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Retrospective Study of Clinical and Surgical Outcomes in Rastelli Precedure over the Last Ten Years

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Abstract: ***Aims and Objectives: 1. To review our experience in Rastelli procedure. 2. To assess the risk factors for early mortality/morbidity and late deaths. 3. To determine the early and mid term outcome following surgery. Materials and Methods: Patients from January 2009 to January 2019, 24 patients underwent Rastelli procedure. All the operative and post operative records were available for 22 patients. Conclusion: Rastelli operation is low risk procedure which is done for various complex congenital malformations which are classified either morphologically (as conotruncal abnormalities) or surgically (as right ventricular-pulmonary artery discontinuity) like TGA, VSD and PS, TOF with Severe PS, TOF with PA, DORV, VSD and PS, Truncus Arteriosus.***

Keywords: Rastelli, risk factors, conotruncal

1. Introduction

In 1969, Rastelli and colleagues successfully developed a new surgical procedure for complete repair of the Transposition of the Great Arteries associated with pulmonary stenosis and ventricular septal defect based on redirection of ventricular outflows: an intraventricular tunnel repair (left ventricle to aorta), with closure of proximal pulmonary artery and restoration of right ventricle to pulmonary artery continuity with a valved extra cardiac conduit .Similar procedures have since been collectively referred to as the "Rastelli operation".

Right ventricular to pulmonary artery (RV-PA) conduits have made it possible to repair many complex congenital cardiac lesions. These lesions include:

1) Tetralogy of Fallot with severe pulmonary artery stenosis. (T`OF with PS)
2) Double outlet right ventricle with ventricular septal defect with pulmonary artery stenosis. (DORV with VSD and PS)
3) Pulmonary atresia with ventricular septal defect. (PA with VSD)
4) Transposition of great arteries with ventricular septal defect and pulmonary stenosis. (TGA with VSD and PS)
5) Corrected transposition (L-TGA) of great arteries with ventricular septal defect and pulmonary stenosis.
6) Truncus arteriosus.

From a surgical view point, all these lesions are characterized by the absence of a satisfactory anatomic continuity between the pulmonary arterial system and the right side of the heart and is usually associated with a VSD. Therefore, as a surgical problem, the solution is (1) closure of the VSD sothat the left ventricle ejects directly and into the aorta, (2) establishment of continuity between the right heart and the pulmonary artery with the use of a valved external conduit and (3) interruption of major connections between the aorta and pulmonary arteries.

The use of RV-to-PA conduits in these young patients allows an early biventricular repair which ensures normal pulmonary blood flow and pressure, and minimizes volume and pressure loading on the developing RV

Aims and Objectives

1) To review our experience in Rastelli procedure.
2) To assess the risk factors for early mortality/morbidity and late deaths.
3) To determine the early and mid term outcome following surgery.

2. Materials and Methods

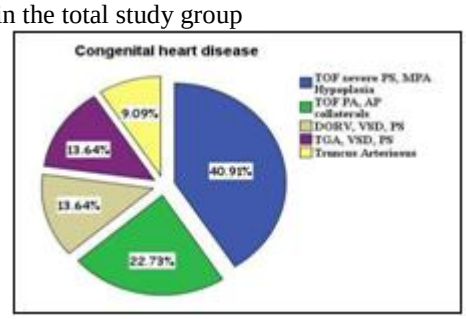
Patients

From January 2009 to January 2019, 24 patients underwent Rastelli procedure. All the operative and post operative records were available for 22 patients. Two patients were excluded from this study because of unavailability of proper records. All these patients underwent surgery using similar operative technique under the experience of single senior surgeon. 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 included time of aortic cross clamp, cardio-pulmonary bypass time, post operative need for ventilation, post operative complications, post operative follow up etc was performed . The distribution of congenital heart diseases among the 22 patients is listed in Congenital cardiac defects included Tetralogy of Fallot with severe with main pulmonary artery hypoplasia (TOF,PS,MPA hypoplasia, n=9), Tetralogy of Fallot with pulmonary atresia with aortopulmonary collaterals (TOF,PA, n=5), Double outlet right ventricle with ventricular septal defect with pulmonary stenosis, (DORV,VSD,PS n=3), Transposition of great arteries with ventricular septal defect with pulmonary stenosis (TGA,VSD,PS n=3), Truncus Arteriosus type 1 and type 2 (TA n=2).

