AN APPRAISAL OF DE VEGA ANNULOPLASTY IN FUNCTIONAL TRICUSPID REGURGITATION

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ABSTRACT

Objective: To assess the outcome of DeVega annuloplasty technique for Functional Tricuspid Regurgitation (FTR) secondary to left sided Valvular Heart Disease.
Study Design: Descriptive study.
Place and Duration of Study: Department of adult cardiac surgery, armed forces institute of cardiology and national institute of heart diseases, Rawalpindi, from Mar 2009 to Jan 2018, including 30 months of follow-up.
Methodology: Sixty-three consecutive cases requiring surgery for mitral and/or aortic valve disease and having moderate to severe FTR or mild FTR with dilated tricuspid annulus were included in this study. De Vega annuloplasty of the tricuspid valve was done in addition to mitral valve replacement in 45 patients (71.43%), aortic valve replacement in 4 (6.35%) and combined mitral and aortic valve replacement in 14 (22.22%). All patients were followed-up for peri-operative mortality, degree of tricuspid regurgitation (TR) after surgery and before discharge from hospital, and New York Heart Association (NYHA) functional class, left ventricular ejection fraction (LVEF), survival, and severity of residual or recurrent TR for a mean period of 30 months.
Results: There were 2 (3.17%) early deaths. Twenty-one patients (33.33%) had no TR, 38 (60.32%) had mild TR and 4 (6.35%) had moderate TR, in the early post-operative period. One patient died 19 months after surgery due to prosthetic valve thrombosis and another died 25 months after surgery due to an is chaemic stroke. At 30 months most patients showed improvement in NYHA class, LVEF and degree of TR when compared with the pre-operative status.
Conclusion: We conclude from this study that the De Vega technique of tricuspid annular repair is an effective method of treating FTR secondary to mitral and aortic valve disease, with acceptable short- and medium-term results.

Keywords: De Vega annuloplasty, Functional tricuspid regurgitation, Outcome Y.

INTRODUCTION

Functional tricuspid regurgitation (FTR) is tricuspid regurgitation (TR) due to disarrangement of the constituent components of the tricuspid valve without any organic lesion of the valve. It is mostcommonly encountered secondary to left-sided valvular heart disease causing volume- and pressure overloading of right ventricle (RV). This in turn leads to dilatation of the anterior and the posterior portions of the tricuspid annulus resulting in non-coaptation of the leaflets and, therefore, regurgitation. As it progresses, the FTR causes right atrial (RA) and RV enlargement and tethering of the tricuspid leaflets[1]. Chronic atrial fibrillation (AF) tends to increase stasis in the RA, enlarging RA dimensions and tricuspid annulus and thereby compounding the TR even more. Mild TR may not progress and may even improve after correction of the left-sided valvular pathology but moderate and severe FTR if left untreated is associated with increased morbidity and mortality[2-5] due to deterioration of TR and RV function. Therefore, both the European Society of Cardiology/European Association for Cardio-Thoracic Surgery (ESC/EACTS)[6,7] and the American College of Cardiology/American Heart Association (ACC/AHA)[8,9] guidelines strongly recommend surgical management of moderate to severe FTR at the time of mitral and aortic valve

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surgery especially if tricuspid annulus (TA) dilation is more than 40mm.

METHODOLOGY

Study Population and Clinical Outcomes

The descriptive study was conducted at the Armed Forces Institute of Cardiology and National Institute of Heart Diseases (AFIC/ NIHD), Rawalpindi, from March 2009 to June 2015. Sixty-three consecutive patients requiring surgical management of mitral and/or aortic valve disease, who had concomitant significant (moderate-to-severe or mild with dilated TA) FTR were included. Diagnosis was made using 2-dimension echocardiography (2-D Echo) combined with colour flow Doppler. Coronary angiography was performed in all patients above 40 years of age and in those having angina.

