COMPARATIVE STUDY TO EVALUATE THE EFFICACY OF TRANSTHORACIC ECHOCARDIOGRAPHY VERSUS CARDIAC CATHETERIZATION FOR PRE OPERATIVE ASSESSMENT OF TETRALOGY OF FALLOT

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ABSTRACT

Objective: To determine the results of transthoracic echocardiography and cardiac catheterization for pre operative assessment of Tetralogy of Fallot and operative outcomes for the patients.

Study Design: Case Series; prospective descriptive study.

Place and Duration of Study: Armed Forces Institute of Cardiology/National Institute of Heart Diseases, Rawalpindi, Jan 2006 to December 2010.

Patients and Methods: All patients admitted in AFIC/NIHD for surgical repair of Tetralogy of Fallot.

Results: A total of 746 patients were included in study, male (33%), female (67%), mean age was 4.7 years. Group I was evaluated for total correction with combined transthoracic two dimensional echocardiography and cardiac catheterization, and group II was subjected to transthoracic two dimensional echocardiography only for pre operative assessment. Overall mortality was 8.4% in group I and 10.8% in group II. In group II, 84% had total correction and 16% had closed heart, while in group II 73% had open heart and 27% had closed heart surgery.

Conclusion: Tetralogy of Fallot is the leading cause of cyanotic congenital cardiac heart disease. The pre operative evaluation with help of Transthoracic two dimensional echocardiography requires oral sedation, is cost effective and minimally invasive. Cardiac catheterization being reserved for the patients having inadequate information on Transthoracic echocardiography. Early surgery during childhood has long term benefits in terms of morbidity and lifestyle adjustment.

Keywords: Total correction, Transthoracic echocardiography, Cardiac catherterization.

INTRODUCTION

Tetralogy of Fallot (TOF) is the leading cause of cyanotic congenital cardiac defect affecting 4 /10,000 children per anum accounting for 16.6% of all cyanotic congenital heart disease CCHD[18]. The halmark being big mallalinged ventricular septal defect, aortic override, right ventricular outflow tract obstruction and right ventricular hypertrophy. The set of combination leads to right to left shunting hence cyanosis, clubbing, shortness of breath and growth retardation. The standard treatment is surgical total correction. As an evaluation and management strategy, cardiac catheterization has been considered mandatory. Recent advances in imaging techniques have lead to essential evaluation of TOF on the basis of two dimensional echocardiography alone using cardiac catheterization for special circumstances. The objective of the study was to establish the efficacy and utility of two dimensional echocardiography alone versus two dimensional echocardiography and cardiac catheterization for preoperative evaluation of TOF for suitability for total correction.

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METHODOLOGY

This study was conducted at Armed Forces Institute of Cardiology /National Institute of Heart Diseases, Rawalpindi from Jan 2006-Dec 2010. It was a prospective comparative study..All patients who underwent surgical repair for TOF were enrolled in this study We reviewed the patients according to age, anatomical defects, growth parameters, surgical echocardiography and cardiac catheterization data when done. Baseline investigations of blood complete picture, renal function, hepatic function, blood sugar, serum electrolytes, chest x ray, 12 lead ECG were done after admission in pre surgical ward. Group

I included patients who underwent total correction on basis of echocardiography and cardiac catheterization and group II included patients who had total correction on basis of echocardiography alone.

Axiom Artis VB- 23 G fluoroscopy unit. Femoral vein and artery was cannulated with adequate size sheath. 5/6 F pigtail/ NIH catheter was used. Ipamerio 360 non ionic contrast was used @2-4 ml/kg/injection. RV angiogram for

Table-2: Comparative description of results of group I and group II.

Variables	Group 1 (102) (Cardiac catheterization plus echocardiography)	Group 2 (645) (Echocardiography alone)
Alive	91	597
Dead	11	48
Gender	37(F)65(M)	515(F)130(M)
Conduit (RV to PA)	97(no)5(yes)	614(no)28(yes)
Close/Open heart	7 (C) 82 (O)	115(C) 482(O)
Pleural effusion	97(N)5(Y)	575(N) 67(Y)
Re-opened	93(N)9(Y)	561(N) 84(Y
Wound infection	101(N)	608(N) 37(Y)
Pace maker	83(N)19(Y)	541(N) 59(Y)
Renal failure	101(N)	470(N) 172(Y)
Rhytm disturbance	AF(12) VF(1)	AF(22) CHB(7) JET(1)) SVT(3) PAT(1) VT(10) Nodal (3) AVNRT(2)
Inotropes	94(Y) 8(N)	589(Y) 53(N)
RACHS	73(3) 24(4) 1(6)	407(3) 199(4) 39(5)

Transthoracic two dimensional echocardiography required adequate oral sedation with chloral hydrate. Philips X matrix iE33 machine was used with 3.5-7 Hz probes. Parasternal long axis, short axis, apical four chamber and five chamber views, suprasternal and subcostal views were selected. The size and morphology of VSD, confluence and size of pulmonary arteries, aorta, adequacy of left ventricle, origin of coronary arteries , presence of persistent left SVC and additional defects was recorded. In patients with limited information on echocardiography, cardiac catheterization was done as well.

