac catheterization revealed the presence of atrial septal defect in 6 patients (8.1%); Coronary artery anomaly in 5 patients, aortomitral continuity was absent only in one patient with all other features classical of Tetralogy. Collaterals were found in 33patients. Additional VSDs were not seen in any of the patients. All the ventricular septal defects were in subaortic position. Degree of aortic override was between 25-50% in 19, 50 to75% in 43, and 75-90% in 9 and more than 90% in only one patient. Pulmonary Artery Anatomy as analysed by the CATH study were indexed and standerdised using McGoon ratio. The normal sizes of the MPA, RPA and LPA were compared with the normogram according to body weight. The Main pulmonary artery was normal in 53(71.6%) patients, small in 16(21.6%) and atretic in 5 (6.8%) patients. The Left pulmonary artery was absent in one patient, small in 12 patients. Only 10 patients had small RPA [Table 1]. All the patients underwent either palliative or corrective surgery based on cath findings or anatomy at the time of surgery. 9 patients underwent palliative shunt surgery and 65 patients had corrective surgeries. Out of the 9 palliative shunts, 7 were central shunts and the 2 were modified Blalock-Taussig shunts .Out of the 65 patients who had corrective surgery 43 patients underwent Transannular patch,13 patients had RightVentricular patch only ,8 patients had Rastelli operation and one patient had Infundibular resection with ventricular septal defect closure. Intraoperatively, various lesions encountered are enlisted [Table 2]. Two patients underwent aortic valve replacement along with transannular patch repair; two patients had associated ligation of patent ductus arteriosus along with intracardiac repair. Potts shunt take down was done under total circulatory arrest. Another patient had right BT shunt takedown through right thoracotomy.

The mean total bypass time for patients who underwent total correction was 124.16 minutes and the mean cross clamp time 71.4minutes [Table 3] shows the CPB and cross clamp times for the various corrective groups.

In the postoperative period 20 patients required high ionotropic support (High Ionotropic requirement in this study defined as requiring more than 0.2microgram infusion of adrenaline per hour and/or simultaneous requirement of noradrenaline, adrenaline and dopamine) out of the total number of patients who underwent both palliative and corrective surgery. Out of 13 patients who had RV patch only 2(27%) patients required high supports. 13 out of 43(30.2%) and 3 out of 8(37.5%) patients who had transannular patch and Rastelli required high supports. Two patients following shunt surgery also required high supports. Sixteen patients who underwent corrective surgery developed ECG changes in the immediate postoperative period .Three patients had complete heart block out of which only one needed permanent pacemaker. Right bundle branch block was the most common electrocardiographic abnormality. One patient had a bifascicular block.

The most common complication noted in our patients after surgery was bleeding. It was seen in one patient with RV PATCH, 4patients with TAP, and 2 patients with Rastelli operation. Reexploration was done for the same. One patient had mild pericardial effusion which was managed conservatively. Six patients following TAP had pleural effusion and were managed with tube thoracostomy. Three of the patients developed features of congestive cardiac failure which was managed with fluid restriction, diuretics and digoxin.

The mean postoperative hospital stay for patients who underwent corrective surgery was 10 days. The mean hospital stay was 10.5+/-3.0daysin RV patch group, 11.89+/-6.28days in the TAP group and 11+/-4 days in patients who underwent Rastelli operation.

Two patients were lost to follow up with no post-operative reviews which included one patient who had transannular patch and one patient who had shunt. Duration of follow up, ranged from 1 month to 10 years, Majority of the patients were in NYHA CLASSI. All the patients were either in NYHA classI or classII. 60% of the patients who had TAP were in ClassI and remaining in NYHA class II. 85% of the patients who underwent Rastelli procedure was in NYHA class I.

Majority of patients (79.5%) after transannular patch repair had conduction defect, 33 patients had right bundle branch block, 1 patient needed permanent pacemaker and one patient had left posterior fascicular block. RBBB was present in 27% of RVOT patch, 71% of Rastelli group (Table4).