Table 1: (N=22)

S. No	Congenital Hheart Disease	Patients in each Group	%
1.	TOF, PPS, MPA Hypoplasia	9	40.90%
2.	TOF, PA, AP-collaterals	5	22.72%
3.	TGA, VSD, PS	3	13.63%
4.	DORV, VSD, PS	3	13.63%
5.	Truncus Arterious type 1 and type 2	2	9.09%

Pie chart representing the contribution of congenital heart disease in the total study group



Intial palliative procedures were done in 3 patients. All 3 patients had TOF with PA. The age at which shunts performed was at age of 1 year, 4 year, and 18 years respectively. Two patients had right side modified Blalock–Taussig shunt and one patient had left modified Blalock-Taussig shunt respectively.

The mean age of patients at operation was 136.36 months (range 12 months to 456 months). The mean body weight at definitive correction was 26.46 kg (range 7kg to 65kg). The mean body surface area (BSA) 0.94 m2 (range 0.38 to 1.82m2). There were 40.90% (n=9) females and 59.09% (n=13) males in our study group.

Demographic data	Mean Value	Range
1. Age (months)	136.36 months	12-456 months
2. Weight (Kg)	26.46 kg	7-65 kg
3. BSA (m^2)	0.94m^2	0.38-1.82m^2

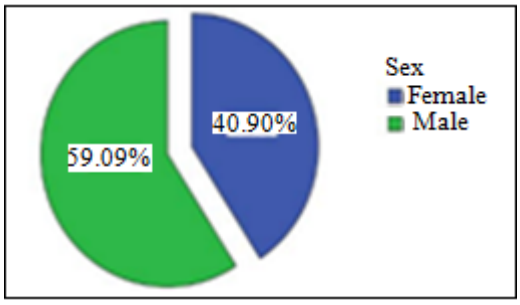


Figure 2: Sex Distribution

Cyanosis was most common presenting symptom and seen in all patients. Dyspnoea on exertion and recurrent respiratory tract infection was seen in 86% (n= 19) and 27% (n= 6) of patients respectively. Clubbing was observed in all patients. Cyanotic spell and squatting equivalent was seen in 40% (n=9) and 40% (n=9) of patients respectively. History of delayed miles stones was present in 27% (n= 6) patients. Failure to thrive was present in 1 patient.

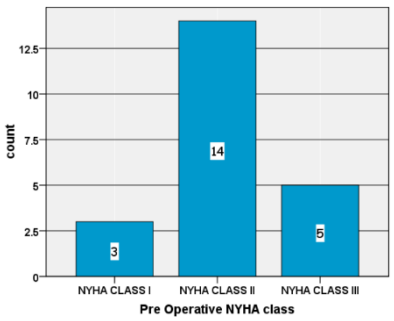
Table 5: Symptoms

S. No.	Symptoms	Total
1	Cyanosis	22 (100%)
2	Dyspnoea on exertion	19 (86%)
3	Cyanotic Spell	09 (40%)
4	Squatting Equivalent	09 (40%)
5	Respiratory Tract infection	06 (27%)
6	Failure to thrive	01 (4.5%)

Preoperative management

In the preoperative period about 3 patients were in NYHA Class I. 14 patients were in NYHA Class II, 5 patients in NYHA Class III. All patients were on tablet Inderal during the preoperative period, and was stopped 48 hours before surgery. None of the children required mechanical ventilation in the immediate preoperative period. None of patients had renal failure or features of septicemia before surgery. There was no history suggestive of seizure or other abnormal involuntary movement in the study group. None of the patients had atrioventricular block in the preoperative period.