Cardiac catheterization was done with GA/LA under fluoroscopic guidance of SIMENS pulmonary artery size, LV angiogram for LV size and additional VSD, selective PA angiogram for pulmonary arteries size and morphology, SVC angiogram to rule out persistent LSVC and Descending aortogram for collaterals were recorded for coronary arteries and MAPCAs/PDA.

Surgical procedure was carried out via median strenotomy under GA transatrial / transpulmonary artery approach for total correction and lateral thoracotomy for Blalock Taussig (BT) Shunt. Patients remained in pediatric intensive care unit during immediate post operative period. They were called for follow up at 3 weeks interval with regular follow up of 6 months interval for residual defects.

Echocardiography at the time of discharge was performed. Results were analyzed with SPSS version 17.0. Sample t-test and chi-square test were employed. Comparison was made between the anatomical findings during cardiac surgery for group I and group II.

RESULTS

A total of 746 patients of TOF were operated from 2006-2010. The baseline parameters are indexed in Table-1. The patients had mean height 101 cm range (31-182), weight 17.37 kg range (2.8 -76 kg), mean age 4.7 yrs range (5 mon-25 years),33% were male and 67% female.52.8% had hemoglobin 10-15 g/dl with 7.1% having hemoglobin more than 20 g/dl. Group I includes patients of total correction with cardiac catheterization and echocardiography guidance, group II includes patients of total correction with echocardiography guidance alone.

On comparative evaluation ,mortality was 10.8% in group I and 7.4% group II. Successful surgery in 685 (92.5%) with 8.17% mortality, 6.07% died in pediatric intensive care and 2.1% died in operation theater. Cardiac catheterization was required in 101 (13%) group I and two dimensional echocardiography in 746 (100%) group I and II. In group I, 15% had closed heart surgery 84% total correction and in group II 25% had closed heart surgery and 73% total correction. Pleural effusion developed in 4.9% group I and 10.3% in group II. Re opening was required in 8.8% for group I and 13% group II. Wound infection occurred in 5.7% of group II patients. RV to PA conduit was needed in 4.9% of group I and 4.3% of group II while 95.5% did not require conduit. Rhythm disturbances were present in 12% in group I and 7.5% in group II. Inotropic support was required in 92%of the patients in group I and 91% of group II (dopamine and dobutamine). Overall 56% patients required mean ITC stay of 12-72 hours in group I and II, 7% developed chest infection. Peritoneal dialysis was required in 26% of patients for renal impairment in group II. (table - 2).

In overall assessment for group I and II, Total correction was done in 553 (74%), RBTS in 160 (22%), LBTS in 24 (4%) and central shunt in 4 (0.6%).

Table-1: Basic demographic parameters of study population.

Weight	17.37 kg	2.8-76 kg
Height	101 cm (mean)	31-182 cm
Age	4.7 years	5 months-25 years
Male	33%	
Female	67%	
Haemoglobin	52.8%	10-15 g/dl
Total patients	746	
Total correction (553)	Group 1 82	Group 2 482
Right BT shunt (160)	6	154
Left BT shunt(24)	1	23
Central shunt (4)	0	4
Alive	91	597
Dead	11	48

DISCUSSION

Total correction has been the standard treatment for TOF. Increase patients survival in adulthood[1] with complications of arrhythmias, RV dysfunction, functional disability, it is imperative that earlier total correction be carried out. Neonatal total correction[6,20] has been reported with good results. There are reported cases of total correction in adulthood[11] with 7.7% mortality and significant morbidity. We can detect TOF in intrauterine life with the help of fetal echocardiography[19] so we can mobilize our resources towards neonatal surgery. As 95% of the patients die in fourth decade of life if left untreated, the current management strategies is shifting towards earlier diagnosis and surgical correction[2]. The oldest reported case of unoperated TOF being 68 years of age[13], TOF remains a major burden of cyanotic congenital

cardiac defect. The long-term complications of total correction as residual RVOTO, residual VSD, RV dysfunction, need for PVR, arrhythmias, require long follow up and management. In greater accuracy can be achieved[10]. Reports of infants having total correction with better outcome and lesser morbidity have been

Figure-1: Descending aortogram for collaterals.