Echocardiography done at review showed one(8.3%) residual VSD for RV patch group, while 6 patient (17.14%)in transannular patch had small hemodynamically insignificant VSD and in one patient in whom VSD was not closed due to intraoperative arrhythmia in a severely hypertrophic right ventricle waiting to be closed at a later date. One patient (14.2%) with Rastelli also had a tiny residual VSD. The overall incidence of residual VSD in our study was 14.5%.

3(27.3%) patients following RV patch had mild pulmonary stenosis while 15(46.9%) patients had mild pulmonary stenosis following transannular patch repair with one patient having moderate pulmonic stenosis. 2 (28.6%)patients following Rastellies repair also had mild pulmonic stenosis.

At review mild Tricuspid regurgitation(TR) was present in 24(75%) patients with transannular patch,4 patients(12.5%) had moderate TR,4 patients(36.4%) with RV patch alone had moderate TR ,6 patients who had Rastelli had mild TR .65.6% had pulmonary regurgitation(PR) following transannular patch repair out of this only 2 (6.5%) patients had moderate PR. 2 patients (28.6%) who underwent Rastelli operation had PR an in the RV patch group six patients (50%) had mild regurgitation.

Analyzing mortality, 9 patients died after total correction, of this 7patients had transannular patch including two patients who had aortic valve replacement and one each of Rastelli and RV patch .Disseminated intravascular coagulation was the cause of death in 3 patients .ARDS was the cause in one patient, septicemia in 2 patients and low cardiac output in the rest. Two patients had associated aortic valve replacement for severe aortic regurgitation. Most of the patients had preoperative bleeding tendencies with numerous aortopulmonary collaterals on angiography.one had history of PTB. There were no late deaths in patients who underwent corrective surgery. Two patients who had palliative shunt expired, 2 years and 6 month after procedure. Both were sudden death, cause unknown.

We studied the follow up of the patients in the surviving group of patients for the various morbidity data including - NYHA class, need for reoperation secondary to restenosis, evidence of pulmonary regurgitation and evidence of right ventricular dysfunction. All the patients followed were either in NYHA classes I or II. None had reoperations, all were acyanotic and had marked reduction in clubbing .Most were on no medications except in patients who underwent Rastelli who were on aspirin and prophylactic antibiotics during dental care or other invasive procedures.

DISCUSSION

Among adult patients with congenital heart disease, Fallot`s Tetralogy is a frequent diagnosis. The natural history of this anomaly is bleak; 50% of patients are dead by 3 years of age. Nevertheless, Tetralogy of Fallot remains the form of cyanotic heart disease in which patients frequently may survive for longer than 21years[3]. The oldest patient who underwent surgery in our study group was 49 years old and was being still followed up at 10 years after surgery.

Historically, palliative operations were a major therapeutic advance with increased the pulmonary blood flow by creating a systemic to PA anastomosis such as the Blalock Taussig, Waterston or Pott`s shunt. These procedures improved oxygenation, promoted PA growth and enhanced exercise capacity. Approximately 75% of palliated patients survived longer than ten years [4]. Potential Sequelae of these shunting procedures include pulmonary hypertension from excessive blood flow, anatomic distortions of the branch PA`s and a chronic overload of the left ventricle.

Consequent to tremendous improvement in surgical techniques and methods of myocardial protection, the morbidity and mortality following repair of TOF has drastically reduced .The present day consensus is to perform total correction at the earliest preferably during infancy if the anatomy is suitable. This probably explains the lesser no of previous palliative surgery in our study group (n=7) compared to John, Kejriwal, Ravikumar et al[12] n= 27(200), Presbitero et al[7] n=28(40), Horer et al[8] n= 45(52).

In our study ,19 patients had complications of Tetralogy of Fallot prior to surgery and most of these were due to the presence of collaterals(haemoptysis in 16pts).This is comparable to the experience of Stanley john et al[12], Presbitero et al [7], Balram Airan et al[11]. Seven patients had previous palliative procedure, out of which one patient had Potts shunt, four patients had corrective surgery and one patient had a central shunt secondary to blocked BT shunt after 37 years and died after two years after surgery due to unknown cause, two other patients had repeat shunt due to blocked shunt after 13 and 15 years. Two patients underwent Rastelli operation and the other two had Transannular patch repair. Potts shunt take was done under total circulatory arrest.

