Original Article

First One Hundred Corrective Surgeries for Tetralogy of Fallots: Lessons Learned

Corrective Surgeries for Tetralogy of Fallots

Faiz Rasool[1] and Mohammad Sarwar[2], Nighat Sultana[1]

ABSTRACT

Objective: Tetrology of fallots(TOF) is the most common cyanotic heart disease with the incidence of 0.34/1000 live births. Results of surgery has tremendously improved in last two decades. In this article author is discussing the lessons that were learned while doing first one hundred primary repairs in the patients of tetrology of fallots

Study Design: A Retrospective Study

Place and Duration of Study: This study was conducted at the Children's hospital Lahore, University of Lahore teaching hospital and Hameed Latif hospital Lahore from September, 2017 to February, 2020.

Materials and Methods: Age, weight, pre-operative status, intra operative time, management strategies, icu stay, hospital stay and follow up echocardiogram were looked for. Mortality and complications were given in percentages.

Results: 100 primary repairs were done, mortality rate was 9%. Complete heart block occurred in 1, JET in 10, mean icu stay was 40hrs, mean ventilation time was 12 hours, mean duration of inotropes was 30 hours.

Conclusion: Pre-operative MAPCA coiling, adequate right ventricular outflow tract resection, avoidance of pulmonary regurgitation, and good post-operative care can produce acceptable results after repair of tetralogy of fallots.

Key Words: tetralogy of fallot, MAPCA, monocusp valve, pulmonary valve preserving total correction.

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INTRODUCTION

Congenital heart disease (CHD) is the most common birth defect[1]. It is estimated that every year 42000 babies are born with CHD in Pakistan. [2] Tetralogy of fallots (TOF) is the most common cyanotic heart disease with the incidence of 0.34/1000 live births. [3]

It is also most common surgically treated congenital heart disease in Pakistan [4].

Surgical repair of TOF was first described in 1955 by Lillehei et al. [5] since there has been a lot of changes in the surgical management strategies.

Results of surgery has tremendously improved in last two decades, [6] recently studied mortality rate in the modern world is 0-1.4% [7] but mortality in low income countries where delayed surgeries are performed, is still up to 12.5% [8]

In this article author is discussing the lessons that were learned while doing first one hundred primary repairs in the patients of tetralogy of fallots.

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MATERIALS AND METHODS

It is a retrospective study of the patients who underwent primary repair for TOF from September 2017 to February 2020.

Settings: Children's hospital Lahore, University of Lahore teaching hospital and Hameed Latif hospital Lahore. All the patients underwent primary repair via trans atrial trans pulmonary approach with aorto bicaval cannulation and moderate hypothermia. Files were reviewed and data was looked for immediate post-operative results and short term follow up. Age, weight, pre-operative status, intra operative time, management strategies, ICU stay, hospital stay and follow up echocardiogram were looked for. Mortality and complications were given in percentages.

RESULTS

From September 2017 to February 2020, 100 patients underwent complete repair by the author. Breakup of the operative settings is given in fig 1. Which shows 89 were done at childrens hospital Lahore, 7 at Hameed Latif hospital and 4 at university of Lahore teaching hospital.

Base line characteristics, intra operative characteristics and post-operative details are given in Table 1,2, and 3 respectively. Mean age was 3.2 years (range from 9 months to 14 years). Mean weight was 13kg (ranged from 7 kg to 45kg). Baseline characteristics are given in table 1. There was no intra operative death. 91 patients were discharged home successfully (survival 91%), 8

patients died in ICU, one patient was shifted from ICU to ward but had patch dehiscence of additional muscular VSD for which pulmonary artery band was performed but the patient didn't survive.

Out of 8 patients who died in ICU, 5 died of right ventricular dysfunction, resulting in low cardiac output syndrome. 1 died of ventricular fibrillation and 2 died of pulmonary sepsis because of multi drug resistant gram negative rods.

Out of 91 who survived 57 patients were extubated on the day of surgery. Average ventilation time was 12 hours (ranged from 3 hours to 72 hours). Inotropes were required for mean of 30 hours post operatively. Average ICU stay was 40 hours. (24-122)

7 patients had delayed sternal closure because of bleeding or ventricular dysfunction.

5 patients needed reopening for the bleeding. 2 patients required tube thorocostomy or pleural effusion. One patient required permanent pacemaker for iatrogenic complete heart block.

Junctional ectopic tachycardia (JET) was most common arrhythmia, that occurred in 10% One patient developed ventricular fibrillation which was successfully cardioverted.

Table No.1: Pre-Operative Characteristics

Mean Age	3.2years (0.9 -14)
Mean Weight	13kg(7-45)
Male	67
female	33
Mean Oxygen saturation	73% at room air (33-93)

Table No.2: Intra Operative Characteristics

Mean cardiopulmonary bypass time	120 min ± 40
Mean cross clamp time	73 minutes ± 30
Cardioplegia	DelNido in all
Trans annular patch	73%
Pulmonary valve normal	12%
Pulmonary valve commissurotomy	15%
Branch pulmonary artery repair	10%

Table No.3: Post-Operative Characteristics

Mortality	9%
Mean ICU stay	40 hours (24 -122 hours)
Mean duration of ventilation	12 hours
Mean duration of inotropes	30 hours
Post-operative residual VSD	None
Post-operativez Heart block	1%
Residual outflow tract obstruction	none
Significant pulmonary regurgitation	20%
JET	10%
Re opening for bleeding	5%
Additional VSD patch dehiscence	1%

