

DE VEGA VERSUS SEGMENTAL REPAIR IN SURGICAL TREATMENT OF TRICUSPID VALVE DISEASE**Hatem M. Aboalazayem*, MSc, Elhussainy Gamile, MD, Mohammad Abdelbaset, MD, Saleh Raslan Hussain, MD, Mohammad Alsaïd Mosa, MD**

Department of Cardiothoracic Surgery, Elhoussain Hospital, Faculty of Medicine, Alazhar University.

***Corresponding Author: Hatem M. Aboalazayem**

Department of Cardiothoracic Surgery, Elhoussain Hospital, Faculty of Medicine, Alazhar University.

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ABSTRACT

Background. Adjustable segmental tricuspid annuloplasty is a new recently published procedure. The purpose of this prospective study was to present the technical advantages of this new tricuspid annuloplasty and Compare between it and De Vega repair and analyze its early and midterm results. **Methods.** between March 2015 and August 2016 in El-Hussain Hospital., 60 patients who had moderate or severe pure functional tricuspid regurgitation (TR), Patients were divided into 2 groups: (**group A**)30 patients where De Vega annuloplasty was performed and (**group B**)30 patients where segmental annuloplasty was performed, The decision for type of repair of tricuspid valve depended on randomization in the selection of two groups. The mean age of the patients was 34.87 ± 9.83 years and Females represented (46.7%) and (53.3%) of the patients in group A and B respectively. All patients had recent preoperative transthoracic echocardiography (TTE). two postoperative TTE were performed: (I) before the hospital discharge;(II) 6 months after surgery. **Results: In Early postoperative ECHO: In group A** 5 of patients (16.7%) had moderate TR, while in **Group B** no one have moderate TR. The difference between both groups is statistically significant. But **in Late postoperative ECHO (after 6 months)**In **Group A** : 10 of patients (33.3%) have moderate TR, but 4 of them (13.3%) have moderate to severe TR, and finally 3 of them (10%) had severe degree of TR, while In **group B** : 3 of patients (10%) had moderate TR. The difference between both values is statistically highly significant. **Conclusion:** no hospital mortality was reported. Progressive overall clinical improvement was observed and postoperative TTE revealed that recurrence rate of TR occurs more in De Vega repair group, and result of repair was better in segmental repair group in early and midterm results.

KAY WORDS: De Vega annuloplasty, segmental annuloplasty.**INTRODUCTION**

Functional tricuspid regurgitation (FTR) is a common type of tricuspid regurgitation. It is encountered in 22% to 59% of patient having mitral or combined mitral and aortic disease. Secondary TR is the most frequent type and refers to regurgitation not related to primary organic tricuspid valve disease. The pathophysiology of secondary TR is related to RV and annular dilatation or tethering (even with little annular dilatation) in connection to pulmonary hypertension. In most cases this is secondary to left-side valvular diseases, but can also occur in primary RV disease or pulmonary hypertension. Some authors have demonstrated that loss of contraction of the myocardium surrounding the annulus is the leading mechanism of TR, thus atrial fibrillation can also contribute. With progressive dilatation of ventricle and annulus, there is a failure of coaptation and tethering of the leaflets with progression of the TR.^[5]

Surgery for TR commonly occurs at the time of MV surgery. TR associated with dilatation of the tricuspid annulus should be repaired because tricuspid dilatation is

an ongoing process that may progress to severe TR if left untreated.^[1]

Principles of surgical therapy for secondary tricuspid regurgitation include the following:

- 1- Elimination of increased after load to the right ventricle by correction of left-sided valve dysfunctions and optimization of left ventricular function.^[2]
- 2- Maximization of right ventricular remodeling by reducing pulmonary hypertension.^[3]
- 3- Correct tricuspid annular dilatation and dysfunction. This usually consists of a tricuspid valve annuloplasty to restore annular size and geometry.^[2]

In recent years, annuloplasty has become an established surgical approach to significant TR.^[4]

The management of functional TR and choice of most appropriate surgical techniques remain debated among various surgical teams. An ideal tricuspid annuloplasty should take into consideration the anatomic and functional characteristics of the normal and pathologic TV.

It should be cost-effective, easy to perform, and safe; preserving the normal function of the TV and free of complications such as thromboembolism or heart block, durable, and free of long-term of recurrence of TR.^[6]

PATIENTS AND METHODS

This study was conducted on 60 patients randomly selected as regard to age and sex; all have secondary tricuspid regurgitation from moderate degree to severe degree of TR) as detected by preoperative echocardiographic assessment.

All patients were operated on in the period between March 2015 and August 2016 in El-Hussein Hospital.

