

Original article

Results of tricuspid valve annuloplasty along with mitral valve replacement

¹Dr. Ankit Goel*, ²Prof. Dr. M.A. Geelani, ³Prof. Dr. Harpreet Singh, ⁴Dr. Sanjay G., ⁵Dr. Sneha Daniel, ⁶Dr. Nimesh Srivastava

¹ Senior Resident, Department of Cardiovascular and Thoracic Surgery (CTVS), GIPMER, New Delhi.

² Head of Department of Cardiovascular and Thoracic Surgery (CTVS), GIPMER, New Delhi.

³ Professor, Department of Cardiovascular and Thoracic Surgery (CTVS), GIPMER, New Delhi.

⁴ Senior Resident, Department of Cardiovascular and Thoracic Surgery (CTVS), GIPMER, New Delhi.

⁵ Senior Resident, Department of Cardiovascular and Thoracic Surgery (CTVS), GIPMER, New Delhi.

⁶ Senior Resident, Department of Cardiovascular and Thoracic Surgery (CTVS), GIPMER, New Delhi.

Corresponding author*

Abstract:

Background: Functional tricuspid valve regurgitation is mostly due to left sided valvular lesion. Most important question arises whether to leave it or repair it at the time of left sided valve lesion surgery.

Methods: It is a retrospective observational study from July 2021 to June 2023 done in GB Pant institute of postgraduate medical education and research. 44 patients underwent mitral valve replacement with tricuspid valve annuloplasty as per standard operating protocol. Clinical examination and transthoracic echocardiography were used for diagnosis, results and follow up.

Results: 41 patients were successfully treated and there was significant decrease in symptoms And regurgitation on echocardiography. There were 3 early deaths and 1 late death none related valve failure or annuloplasty.

Conclusion: Modified DeVega's tricuspid annuloplasty proved to be a safe procedure for the management of secondary tricuspid regurgitation and is technically easy and reproducible even by relatively inexperienced surgeons. It can be used in all patients with more than mild "functional" tricuspid regurgitation.

Key words – Devega tricuspid valve annuloplasty, mitral valve replacement, tricuspid regurgitation

Introduction

Rheumatic heart disease may have tricuspid valve regurgitation associated with long standing mitral disease which is functional in nature and usually secondary to pulmonary hypertension and right ventricular dilation. The incidence of tricuspid regurgitation (TR) associated with left-sided valve disease, especially mitral, has been described as 8% to 30%. In approximately 80% of the cases, the TR is said to be "functional," caused by isolated dilation of the annulus, secondary to right ventricular dysfunction, and in the remainder, the lesion is primarily rheumatic (organic), usually with fibrosis of the leaflets and fusion of the commissures.

There are 2 schools of thought, one is to leave tricuspid valve as it is and it will regress when primary lesion is treated(1) and second is to treat it by annuloplasty or replacement (2). It is widely accepted that annuloplasty is a safe and effective surgical procedure. Therefore, we explore the role of Devega's tricuspid valve annuloplasty in patients undergoing mitral valve replacement.

Methodology

Tricuspid annuloplasty, as described by DeVega (3), was performed in 44 patients undergoing mitral valve replacement between July 2021 and June 2023. There were 27 female and 17 male patients, and their ages ranged from 18 to 67 years with a mean of 46.2 years.

Inclusion criteria – 1. Patients above 18 years, 2. Severe mitral valve disease (stenotic/ regurgitant), 3. Moderate to severe tricuspid valve regurgitation

Exclusion criteria - 1. Any concomitant cardiac lesion other than Mitral valve and Tricuspid valve 2. Age less than 18 years.

The preoperative diagnosis of tricuspid regurgitation was made clinically and was confirmed with Trans thoracic Echocardiography. Thirty five (79%) patients were in atrial fibrillation before surgical treatment. The preoperative clinical data are summarized in Table 1.

Preoperative data

Clinical features number percentage

Preoperative data		
Clinical features	number	Percentage
Total no. of patients	44	100
Sex		
Male	17	39
Female	27	61
Cardiac rhythm		
AF	35	79
sinus	9	21
NYHA		
I	2	5
II	7	16
III	29	66
IV	6	13

All 44 patients underwent Mitral valve replacement with Tricuspid valve Annuloplasty as per standard operating protocol.