Excluded from this study were patients with accompanying coronary artery disease requiring coronary artery bypass surgery, patients with tricuspid stenosis or endocarditis, and those with organic, primary tricuspid valve disease meriting either valve replacement or a complex repair of the leaflets, annulus and sub valvular apparatus.

All cases were treated with left-sided valve replacement followed by De Vega suture- annuloplasty of the tricuspid valve if the FTR was of moderate to severe in intensity and even in cases of mild FTR where the TA diameter was greater than 40 mm.

The data was collected and reviewed prospectively. This included demographics, operative record, operative mortality and morbidity, as well as a 30-months follow-up of patients' NYHA functional class, LV function, degree of TR and survival.

Surgical Indication and Technique

The decision of tricuspid valve intervention for moderate to severe FTR was made preoperatively but the final choice of the technique was made after exposing and examining all the valve components especially the annulus, leaflets and the subvalvular apparatus. Patients were counselled about the proposed management of the left and right-sided valvular pathology and informed consent was obtained. Trans-oesophageal echocardiography (TOE) was performed perioperatively before commencing cardiopulmonary bypass (CPB) to confirm valvular pathology and ventricular function. Systemic cooling to 32°C was instituted and antegradetepid blood cardioplegia was administered intermittently to arrest the heart.

After replacing the mitral and/or the aortic valve the caval snares were tightened and RA opened to expose the tricuspid valve. We routinely use the "saline test" to evaluate valve patency and then proceed to inspect the valve in detail to exclude a primary pathology that would prompt us to perform either a complex repair or a valve replacement, instead of an exclusive annuloplasty. A tricuspid ring sizeris utilized to assess annular dilation and then De Vega repair is begun at the septal-posterior commissure using a 4-0 prolene double-arm pledgetted suture to proceed with 5-mm bites of the annulus to the anterior-septalcommissure. Employing a second pledget the suture is continued back just outside the first suture line to the point of onset where the needle is passed through the first pledget. The suture is then tightened over a tricuspid ring sizer, ensuring competence utilizing the saline test before tying the knots. All cases were performed by the same surgeon to ensure uniformity of the procedure.

TOE was repeated after weaning from CPB to assess prosthetic-valve function, ventricular contractility and tricuspid valve competence.

Postoperative anticoagulation was as per institutional protocol dictated primarily by the type of valve prosthesis seated on the left side.

Operational Definitions

Operative or early mortality was defined as death within 30 days of surgery; LV dysfunction as LV ejection fraction <45%; respiratory failure meant requirement of mechanical ventilation for more than 48 hours or the advent of pneumonia; severe pulmonary hypertension was defined as

mean pulmonary artery pressure (MPAP) greater than 55 mmHg.

The data was collected and reviewed prospectively. Statistical analysis was done using SPSS software package (version 23). Continuous variables are documented as mean ± standard deviation where as categorical variables are presented as percentages. This study was approved by the institutional review board.

Table-I: Preoperative patient characteristics (n=63).

Characteristics	Frequency (%)
Age in year	
Mean	38.62
Range	19-67
Gender	
Male	29 (46)
Female	34 (54)
Smoking	8 (12.7)
NYHA Functional Class	
1	1 (1.59)
2	10 (15.87)
3	39 (61.90)
4	13 (20.63)
Associated Valvular Pathology	
Mitral valve disease	45 (71.43)
Aortic valve disease	4 (6.35)
Mitral and aortic valve disease	14 (22.22)
AF	38 (60.32)
FTR Severity	
Nil	-
Mild	13 (20.64)
Moderate	24 (38.09)
Severe	26 (41.27)
MPAP in mmHG	
24 - 40	13 (20.64)
41 - 55	28 (44.44)
> 55	22 (34.92)
LA size in mm	
Upto 40	14 (22.22)
41 - 50	18 (28.57)
> 50	31 (49.21)
LVEF in %	
<35	3 (4.76)
35 - 44	17 (26.98)
45 - 54	22 (34.92)
≥ 55	21 (33.33)