All patients were approached through median sternotomy except 5 patients were approached through RT anterolateral thoracotomy with bicaval and ascending aorta cannulation. On beating heart after aortic declamping and after bicaval snaring;

Direct intraoperative assessment of the tricuspid valve through right atriotomy was done in all patients.

Assessment of the tricuspid valve leaflets, subvalvular apparatus for absence of leaflet thickening, fibrosis, calcification, loss of its substances, commissural fusion, chordal fibrosis, shortening (**secondary TR**). All patients were secondary TR. Patients were divided into 2 groups: (**Group A**) 30 patients where De Vega annuloplasty was performed and (**Group B**) 30 patients where segmental annuloplasty was performed,

The annular diameter was narrowed until the maximum intercommissural distance between anteroseptal and anteroposterior commissures become 21mm/m² of the body surface area.

All patients had recent preoperative TTE (no more than 2 months prior to surgery). Two postoperative TTEs were performed: (I) before the hospital discharge; (II) 6 months after surgery, the Inclusion criteria were:

- 1- Patients with tricuspid valve regurgitation from moderate degree severe.
- 2- Patient with any EF.
- 3- Patient with any degree of pulmonary hypertension.
- 4- Patient with associated valvular diseases.

Exclusion criteria

1. Patient with coronary artery disease
2. patient with organic tricuspid valve disease
3. Preoperative infective endocarditis of TV
4. Patients with mild tricuspid valve regurgitation

Surgical technique of segmental repair

The right atrium was opened obliquely and the TV was carefully explored in a beating heart. The tricuspid

annulus was identified, and the distance between the anteroseptal and posteroseptal commissures was measured.

Two 2-0 Ethibond sutures with a Teflon pledget were used for double suture lines.

The first suture was placed in the region of the posteroseptal commissure and threaded along the tricuspid annulus where the posterior leaflet is attached. The second suture was placed in the region of the anteroseptal commissure and threaded along the tricuspid annulus where the anterior leaflet is attached. The two separate sutures met in the middle, close to the anteroposterior commissure, and were held together using a wider Teflon pledget pointing toward the 12 o'clock position. The sutures were then passed through a short rubber tourniquet to equalize and adjust the pursing force at both ends of the same suture.

The pulmonary artery was cross-clamped and a warm saline solution was injected into the RV through the tricuspid valve. While the first suture was cinched until coaptation of the anterior tricuspid leaflet with the other leaflets was achieved, the middle pledget turned clockwise and pointed up toward the 10 o'clock position and down along the anteroposterior commissure. The second suture was cinched nearly one-third of that applied to the first suture (ie, the correlation between the anterior and posterior annular dilatation) the pulmonary artery was declamped, and the sutures were tied in sequence. The competence of the tricuspid valve was retested, as described previously.

Surgical technique of De Vega repair

After opening of right atrium and exposure of tricuspid valve running a single pledgeted 2-0 Ethibond sutures between the antero-septal commissure and postro-sptal commissure. Two sequential sutures are placed in this fashion, running clockwise through the annulus. These sutures are tightened to obliterate the portion of the annulus that has been plicated, after that saline test was used as in segmental repair.

Statistical Study

Data were analysed using Statistical Program for Social Science (SPSS) version 20.0. Quantitative data were expressed as mean± standard deviation (SD). Qualitative data were expressed as frequency and percentage.

Probability (P-value): P-value ≤0.05 was considered significant.

P-value ≤0.001 was considered as highly significant.

P-value >0.05 was considered insignificant.

RESULTS

No statistical significant difference between two groups as regard age, sex, and preoperative NYHA classification of dyspnoea and AF, as shown in this table.

Comparison between groups in preoperative data.

Data	Group A	Group B	p-value
Sex			
Female	14 (46.7%)	16 (53.3%)	>0.05
Male	16 (53.3%)	14 (46.7%)	
Age (years)			
Mean±SD	34.87±9.83	33.60±8.05	
Range	19-A62	19-A55	
class III	20(66.7%)	22(73.3%)	
class IV	10(34.3%)	8(26.7%)	
AF	10 (33.3%)	12 (40%)	
Sinus rhythm	20 (66.7%)	18 (60%)	

In preoperative ECHO, there was no statistical significant difference between two groups as regard degree of tricuspid

regurgitation, RV dilatation, EF, and pulmonary hypertension as shown in this table.

Comparison between groups according to preoperative ECHO.