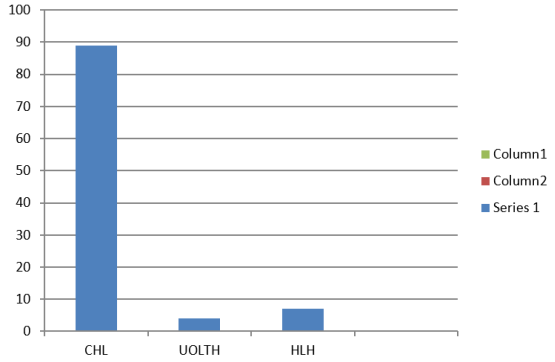

Figure No.1:

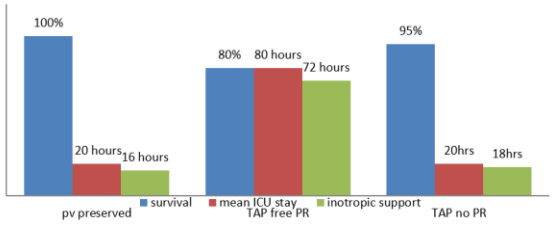

Figure No.2

DISCUSSION

Lessons Learned:

Pre-operative Assessment: Looking at the echocardiogram the surgeon should look specifically to the pulmonary arteries and severity of right ventricular outflow tract obstruction. If the patient is older than one-year pre-operative angiography is done in all cases specially to look for major aortopulmonary collateral arteries(MAPCAs) and if found they should be coil occluded before going to operation theatre. MAPCAs can result in a number of complications, including erosion of the bronchi, haemoptysis, postoperative pulmonary oedema and prolongation of postoperative mechanical ventilation and ICU stay[9]. It is recommended by many to occlude MAPCAs preoperatively[10].

Cannulation: Author used aortic cannation and DLP metal tip venous cannulae. Although many surgeons prefer to cannulate superior vena cava (SVC) through the right atrium,[11] author always cannulate SVC directly.

Temperature: Although it is arguable at what temperature surgery should be done [12], the author has learned to decrease the temperature to 26^0 C, especially when there is lot of blood coming in the left atrial vent because of collaterals. At this temperature brain protection is better and surgeon can ask the perfusionist to decrease the blood flow rate so that there is blood less field.

Cardioplegia: Because of its better myocardial protection and lesser post-operative arrhythmias[13] DelNido cardioplegia was used in all patients

Right ventricular outflow tract resection: After retracting the tricuspid valve, obstructing muscle bundles at the parietal and septal surfaces are identified and divided. It is essential to visualize the pulmonary valve annulus to be certain that all potentially obstructing muscle bundles have been divided. Author always open the pulmonary artery and look the right ventricular outflow tract from the pulmonary valve to be sure that there are no obstructing muscle bundles. There has to be not more than mild obstruction. Author disagrees with Iqbal Hussain Pathan[14] according to whom we can leave residual right ventricular obstruction without any consequences. In author's experience, leaving more than mild right ventricular outflow tract obstruction can lead to low cardiac output syndrome, renal failure and death.

Adequacy of RVOT resection is assessed by Hagar dilator.

Dealing with pulmonary valve/ monocusp valve: Opening the pulmonary artery allows the surgeon to assess the pulmonary valve. If required, commissurotomy of the valve is done under vision. Every attempt is made to preserve the pulmonary valve and still leaving no obstruction as described by Choi [15]. But in most of the cases trans annulus of the pulmonary valve had to be divided. Whenever trans annular patch was required, monocusp valve made up of PTFE or autologous pericardium was implanted to prevent pulmonary regurgitation and right ventricular dilatation. [16 -20]

In author's experience those patients who had their pulmonary valves saved had excellent outcome in terms of mortality, duration of ventilation and ICU stay. Those who had trans annular patch and significant pulmonary valve regurgitation despite of monocusp valve had worst outcome. Fig 2

Preservation of small coronary arteries close to annulus: In author's experience, surgeon must try his best to preserve even the small coronary artery branches that are crossing RVOT, dividing them can have devastating consequences

VSD closure: Author used interrupted suture technique in all cases. Dacron or bovine pericardium was used as the patch material.

Intra operative echocardiogram:

After coming off pump, intra operative echocardiogram was done in all cases to look for any residual lesion. In 2 cases, CPB had to be established again for residual VSD, 16 times for residual RVOT obstruction. With experience the chances of going back on pump to correct the residual lesions decreased.

Post-operative management points:

Keeping the chest open for 24 hours if there is right ventricular dysfunction, or bleeding is quite effective in reducing the post-operative mortality.

Post-operative milrinine infusion reduces the chances of going into low cardiac output state.

Follow up: mean duration of follow up was 1 year, all of the patients were in NYHA class I or II. Monocup Pulmonary valve was functional in all of the patients.

CONCLUSION

Pre-operative MAPCA coiling, adequate right ventriculart outflow tract resection, avoidance of pulmonary regurgitation, and good post-operative care can produce acceptable results after repair of tetralogy of fallots.

Author's Contribution:

Concept & Design of Study:	Faiz Rasool
Drafting:	Mohammad Sarwar
Data Analysis:	Mohammad Sarwar, Nighat Sultana
Revisiting Critically:	Faiz Rasool, Mohammad Sarwar
Final Approval of version:	Faiz Rasool

Conflict of Interest: The study has no conflict of interest to declare by any author.

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