NYHA: New York Heart Association; FTR: Functional tricuspid regurgitation; AF: Atrial fibrillation; MPAP: Mean pulmonary artery pressure; LVEF: Left ventricular ejection fraction

RESULTS

Preoperative demographics are presented in table-I. Thirty-eight (60.32%) patients had atrial fibrillation; 50 (79.36%) had moderate to severe pulmonary hypertension (PHtn) with a mean pulmonary artery pressure (MPAP) ranging from 41 to 72 mmHg; mild FTR was present in 13 patients and annuloplasty was done due to enlarged TA (>40mm), whereas moderate and severe FTR existed in 24 (38.09%) and 26 (41.27%) patients respectively. Fifty-two (82.53%) patients were in NYHA functional class III and IV.

Table-II: Early postoperative data.

Characteristics	Frequency (%)
Mortality	2 (3.17)
Ventricular Dysrythmias	5 (7.94)
AF	29 (46.03)
Ventilatory Support >48 hours	14 (22.22)
CVA	-
TR Severity – Immediate postoperative	
Nil	34 (53.97)
Mild	29 (46.03)
Moderate	0 (0.00)
Severe	-
TR Severity – Before hospital discharge	
Nil	29 (47.54)
Mild	28 (45.90)
Moderate	4 (6.56)
Severe	-
LVEF – Before hospital discharge	
< 35	2 (3.28)
35 - 44	19 (31.48)
45 - 54	26 (42.62)
≥ 55	14 (22.95)

AF: Atrial fibrillation; CVA: Cerebrovascular Accident; TR: Tricuspid regurgitation; LVEF: Left ventricular ejection fraction

Early results are shown in table-II. There were 2 (3.17%) early deaths; both had mitral valve replacement for severe mitral stenosis and low pre-operative ejection fraction (LVEF<35%) and died of low cardiac output and sepsis. Post-operative TOE in the operating room revealed absent TR in 34 (53.97%) patients and mild TR in 29 (46.03%). 2-D Echo done before discharging

the surviving patients from hospital showed no TR in 29 (47.54%), mild in 28 (45.90%), and moderate TR in 4 (6.56%) patients. The LVEF recorded at the same time was greater than 55% in 14 (22.95%), 45-54% in 26 (42.62%), 35-44% in 19 (31.48%) and less than 35% in 2 (3.28%).

Outcome at a mean period of 30 months (table-III). There were 2 (3.28%) late deaths. One patient died of prosthetic valve thrombosis in the mitral position 19 months after hospital discharge and the other died at 25 months due to a

Table-III: Outcome at 30 months (n=59).

Characteristics	Frequency (%)
Mortality	2 (3.28)
AF	27 (45.76)
CVA	1 (1.69)
NYHA Functional Class	
1	19 (32.21)
2	33 (55.93)
3	7 (11.86)
4	-
TR Severity	
Nil	24 (40.68)
Mild	27 (45.76)
Moderate	8 (13.56)
Severe	-
LVEF in %	
< 35	-
35 - 44	2 (3.39)
45 - 54	31 (52.54)
≥ 55	26 (44.07)

AF: Atrial fibrillation; CVA: Cerebrovascular Accident; NYHA: New York Heart Association; TR: Tricuspid regurgitation; LVEF: Left ventricular ejection fraction

hemorrhagic stroke. At a mean period of 30 months after the initial hospital discharge, 19 (32.2%) patients were in NYHA functional Class I, 33 (55.93%) were in NYHA Class II, and 7 (11.86%) in Class III. TR noted in these patients was nil in 24 (40.68%), mild in 27 (45.76%), and moderate in 8 (13.56%). LVEF measured at the same time was greater than 55% in 26 (44.07%), 45-54% in 31 (52.54%), and 35-44% in 2 (3.39%).