Figure 3: Pre-operative NYHA class



Preoperative Diagnosis

Echocardiogram and Cardiac catheterization was done in all patients. The mean preoperative hemoglobin concentration was 15.2gm/dl (range9.5-23.5gm/dl). The mean hematocrit was 53.6 % (range 37.5-70.5%). INTRAOPERATIVE MANAGEMENT Anesthetic management Patients were kept nil per mouth for a minimum of six hours for solids and formula feeds, 4 hours for breast milk for children and 2 hrs for clear fluids prior to surgery. Only children were pre-medicated with syrup Trichloryl at a dose of 75-100 mg per kg body weight about 1 hr prior to surgery. Beta-blockers were gradually withdrawn and stopped 2 days prior to surgery in all patients. Small children were induced with either Halothane (0-5%) or with Sevoflurane (0-8%) with addition of oxygen. Fentanyl (1-2microgram /kg) was used during induction and non- depolarizing muscle relaxant (vecuronium/atracurium) was used for neuromuscular blockade.Anesthesia was maintained with O2, air, and inhalation anasthetics.

Fentanyl (5-10 microgram /kg) and Morphine (0-1-0.5mg) were given before going on pump in order to maintain sedation, analgesia and also to reduce systemic inflammatory response to CPB. All the blood products were given via blood filter. At the end of the procedure, oral endotracheal tube was changed to nasal position in children before shifting to Intensive care unit. Cardiopulmonary bypass (CPB) The CPB circuit used was a MINIMAX,

Medtronic, USA, prime membrane oxygenator with ¼ inch arterial and venous lines for children less than 7kg body weight and ¼ inch arterial and 3/8 inch venous for patients with body weight between 10-20kg. The static prime volume in the oxygenator was 135ml, 175ml in the A-V loop and 125ml in the pump head. Children underwent hemodilution to a hematocrit value of 20-25% with the use of Ringer lactate solution and the balance of the total priming volume was complemented with whole blood. For adults POLYSTAN oxygenator was used and the prime volume in the oxygenator was 1200ml (700ML-Ringer lactate solution Standard and 500ml-Haesteril). 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 (280C) was induced and aorta was cross clamped. Heart was arrested by giving cold blood cardioplegia 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 and calcium gluconate added if whole blood was added in to the prime. When rectal temperatures reach 360C, the patients were weaned off bypass.

Surgical Technique

All patients had routine midline sternotomy. Two patients had additionally thoracotomy done (one had left thoracotomy done for PDA ligation and other had right thoracotomy done for Modified BT shunt ligation).

The principle of Rastelli procedure is illustrated in the above figures.

a) Illustrates the anatomy of TGA with VSD with LVOTO.
b) The VSD was not closed but an intracardiac tunnel was constructed to connect the left ventricle to the aorta with the large prosthetic patch.
c) The pulmonary artery was transected, its proximal end oversewn and the continuity between right ventricle and the pulmonary artery was reestablished with an external valve bearing conduit.

Sternum was splinted with PVC tubing in 12 patients and skin and muscle was closed over it in one layer. The patient was transferred to intensive care unit with endotracheal tube in place, for elective ventilation.

Post Operative Management

Ventilation was accomplished with the Servo Ventilator (Siemens – Elema AB, Solna, Sweden) in all patients with endotracheal tube or nasotracheal tube. Patients received ventilation in the pressure controlled mode with a tidal volume of 10-12ml/kg. The minimum inspired oxygen fraction that provides acceptable arterial oxygen saturation was used. (usually 50% of FiO2).

Sedation and analgesia consisted of a continuous infusion of Fentanyl at a dose of 5-10 microgram/ kg/ hr for all children till 4 hours prior to extubation. For adult patients sedation and analgesia consisted of intermittent boluses of Morphine and Midazolam. Neuromuscular blockade was accomplished with intermittent boluses of Vecuronium/Atracurium

Various inotropic agents used in our patients were Adrenaline, Calcium gluconate, Dopamine, and Dobutamine. Inotropes dosage was adjusted according to the hemodynamic status and all the inotropes were usually continued till the time of extubation.

All the inotropes were gradually tapered, twelve hours after extubation if the patient was haemo-dynamically stable. All patients received perioperative antibiotics. The standard antibiotic regimen consisted of a combination of Cefuroxime (second generation Cephalosporin) and Gentamicin (Aminoglycoside). Antibiotics was continued minimum of five days after surgery in all patients.

All patients were discharged on Tab. Ecospirin and Tab. Warfarin (dose to be adjusted according to INR) for 3 months in addition to digoxin and diuretics and then reviewed in follow up.

3. Data Collection and Analysis

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, temperature fall during CPB and pH management (pH stat or alpha stat). Mean duration of ventilation, total number of days stay in hospital and post operative follow up at the end of six months, 1 year, 4 years were also reviewed. Those who did not come for regular follow up were enquired about their status by postal letter.