Surgical procedure - After midline sternotomy, pericardium is opened. Heparin is given and standard Aortobicaaval cannulation done and CPB instituted. MVR was done via LA approach. Then RA was opened. For adequate exposure of the valve, Cooley tricuspid retractor was used. Alternatively, appropriately placed traction sutures may be used. The anatomy of the tricuspid valve is assessed (the position of the conduction system and of the atrial portion of the membranous interventricular septum should also be noted). A dilated annulus is invariably present. If the leaflets are not involved by the pathological process, the final decision is made to proceed to a DeVega annuloplasty. In cases where the tricuspid leaflets are retracted and there is commissural fusion, a tricuspid ring is preferred.

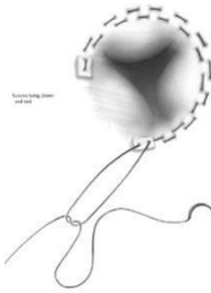


Figure 1 – DeVega annuloplasty

The classic annuloplasty (figure 1) consists of a double continuous suture which runs along the anterior and posterior annulus, corresponding to the right ventricular free walls, which are mostly involved in this process. The septal portion of the annulus is usually not involved in the dilatation process and is spared for protection of the conduction system. In the classic DeVega technique, a 2/0 or 3/0 polypropylene suture is commenced at the posterior extremity of the septal portion of the annulus and continues, in an anticlockwise direction, in the posterior and anterior portions of the annulus. The suture needle penetrates at a depth of 1 to 2 mm, in bites approximately 5 to 6 mm long. Once the suture reaches the fibrous trigone, close to the antero-septal commissure, it is reversed over a pledget. Each bite of the annulus in the second suture line intercalates that of the first one. The suture ends where it started and is tied over a pledget. The degree of narrowing of the annulus may be controlled over a Hegar dilator or a valve sizer depending on the body surface of the patient, but having in mind that mild regurgitation is better tolerated than stenosis.

RA closure, weaning from bypass and closure were as per standard steps.

Post procedure patients were kept in ICU and were discharged in haemodynamically stable condition.

All the patients who were discharged after surgery were seen in the outpatient department at 3 month intervals during the first year and at yearly interval after that. Every time in OPD, careful clinical history and physical examination was done and if required, electrocardiogram, chest radiograph or TTE was performed based on clinical findings.

Results

Parameter	Category/Details	Count	Percentage (%)
Total Patients		44	100
Age Range	18 to 67 years		
Surgery Undergone	MVR + TVA		
Valve for MVR	SJM Bileaflet	28	64
	Carbomedics Optiform	14	32
	TTK Chitra	2	4
Post-op NYHA Class	I	14	32
	II	23	52
	III	4	9
	IV	0	0
In-Hospital Mortality		3	7

There were 3 (7%) hospital deaths. 1 patient died of myocardial failure in the early postoperative period. The Causes of death in the remaining patients were arrhythmia in 1 patients and sepsis in 1 patient.

None of the deaths was related to the tricuspid annuloplasty. There was 1 late death due to infective endocarditis.

Survival

4 patients were in Grade III and IV of New York Heart Association classification at the latest follow-up compared with 35 patients before the operation. Following the operation, the diuretic requirement was reduced in 18 patients (41%), and unchanged in 23 patients (52%). The cardiothoracic ratio on chest radiographs fell from a mean value of 0.62 to 0.52 after operation. There were no incidents of heart block in the immediate postoperative period. Bacterial endocarditis developed in 1 patient after 6 months on the mitral prostheses and the patient died subsequently. No patient required re surgery till 1 year follow up.

Discussion

A reported 8 to 30% of patients with mitral valve disease have associated tricuspid regurgitation(4, 5, 6). Clinically evident functional tricuspid regurgitation often disappears after intensive medical treatment.

In 1967, Braunwald and colleagues (7) wrote that “in “most” patients with secondary TR, the surgical treatment of mitral valve disease corrects the right sided problems.” It should be expected that by eliminating the triggering factor, after adequate correction of left heart valve disease, the tricuspid regurgitation would regress, but this does not always happen. Mild degrees of functional tricuspid regurgitation in the presence of raised

pressure in the pulmonary circulation are best left alone because they may resolve spontaneously with reduction of right ventricular load following repair of the mitral valve lesion.

It is with moderate and severe degrees of tricuspid regurgitation that the controversy arises. The ideal annuloplasty should be easy to perform, and the technique should be reproducible, preserve normal valve function, produce a predictable result, and provide a definitive or at least a long-lasting repair. Over repair of the insufficiency may lead to stenosis, and under repair to residual regurgitation. These complications may partly explain the unpredictable postoperative hemodynamic results found in our patients and in those patients in other reported series (8, 9). The mitral valve function also determines the right-sided pressures, and it is difficult to place the blame for any rise in right-sided pressures on the tricuspid valve alone.