DISCUSSION

Functional tricuspid regurgitation has been treated conservatively in the past with the intent that it will resolve with time, once the primary left-sided valvular disease is surgically corrected. Mild to moderate FTR should be repaired if the TA is dilated more than 40mm (21mm/m^2), otherwise, significant TR will develop later,[5,10,11,12,13] leading to increased morbidity and mortality[14-16]. A reoperation is usually warranted to correct the TR and this procedure carries a much higher risk than the primary one. Moderate and severe FTR is a common accompaniment in left-sided valvular heart disease. The majority of patients with NYHA II and III symptoms are treated medically by most physicians with diuretics, digoxin, beta blockers, anticoagulants and ACE-inhibitors. By the time the patients are

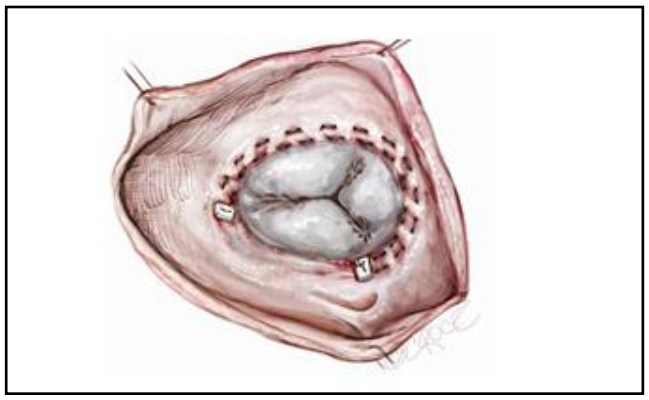

Figure: De Vega Tricuspid Annuloplasty.

referred to the cardiac surgeon, most have large sized atria, compromised LV and RV function, high pulmonary artery pressure, irreversible AF and Class III and IV symptoms. Late arrival at the cardiac surgery clinic is due mainly to the financial concerns, as the vast majority of patients with rheumatic disease belong to the low socio-economic group. Furthermore, public misconception regarding surgical treatment of valvular heart disease is not appropriately addressed. Under the backdrop of these peculiar circumstances most of the patients end up with valve replacement on the left side and repair of the FTR on the right.

Many contemporary studies have favoured the use of a ring as opposed to suture annuloplasty quoting inferior durability of the latter[17-19] and better functional results with the ring-

annuloplasty[19-21]. One complication that can cause recurrent TR after a De Vega repair is the "bow-string" effect due to the tearing of tissue by the suture[22]. However, we have not encountered this complication in our practice, possibly due to a more robust annular tissue as a result of prolonged exposure to the rheumatic process and its sequelae, becauseof the late presentation of these patients for surgery. Our short- and medium-term results are quite encouraging and compare well with the international literature[22,23]. The 2 early deaths, both, occurred in patients having poor ventricular function and we tend to agree with those who believe that the true predictors of mortality are the pre-operative functional state, and the ventricular function rather than nature of the procedure[23]. One can note in this study that the LVEF decreased in the early post-operative period due mainly to factors such as the excision of some of the mitral sub-valvular apparatus and certain amount of the stunning of the myocardium as a result of the ischaemic arrest of the heart during surgery.

The main advantage of the De Vega technique is its simplicity, reproducibility and the remarkably low cost of the procedure when compared with the use of a ring. Whereas, Sarralde *et al*[24] concluded that the De Vega annuloplasty produced better results than ring annuloplasty.

LIMITATION OF STUDY

The relatively less number of patients is one limitation of this study. The lack of a control group treated with ring annuloplasty is due predominantly to financial constraints mentioned above. The follow-up period is some what short, however, the very encouraging peri-operative control of the FTR being sustained to a period of 30 months is quite heartening.

CONCLUSION

We conclude that the De Vega suture annuloplasty is a simple and safe procedure to correct FTR accompanying mitral and aortic valve pathology in the short- and medium-term. It can be performed quickly with a considerable financial advantage to the patient.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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