Data are expressed as mean values, standard deviations, and range.

Continous variables were compared by the Mann-Whitney U test. A p- value of less than 0.05 was considered statistically significant. Statistical processes were conducted with SPSS11.0 for Window package (SPSS Inc., Chicago)

4. Results

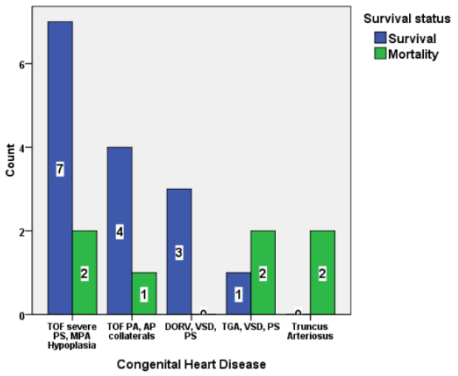
Overall survival rate in the study was 68.18% (15/22) and mortality was 31.80% (7/22). Mortality included early and late deaths. Early mortality means hospital mortality and late mortality means death during follow up. Depending on the end results following surgery, two groups could be identified: a survival group and a mortality group.

Table 6: Survival group and a mortality group

S. No	Study Group	Patients (n=22)	Survival 15(68.18%)	Mortality 7(31.80%)
1.	TOF, PPS, MPA Hypoplasia	9	7 (77.77%)	22 (22.22%)
2.	TOF, PA, AP-collaterals	5	4 (80%)	1 (120%)
3.	TGA, VSD, PS	3	1 (33.33%)	2 (66.66%)
4.	DORV, VSD, PS	3	3 (100%)	-
5.	TRUNCUS ARTERIOUS	2	-	2 (100%)

Of the 7 patients who died, there were 6 (27.27%) early deaths and 1 (6.25%) late death which occurred 10 months following surgery.

Figure 5: Representing the Survival and Mortality



Mean Age in study population

In our study, the mean age of children was 120.8 months in the survival group (range 12 months to 216 months). The mean age in the mortality group was 169.71 months (range 12 to 456 months). The mortality seems to be high in higher age group but it is not statistically significant.

Table 7: Mean age

Study group	Mean age in months	p-value (0.05)
Survival	120.8+/-64.37	0.92
Mortality	169.71+/-163.28	

Table 8: Overall age distribution in both groups in months

Study group	<120	120-240	>240	Total
Mortality	3	2	2	7
Survival	7	8	0	15
Total	10	10	2	22
Mortality	30%	20%	100%	31.8%

Weight

The mean body weight in the survival group was to 25.05 kg (range 10 to 48kg) and in the mortality group was 29.5kg (range 7 to 65kg). Weight difference in both groups was not statistically significant.

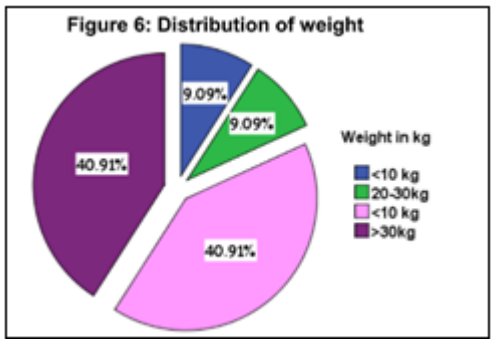
Table 9: Weight

Study group	Mean body weight in kg.	p-value (0.05)
Survival	25.05+/-13.4	0.70
Mortality	29.5+/-21.25	

Table 10: Overall distribution of weight in both groups in kg.

Study group	<10	10-20	20-30	>30	Total
Mortality	1	3	0	3	7
Survival	1	76	2	6	15
Total	2	9	2	9	22
Mortality	50 %	33%	0%	33%	31.8%

Figure 6: Distribution of weight



Sex

In the survival group, 53.3% were males and 46.7% were females. Inmortality group 28.6% were females and 71.4% were males. The p value (0.64) was not statistically significant.

Table 11: Sex Determination

Study group	Male	Female	Total
Mortality	5	2	7
Survival	8	7	15
Total	13 (38.46%)	9 (22.22%)	22 (31.8%)

BSA: The mean BSA in the survival group was 0.916m2 and in the mortality group was 0.99 m2.The p- value between these groups is not statistically significant.