The association of right aortic arch with TOF in our study was 13.5%, while 14.8% of patients had a patent foramen ovale. Left SVC was 5%, Atrial septal defect in 5.4% of patients. Bicuspid pulmonary valve was seen in 12.16% of patents while 4% of patients had bicuspid aortic valve .One had the association of coronary arteriovenous fistula .One patient had absent left pulmonary artery .World literature describes less than 100 cases of surgical treatment of TOF associated with unilateral absence of pulmonary artery[10]. The left lung was being supplied by collaterals from subclavian artery. Bockeria et al[10] recommended that in TOF associated with unilateral absence of pulmonary artery primary complete repair is indicated with a normal size of the contralateral pulmonary artery (Nakata index greater than 200mm /m sq. and Z score more than -2) or its mild hypoplasia (Z score equal to or less than -2 but more than -4).

The major immediate postoperative complications noted were bleeding from the surgical site seen in 10% of patients. Surgical enlargement of the right ventricular outflow tract with transannular patch did not influence degree of pulmonary regurgitation compared to right ventricular patch. This is comparable to the results of H.Miyamura et al[13] and d'Udekem et al [14] who concluded that in TOF, transannular patching does not result in a worse late functional outcome than patching of an incision limited to the right ventricle. Both are responsible for a similar degree of long term pulmonary insufficiency and right ventricular dilatation.

Out of 65 patients who underwent corrective surgery 8 patients had small residual ventricular septal defects (12%) on echocardiography none of which produced any significant haemodynamic abnormality, only one patient had a large VSD, which was left open because of repeated intraoperative ventricular arrhythmia with severe hypertrophic right ventricle .Only one patient had moderate residual pulmonary stenosis without any symptoms. Moderate pulmonary regurgitation was present in 3 patients without any symptoms.

We had low operative mortality, similar to that in pediatric age group, and offered marked symptomatic relief in most cases similar to studies by Cooley et al [18] and In Soopark et al[9]. Long-term survival is excellent, but late sequelae become more frequent with longer follow-up. Most survivors were in NYHA functional class I or II. Whenever anatomically feasible, adults with TOF should undergo total correction regardless of the presence or absence of symptoms and regardless of any previous, palliative procedure. The greatest benefit of complete repair at this age was the functional improvement. On the other hand, late complications closely related to chronic hypoxia, such as arrhythmia and ventricular dysfunction might direct for a more careful follow-up after the surgical correction.

In our study the mortality rate was 13.8% which is comparable to Allen S et al [16] (11%), and John et al [12] (12%).The mortality has been directly related to postoperative hemorrhage. Low cardiac output continues to be the cause of death following total surgical correction. .Six (66%) out of 9 deaths were the result of this factor. There was no correlation with polycythemia and mortality .The mean hemoglobin in the mortality group was 21.4+/-3.1 while the total study group had a mean of 18.7+/- 11.9[12, 17].

In our patients the incidence of residual VSD was only 15% but was without any evidence of congestive cardiac failure or any haemodynamic compromise.VSD were detected echocardiographically during routine follow up. Since the patients were asymptomatic no further investigation were done and is being routinely monitored.

All the patients followed up were well active and completely rehabilitated six months to ten years after total intracardiac repair. The

changes proved most important in enabling them to adopt an entirely different outlook on life. None had evidence of congestive cardiac failure. Majority had complete right bundle branch block. (82%).This is similar to the studies of Horowitz and Kay woon Ho et al[18,19].