ECHO	Group A	Group B	p-value
Moderate	3 (10%)	6 (20%)	>0.05
Severe	27 (90%)	24 (80%)	
RV			
Range	2.54-3.6	2.44-4.13	
Mean ± SD	2.95 ± 0.41	2.97 ± 0.42	
RA			
Range	4.65-6.01	4-6.53	
Mean ± SD	6.91 ±1.22	6.93 ±1.02	
PASP			
Range	40 and 80	45 and 85	
Mean ± SD	63.20 ±11.80	61.40 ±11.22	
EF			
Range	48-68%	46-71%	
Mean ± SD	55.80 ± 5.80	57.80 ± 7.04	

There was statistical significant difference between two groups as regard early postoperative ECHO where in **group A** about 11 of patients (36.7%) had no TR, 13 of them (43.3%) have mild TR, and 1 of them (3.3%) had mild to moderate TR, but 5 of them (16.7) had moderate

TR, while in **group B** about 21 of patients (70%) had no TR, 8 of them (26.7%) had mild TR, and 1 of them (3.3%) had mild to moderate TR, but no one has moderate TR. The difference between both groups is statistically significant.

Comparison between groups according to early postoperative ECHO.

ECHO	Group A	Group B	p-value
Mild	13 (43.3%)	8 (26.7%)	0.025
Mild to Moderate	1 (3.3%)	1 (3.3%)	
Moderate	5 (16.7%)	0 (0%)	
No	11 (36.7%)	21 (70%)	
Total	30 (100%)	30 (100%)	

After 6 months, there is highly statistical significant difference between two groups as regard early postoperative ECHO, where in Group A : 11 of patients (36.7%) had mild degree of TR, but 2 of them (6.7) had mild to moderate TR, and 10 of them (33.3%) had moderate TR, but 4 of them (13.3%) have moderate to

severe TR, and finally 3 of them (10%) had severe degree of TR after 6 months of operation, while In Group B : 17 of patients (56.7%) had mild degree of TR, and 3 of them (10%) had moderate TR, but 10 of them (33.3%) had no TR after 6 months of operation, as shown in this table.

Comparison between groups according to ECHO after 6 months.

ECHO after 6 months	Group A	Group B	Chi-square	p-value
Mild	11 (36.7%)	17 (56.7%)	24.055	<0.001 (HS)
Mild to Moderate	2 (6.7%)	0 (0%)		
Moderate	10 (33.3%)	3 (10%)		
Moderate to Severe	4 (13.3%)	0 (0%)		
Severe	3 (10%)	0 (0%)		
No	0 (0%)	10 (33.3%)		
Total	30 (100%)	30 (100%)		

DISCUSSION

In our study the mean age of patients in group A, was 34.87 ± 9.83 years, while in group B, it was 33.60 ± 8.05 yrs.

All the patients included had moderate +3 to severe +4 degree of TR. Systolic PAP was elevated in all our patients ranged between 40 - 80 mmHg in group A and between 45 - 85 mmHg in group B. The mean systolic PAP in group A was 63.20 ± 11.80 mmHg and in group B it was 61.40 ± 11.22 mmHg. RV was found dilated in all the patients. The mean RV dimension in group A was 2.95 ± 0.41 cm, and in group B it was 2.97 ± 0.42 cm. There was significant correlation between elevated SPAP, RV dilatation and the presence of secondary TR.

The results of this study in early outcome show significant improvement in both groups with significant differences between them as regard to the severity and number of patients with TR. In **group A**, about 11 of patients (36.7%) had no TR, 13 of them (43.3%) have mild TR, and 1 of them (3.3%) had mild to moderate TR, but 5 of them (16.7%) had moderate TR, while in **group B**, 21 of patients (70%) had no TR, 8 of them (26.7%) had mild TR, and 1 of them (3.3%) had mild to moderate TR, but no one has moderate TR.

In mid-term (6months) results there was highly significant differences between two groups in ECHO data for patients in both groups as regard degree of TR. In **group A**: 11 of patients (36.7%) had mild degree of TR, but 2 of them (6.7%) had mild to moderate TR, and 10 of them (33.3%) had moderate TR, but 4 of them (13.3%) had moderate to severe TR, and finally 3 of them (10%) had severe degree of TR. while in **group B**: 17 of patients (56.7%) had mild degree of TR, and 3 of them (10%) had moderate TR, but 10 of them (33.3%) had no TR.

So this study revealed that recurrence rate of TR occurs more in De Vega repair group, and results of repair were better in segmental repair group in early and midterm results **Sarraj and colleagues**^[6], worked on 17 patients with chronic moderate and severe mitral regurgitation (MR) between January 2004 and December 2006, Concomitant tricuspid valve segmental repair (TVR) was performed in 17 patients. The conclusion was: segmental repair is an improved and efficient procedure

for functional TR because it is more selective, more adjustable and more resistant.

Abdul Malik et al^[7] study was conducted on 160 patients with mean age 21 years with 44.4% male and 55.6% female underwent De Vega repair at time from January 2007 to June 2011, the result was: Patients who were free from TR were 81.3% and 19% had recurrent TR at 6 months follow up.