Table 12: Body surface area

Study group	Mean value +/- standard deviation	p-value
Survival	0.916+/-0.36	0.75
Mortality group	0.99+/-0.53	

Preoperative NYHA class:

About 13.33% of patients were in class III in survival group and 42.85% of patients were in class III in mortality group which is statistically not significant (p=0.10).

Table 13: Preoperative NYHA class

S. No	NYHA Class	Number of patients in		p-value
		Survival Group	Mortality Group	
1	I	2 (13.33%)	1 (14.28%)	0.10
2	II	11 (73.33%)	3 (42.85%)	
3	III	2 (13.33%)	3 (42.85%)	

Cardio-pulmonary bypass time:

The mean CPB time in the survival group was 149.73 minutes and in the mortality group was 166.71minutes. This time difference between these two groups is not significant.

Table 14: CPB time (minutes)

Study group	Mean-CPB time (minutes)	p-value (<0.05)
Survival	149.73+/-51.22	0.08
Mortality	166.71+/-32.66	

Aorta cross-clamp time:

The mean aorta cross–clamp time in the survival group was 63.8+/-12.75 minutes and in the mortality group was 74.43+/-17.88 minutes. This time difference between these two groups is statistically not significant.

Table 15: Aorta cross clamp time

Study group	Mean-Aorta cross clamp time	p-value (<0.05)
Survival	63.8+/-12.75	0.12
Mortality	74.43+/-17.88	

The maximum aortic cross- clamp time in the survival group was seen in patient with DORV, VSD, PS (95 minutes). In the mortality group, aortic cross clamp was highest in D-TGA,VSD, PS (111 minutes).

Table 16: Comparison of CPB and Aortic cross clamp time: Survival vs Mortality group (time in minutes)

Study group	CPB	CROSS CLAMP
Survival	149.7	63.8
Mortality	166.7	74.4

CPB time and aorta cross clamp times were longer for patients who died than those who survived but it was not statistically significant (p=0.123)

Ventilation:

The mean days of postoperative ventilation in intensive care unit (ICU) for the survival group was 3.2+/-2.7 days and in the mortality group was 5.29 +/3.04days.The difference in the number of days of ventilation between these two groups was not statistically significant.

Table 17: Mean days of ventilation

Study group	Mean days of ventilation	p-value (<0.05)
Survival	3.2+/-2.7	.11
Mortality	5.29+/-3.04	

Maximum number of days of ventilation was seen in patient with DORV,VSD,PS and TOF,PA (10 days). It was secondary to need of reintubation in both patients.

Table 18: INOTROPIC SUPPORTS

SUPPORTS	Survival	Mortality
1	10 (66.66%)	0
2	2 (13.33%)	5 (71.42%)
3	2 (13.33%)	2 (28.57%)
4	1 (66.66%)	0

Various inotropic agents used in our patients were Adrenaline, Calcium gluconate, Dopamine, and Dobutamine. 66.66% of the patients in the survival group were on one inotropic agent during post-operative period. 71.42% of the patients in the mortality group were on two or more inotropic agents during postoperative period. Using two or more inotropic agents during post operative period in the mortality group was associated with a higher mortality and was statistically significant (p<0.01).

Figure 7: INOTROPIC SUPPORTS

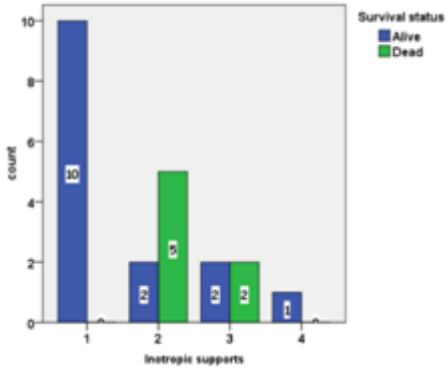


Table 19: RE- EXPLORATION

Mortality	Survival	Total
4	3	7

20% of the patient in the survival group had re-exploration done in the immediate post-operative period. Of 3 patients in the survival group for whom reexploration was done for bleeding, 2 patients had TOF, Severe PS, MPAhypoplasia, 1 patient had DORV, VSD, PS. 57.14% of the patient in the mortality group had re-exploration done in the post-operative period for bleeding. Of 4 patients in the mortality group,2 patient had d-TGA,VSD,PS, 1 patient had Truncus Arteriosus type1,1patient had TOF, Severe PS,MPA hypoplasia.