Tricuspid annuloplasty, per se, was not responsible for any morbidity or mortality in our patients; rather, the severity and duration of the mitral valve disease and the accompanying pulmonary hypertension determine the outcome in these patients. Any failure of tricuspid annuloplasty seems to be secondary to the failure of the mitral valve prostheses in most reported series (10).

Furthermore, the results of mitral valve surgery are less favorable in patients with associated right heart disease. Hence, the quality of the correction of the left-sided valvulopathy appears fundamental. Any incomplete or unsatisfactory repair will result in persistence or progression of the TR. Even with long-term success of mitral valve surgery, in many cases, there is a progressive increase of tricuspid regurgitation, which may give reason to question its "functional" etiology.

Barlow and colleagues have postulated that tricuspid regurgitation is often partly or mainly organic (11).

Recent evidence demonstrates that functional TR can be ignored only in patients with predictable and significant reduction in pulmonary resistance, which usually follows early correction of left-side pathology.

The evaluation and treatment of the secondary TR continues to be a major problem in the surgical decision-making process. There is no reliable method to judge how much of it is reversible when left-sided problems are corrected. Additionally, there is a lack of reliable methods for quantifying the degree of tricuspid regurgitation, and for assessing true right ventricular function.

On the other hand, Dreyfus and coworkers (12) found, very recently, that "secondary" tricuspid annular dilation is present in a significant number of patients with severe mitral disease without TR, which does not resolve with correction of the primary lesion alone. They conclude that in these patients, "tricuspid annuloplasty at the time of mitral valve surgery results in improved functional capacity without any increase in perioperative morbidity or mortality.

On examination, severe TR is usually associated with a fixed raised jugular venous pressure (JVP), a palpable pulsatile liver and, frequently, peripheral edema. The assessment of the severity of tricuspid valve regurgitation is made by echocardiography and by Doppler identification of the regurgitant jet, and indirectly by detection of hepatic portal venous flow and of right ventricular dilation. During surgery, dilated right atrium and ventricle is an indirect sign of severe TR, especially in the absence of severe pulmonary hypertension.

The major remaining controversies in tricuspid valve surgery are the choice between repair and replacement, the effectiveness of different methods of repair, and, when replacement is required, the type of prosthesis. There is a general consensus that an organically diseased or deformed valve should be replaced, because the medium-term and long-term results of conservative procedures for organically diseased valves are disappointing. Besides,

prosthetic tricuspid valve replacement is associated with high rates of mortality and morbidity. The advantages of tricuspid valve replacement are that the early results are predictable in terms of postoperative valve competence and that the valve does not become incompetent secondary to right ventricular dilation consequent on mitral valve failure. On the other hand, tricuspid valve replacement has its own inherent morbidity from suboptimal hemodynamic

performance, valve thrombosis, primary valve dysfunction, intrinsic stenosis caused by tissue overgrowth, and especially with mechanical prostheses, anticoagulant-related hemorrhage [13].

Hence, annuloplasty is the surgery of choice and may be achieved with sutures or rings. We believe that implantation of a ring is specifically indicated when there is organic involvement of the tricuspid valve, usually with stenosis, where commissurotomy is also necessary. In “functional” TR, a suture annuloplasty has yielded excellent results in most surgeons' experience.

Among several types of suture annuloplasty in use, the technique originally described by Dr. Norberto DeVega(14), or one of its many modifications, is the most commonly performed. It aims at reducing and fixing the size of the annulus in the segments that are prone to dilation, those corresponding to the anterior and posterior leaflets. Tricuspid annuloplasty is attractive because it is a simple and short procedure, but it requires essentially intact tricuspid architecture. Early mortality of 4 to 31% has been reported (15). The higher mortality figures were all in series reported before modern techniques of myocardial protection came into general use. The operative mortality in our patients decreased dramatically with the introduction of cold cardioplegia. Nowadays, the preoperative state of the patient and the associated disease are more likely to determine operative mortality than is the operation itself.

Conclusion

In our experience, the modified DeVega's tricuspid annuloplasty proved to be a safe procedure for the management of secondary tricuspid regurgitation. It is technically easy and reproducible even by relatively inexperienced surgeons. In our view, it should be used in all patients with more than mild “functional” tricuspid regurgitation. We have recommended and followed this policy in recent past with encouraging results. Recent evidence may suggest that it should be used “prophylactically” even in patients with annular dilation in absence of significant regurgitation.

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