This result in **Abdul Malik et al**^[7] study due to consideration of recurrent TR when the degree of TR above grade 3 which is moderate to severe TR, so if we consider this in our study, the result will be 23.3% of patient had recurrent TR.

Rias Anwar et al^[8] study was conducted on 22 patients from January 20012 to December 2003, show 80% of patients were free from TR post operative, and 20% of them had recurrent TR.

This study demonstrated that the outcome of tricuspid repair depends on different factors:

- 1-Quality of repair of left side valvular lesion
- 2- duration, extent, and degree of preoperative TR
- 3-systolic and diastolic function of right and left ventricles
- 4- degree of pulmonary artery pressure

Patrick M. McCarthy, et al^[9], worked from January 1990 to January 1999, 790 patients underwent annuloplasty for functional tricuspid valve regurgitation and the results of De Vega repair were recurrent tricuspid regurgitation 1 week after annuloplasty and after 6 months in 14% of patients. This study demonstrated that risk factors for worsening regurgitation included higher preoperative regurgitation grade, poor left ventricular function, permanent pacemaker, and repair type other than ring annuloplasty.

Pradhan et al^[10] study that conducted on 25 patients that underwent De Vega repair on moderate TR preoperative, shown 17% of patient had recurrent TR in postoperative ECHO.

Pradhan et al^[10] study said that the main factor of recurrent postoperative TR is persistent high PAP and dilated RV dimension and impaired ventricular function.

Anas Sarraj and Juan Duarte^[11] study that conducted on 7 female patients Between March and November

2005, with (mean age, 66.2 ± 7.4 years; range, 59 to 74 years) with severe rheumatic mitral valve lesion, functional tricuspid insufficiency, and no severe pulmonary hypertension, underwent mitral valve replacement and adjustable segmental tricuspid annuloplasty. The result of this study after 6 months was: Six months after surgery, Doppler echocardiography was performed in all these patients demonstrating no recurrence of tricuspid regurgitation or residual stenosis by overcorrection.

In comparison between result of this and our studies, we find about 10% of patient in our study had postoperative recurrent moderate TR in patients that underwent to segmental annuloplasty, the cause most probably is increased PAP in our patients which is the main factor for recurrent post-operative TR as this appears from previous studies, but in **Anas Sarraj**^[11] study, patients had no pre-operative pulmonary hypertension.

The results of segmental annuloplasty were better than that of De Vega annuloplasty because this new technique is more selective in the remodeling of the tricuspid annulus. It could achieve better coaptation of the anterior leaflet with the others, successful annular reduction, better adjustment, and distribution of pursing force in the more dilated region.

It could prevent massive insufficiency caused by one suture tear from the endocardium, and prevent the tear of the endocardium in the posteroseptal region, which could be reproduced in the De Vega technique by pursing in an opposite direction.

Adjustable segmental tricuspid annuloplasty is an improved annuloplasty procedure for functional TR because it is segmental, commissural, more selective, more adjustable, and more resistant in the presence of TR associated with severe dilatation of the tricuspid annulus, severe PHT, or both. These results may make this tricuspid annuloplasty the procedure of choice in underprivileged countries. Like all tricuspid annuloplasties, it may be adversely influenced by poor left ventricular function.

We are awaiting the long-term results of this new annuloplasty, which we are continuing to perform, in a larger number of patients.

CONCLUSION

Adjustable segmental tricuspid annuloplasty is an improved suture annuloplasty that only repairs the dilatation of the tricuspid annulus in pure functional TR. Like all other tricuspid suture annuloplasties, it is a simple, low-cost, fast, and safe procedure, which does not cause hemolytic anemia, endocarditis, or thromboembolism, and does not interfere with the physiologic motion of the tricuspid annulus. In addition, adjustable segmental tricuspid annuloplasty has certain advantages:

- (1) It is more resistant, as the sum of the forces of distension is passed over a wide Teflon patch.
- (2) It is segmental, because it divides the forces of distension over two double sutures. in order to avoid the guitar-string syndrome.
- (3) It is more selective, because it acts specifically on the anteroposterior segment, the most dilated portion of the tricuspid annulus.
- (4) It is more adjustable, as the pursing forces can be adapted to the most dilated segment of the annulus.
- (5) It is commissural, as the pursing forces act in the middle of the anteroposterior segment, near the anteroposterior commissure allowing the complete closure of this commissure; and finally,
- (6) This new tricuspid annuloplasty purses the double sutures in the same direction to avoid tearing of the endocardial surface, and uses a tourniquet on each double suture to achieve a gradual and equal pursing at each end of the suture.

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