Table 19: SPLINTING of chest done during closure

Mortality	Survival	Total
4	8	12

A total of 12 (54.5%) patients had splinting of chest during closure to avoid compression of conduit during initial post-operative period. Four of these 12 patients expired. In remaining 10 (45.45%) patients chest was not splinted of whom 3 expired. Splinted chest was closed in 8 patients of the survival group after mean of 3 days.

Table 20: CONDUITS

Type	Total No.	Mortality	Survival
CONTEGRA	12	4	8
ST. JUDE (BIOCOR)	10	3	7
Total	22	7	10

Two types of Xeno-graft conduit was used in our patients. Biocorvalved (St.Judes) conduit in 10 patients and Bovine jugular vein conduit (contegra) in 12 patients.

Table 21: Hospital Stay

Type	No. of Days	MEAN	p value (<0.05)
Mortality	68	9.7+/-10.45	0.044
Survival	266	17.7+/-8.98	7

The mean stay in hospital of the survival group was 17.7+/-8.98 days.

Table 22: Post operative functional NYHA class in the survival group

NYHA CLASS I	NYHA CLASS II	NYHA CLASS III
11 (68.75%)	4 (25%)	1(6.25%)

Mortality group:

Maximum number of days (28 and 21 days) were seen in two patient. One patient was of TOF, Severe PS, MPA hypoplasia group had associated cleft palate. He developed aspiration pneumonia for which he was reintubated and Ryles tube was inserted for feeding. He was discharged with Ryles tube for feeding but he expired 10 months later following respiratory failure. Second patient was of TOF, PA group with right modified BT shunt which was ligated through Right thoracotomy. She was re-intubated after one week following respiratory insufficiency and later developed low cardiac output and multiorgan dysfunction and died.

Figure 8: Post operative functional NYHA class

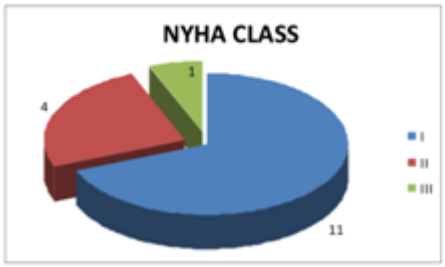


TABLE 23: Non fatal post operative complications in the Survival group

COMPLICATION	No.
None	9
Bleeding	3
Right Ventricular Failure	2
Omental Prolapse from PD	1

Early Morbidity

Incidence of post operative bleeding:
Two patient in the survival group of TOF, Severe PS with MPA hypoplasia had immediate post operative bleeding. One patient had bleeding from SVC cannulation site and other patient had bleeding from dissecting site of LPA and re-exploration was done. One patient in the survival group of DORV, VSD, PS had bleeding from right chest drain site and reexploration was done in ICU and clots evacuated.

Delayed sternal closure
Only eight patients in the survival group had delayed sternal closure following surgery. Chest was closed at mean of 3 days in the survival group

Right Ventricular Failure:
Two patients of the survival group with TOF, Severe, PS, MPA hypoplasia group had developed features of right ventricular failure in early post-operative period and were managed conservatively and discharged.

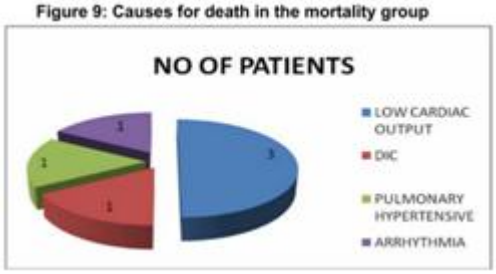
Residual VSD:
Two patients in the survival group, one of TOF,PA and other of TOF,Severe PS,MPA hypoplasia had residual VSD of 3mm size in post operative period routine 2D echo. Both patients were discharged. On follow up work up after 2 years, one patient with TOF,PA group had no residual VSD. The other patient is yet to come for follow up work up.