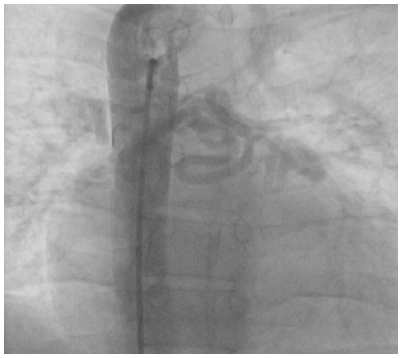


Figure-2: Aortic root angiogram in LAO -45, Cranial -20 for coronary arteries.

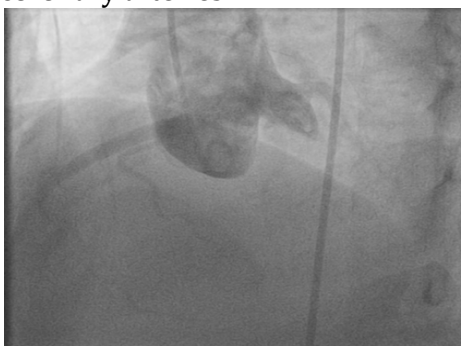


Figure-3: SVC angiogram in AP view to R/O persistent LSVC.

Figure-4: LV angiogram for additional VSD.

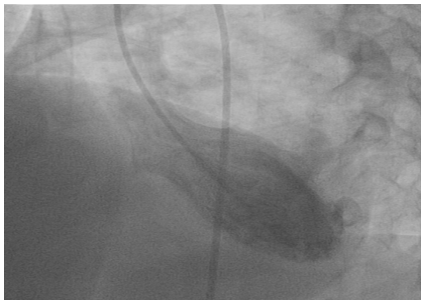


Figure-5: Selective PA angiogram in LAO-30, cranial 15 for PA anatomy, size.

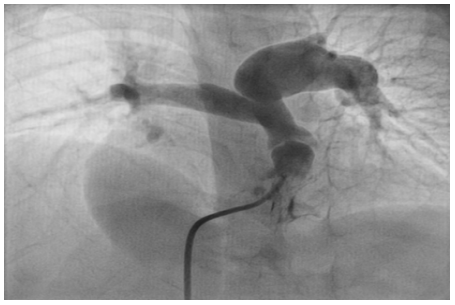
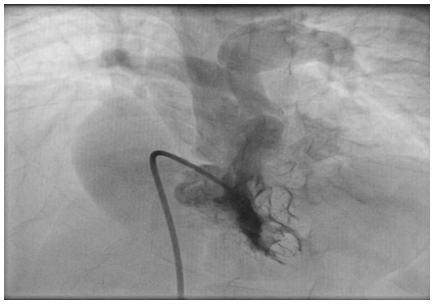


Figure-6: Right ventricle angiogram in RAO-30 for RV morphology.



Pakistan, where the per capita income is Rs 7220/-(380$) annum or Rs 800/- (32$) per month[17] the earlier total correction is carried out the better. The cost of cardiac catheterization remains 20,000-25,000 Rs, and cost echocardiography is from 1200 to 1500 Rs. Hence the need for carrying out less invasive tool of echocardiography for pediatric population.

Many studies have reported the effectiveness of two dimensional echocardiography as non invasive, reliable and effective tool for preoperative evaluation and planning of total correction[5]. With advent of newer applications of echocardiograph i:e; color doppler, TDI, speckle tracing, tissue harmonics published in INDIA[12].

Echocardiography is an excellent tool for assessment of TOF. The surgeon requires the size of pulmonary arteries, macgoon index, origin of coronaries[21], additional VSD and presence of PDA and MAPCAS, the decision of placing trananuler patch, RV to PA conduit / palliative BT shunt rests upon anatomical details. In the case of adults, poor surface window leads to limited assessment of preoperative details therfore when needed, we can safely carry out the diagnostic cardiac catheterization.At times the coil occlusion of non essential collaterals can be done in cardiac cath lab after cardiac catheterization to minimize surgical morbidity.

After total correction exercise capacity and physical activities manifest latent abnormalities[13]. The children and adolescents reveal RBBB, significant QRS prolongation, sinus node dysfunction leading to ventricles fibrillation, sustained ventricular tachycardia due to fibro fatty scar tissue[15]. Doppler echocardiography remains useful assessment in post operative ventricular function after total correction[16]. As the 7.8% mortality for total correction at our centre is comparable to any other cardiothoracic unit, echocardiography alone is preferable choice for preoperative selection and planning the type of surgery for TOF. In cases of small sized LV, small pulmonary arteries Blalock Tausig shunt is recommended for growth and preparation of ventricle for total correction at later stage. Total correction is carried out with transpulmonary/ trans atrial approach. In limited number of cases of anomalous coronary artery (ACA) crossing RVOT modified surgical technique is recommended.

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