Residual right ventricular outflow tract obstruction following total correction is less common in adults than in children most probably because of milder degrees of right ventricular outflow tract narrowing .None of our patients had significant right ventricular outflow tract obstruction.The mean Left ventricular ejection fraction in the follow up group was 58%.RV volume overload seems to alter LV function under exercise. RV dilation affects the geometry of the interventricular septum to prevent the LV from appropriately changing shape or accommodating an increased preload during diastolic filling. Moreover, fibrosis or hypertrophy of the septum, induced by chronic overload, could adversely affect systolic function [20]. Therefore, rather than inflow disturbances, impairments of contractile reserve due to myocardial damage in the septum may be one of the major causes of the LV dysfunction during exercise. However, this issue regarding relations between LV dysfunction and myocardial damage in Tetralogy may require more direct evidence and further studies combining radionuclide ventriculography, myocardial perfusion, and metabolic imaging[20].

Follow up has not been long enough to allow us to draw any conclusions about the effect of operation on late survival. Nevertheless it is quite encouraging that we have observed no late cardiac related deaths to date. Moreover, the quality of life has been substantially improved all the followed up patients up patients following corrective surgery has resumed normal physical activity. Two women had uneventful pregnancy.

We are aware that there are a number of limitations to this study. First, this report is a retrospective review of our institutional approach to the management of this congenital malformation, and the patients were not treated according to a randomized protocol. Second, because of selection of a rather homogeneous, but high-risk, group of patients with Tetralogy of Fallot with pulmonary stenosis, the number of patients in our study is small. This limits us in performing meaningful statistical comparisons between subgroups of patients and in drawing specific inferences regarding the best management approach. The question of whether a right ventricular patch, transannular path or Rastelli operation is best cannot be answered by this study.

Nevertheless we recommend that, whenever anatomically feasible, adults with Tetralogy of Fallot have total correction regardless of the presence or absence of symptoms and regardless of any previous, palliative procedure.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

Ethical approval was obtained from the Institution Ethics Committee prior to the commencement of the study.

Informed consent

As this was a retrospective study involving data obtained from our hospital database, informed consent was obtained from the patients at the time of admission. However, no patient information or any form of identity has been disclosed in this study.

Table 1 Pulmonary artery anatomy

Variable	Frequency (n = 74)	Percent
MPA		
Normal	53	71.6
Small	16	21.6
Atresia	5	6.8
LPA		
Normal	61	82.4
Small	12	16.2
Absent	1	1.4
RPA		
Normal	64	86.5
Small	10	13.5

MPA-main pulmonary artery, LPA- Left Pulmonary artery, RPA-Right Pulmonary artery

Table 2 Associated lesions

ASSOCIATED CARDIAC LESION	FREQUENCY
LSVC	5
OS ASD	4
PDA	2
RIGHT AORTIC ARCH	10
DEXTROCARDIA	1
PFO	11
ABSENT LPA	1
SUBAORTIC MEMBRANE	1
BICUSPID AORTIC VALVEVvVALVE	3
BICUSPID PULMONARY VALVE	9

LSVC-left superior venacva,OS ASD-ostium secendum atrial septal defect, PDA-Patent ductus arteriosus

PFO- Patent foramen ovale

TABLE 3 BYPASS TIME AND CROSS CLAMP TIME IN THE THREE GROUPS (MINUTES)

Patients	(IN MINUTES)	MIN	MAX	MEAN	STD DEVIATION
RV Patch	BYPASS TIME	67	153	122.5	53.08
	CROSS CLAMP TIME	42	124	65.61	26.64
Transannular patch	BYPASS TIME	75	105	122.2	27.24
	CROSS CLAMP TIME	42	54	73.44	29.85
Rastelli	BYPASS TIME	54	179	138.65	19.70
	CROSS CLAMP TIME	28	95	70.75	09.52

RV- Right ventricular

Table 4: Post Operative Conduction defects

SURGERY	Complete block	RBBB	LAHB
1. RV patch	0	3	0
2. Trans Annular Patch	1	33	1
3. Rastelli Procedure	0	5	0
4.Infudibulectomy	0	1	0
TOTAL	1	42	1

RBBB- Right bundle branch Block, LAHB- Left anterior hemifascicular block

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