Omental Prolapse:
One patient in TOF, PA survival group had omental prolapse through the peritoneal dialysis catheter site while removing the peritoneal dialysis catheter . Omental repositioning was done.

Table24 : Causes for early Mortality in the postoperative period:

CAUSE	No of patients
Low Cardiac Output	3 (42%)
Bleeding diathesis	1(16.66%)
Pulmonary Hypertensive Crisis	1(16.66%)
Arrthymias	1(16.66%)

Figure 9: Causes for death in the mortality group



Early Mortality
Low Cardiac Output (LCO) 50% (3/6)
Low cardiac output was the commonest modality of death in this study. One patient in Truncus arteriosus group type II had low cardiac output following surgery. One adult patient in TOF, PS with MPA hypoplasia group had low cardiac output and acute renal failure following surgery. One patient in TOF, PA with large aorto-pulmonary collaterals and post right modified BT shunt had low cardiac output and multi organ dysfunction following surgery.
Bleeding diathesis 16.66% (1/6)

Disseminated intravascular coagulopathy with acute renal failure was cause of death in one patient of d-TGA, VSD with PS group. Patient was re-explored in ICU and clots were evacuated but no definite bleeding site was identified.

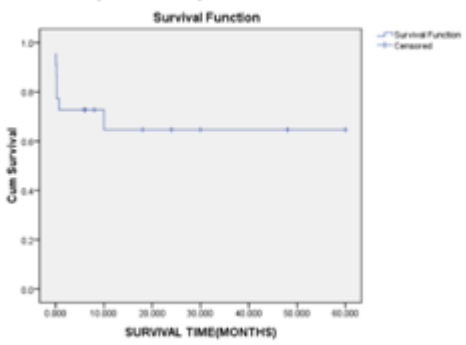
Pulmonary Hypertensive Crisis 16.66% (1/6)
One patient in Truncus arteriosus group Type I develop pulmonary hypertensive crisis following surgery and died.
Arrthymias 16.66% (1/6)
Recurrent ventricular fibrillation was the cause of death in one patient of d-TGA, VSD with PS group.

Causes for late mortality

Respiratory Failure 6.25% (1/16):

One patient in TOF, Severe PS with MPA hypoplasia group with cleft palate developed aspiration pneumonia in post operative period and was treated for it and discharged. But he died at home, 10 months later after discharge, following respiratory failure.

Figure 10: Average Survival Time



Average survival time in our study is 39.65 months with 95% confidencelimit between (27.10 to 52.20 months). None of the surviving patients had undergone any re-operation or conduit replacement.

Follow Up in Survival Group
Letters were sent to enquire about the patients status to all patients who survived (16/22). At six months: (16 patients in

the survival group of which 6 patients were operated between 2007-2008 period) All 16 patients in the survival group were reviewed in the outpatient department at the end of six months. 68.75% were in class I, 25% were in class II, 6.25% were in class III. One patient had right bundle branch block and rest all were in normal sinus rhythm. Residual VSD was seen in 2 patients.

At two year follow up: 8 patients (53.33%) were reviewed at the end of one year. 7 patients were in sinus rhythm. 2 patients were in NYHA class II and the remaining 6 patients were in NYHA class I. No residual lesion was detected The residual VSD (3mm) of one patient which was detected by an echo at the end of six months, was totally closed on conservative management without any other intervention.

At 4 years follow up: Only 3 patients, (20%) at the end of four years had come for follow up. Besides the one patient who had right bundle branch block, no other conduction abnormality was detected.
Responds to letter on telephoning talk all 15 survival patients are doing well.

5. Conclusion

1) None of the demographic data significantly affected the survival or mortality rate.
2) Though age was not found to be significant in the final outcome of patients, 70% of patients in the mortality group were above 4 years which could be significant if analysed.
3) Patients in both survival and mortality groups were comparable in all respect except the need of inotropic supports in the immediate post operative period and duration of the hospital stay.
4) Rastelli operation is low risk procedure which is done for various complex congenital malformations which are classified either morphologically (as conotruncal abnormalities) or surgically (as right ventricular-pulmonary artery discontinuity) like TGA, VSD and PS, TOF with Severe PS, TOF with PA, DORV, VSD and PS, Truncus Arteriosus.

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