International Surgery Journal
Bhagwan J et al. Int Surg J. 2018 Jun;5(6):2131-2136
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20181975

Original Research Article

A comparative analysis between ring annuloplasty and de vega annuloplasty in functional tricuspid regurgitation

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Received: 12 April 2018
Accepted: 21 April 2018

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ABSTRACT

Background: Tricuspid valve disease frequently accompanies left side valve disease. Surgical correction of significant functional TR at the time of left side valve surgery is recommended. The current study was under taken to assess the early impact of ring annuloplasty and De Vega annuloplasty techniques in functional significant TR in a predominantly rheumatic population.
Methods: Between January 2010 and January 2014, a total 80 patients underwent surgery for functional tricuspid valve disease. Retrospective data analysis was done. The patient selection criteria were as per the institutional protocol (for all functional severe TR and moderate TR with Tricuspid Index > 21mm/m^2) based on preoperative TTE (Trans-thoracic Echocardiography) findings and the type of procedure was the surgeon's decision on table. Techniques routinely involved in the repair procedures included tricuspid prosthetic ring Annuloplasty (MC3) and De Vega suture annuloplasty. Postoperatively all the patient had routine TTE before hospital discharge (considered as immediate post op period). Follow up was present till 6 months post-operatively (in the form of another TTE and clinical data sheet) at the time of data collection for this study.
Results: There was no statistically significant difference in residual significant TR when ring annuloplasty was compared to De Vega repair. There was significant improvement in NYHA status after both ring and De Vega annuloplasty.
Conclusions: Present study shows similar results with both the techniques of TV repair when applied to functionally significant TR in a pre-dominantly rheumatic population.

Keywords: Annuloplasty, De vega annuloplasty, Ring annuloplasty, Tricuspid regurgitation

INTRODUCTION

Tricuspid valve disease is a frequent accompaniment of mitral valve disease. Functional tricuspid regurgitation(TR) is caused by tricuspid valve (TV) annular dilation and altered right ventricular geometry secondary to left sided heart disease.[1] The concomitant correction of functional secondary tricuspid regurgitation (TR) remains underused despite recent data showing substantially poorer functional outcomes and survival if untreated. The traditional view that functional tricuspid regurgitation generally resolves with surgical correction of the primary lesions is no longer held. Significant TR secondary to right ventricular dilation and dysfunction associated with mitral valve disease is a risk factor for poor functional outcome and mortality after mitral valve surgery.[2] Surgical correction of significant functional TR at the time of left side valve surgery is recommended.[3-8] Without treatment, TR may worsen over time leading to worsening of symptoms, heart failure and even death. TV

repair in patients with secondary TR does not prolong bypass time in most cardiac operations and is also not a very complex procedure.

According to AHA/ACC guidelines 2017 update, intervention for TR is indicated in patients with severe TR, moderate TR with either tricuspid annular dilatation (greater than 4 cm) or Tricuspid index greater than 21 cm/m^2.

There are several annuloplasty techniques available for the repair of tricuspid valve. The current study was under taken to assess the early impact of ring annuloplasty and De Vega annuloplasty techniques in functional significant TR in a predominantly rheumatic population.

METHODS

Between January 2010 and January 2014, a total 80 patients underwent surgery for functional tricuspid valve disease. We did a retrospective data analysis and reviewed the records of all 80 patients which included clinical histories, perioperative echocardiogram, operative notes and follow up data. The preoperative demography of these patients is listed in the Table 1.

The patient selection criteria were as per the institutional protocol (for all functional severe TR and moderate TR with Tricuspid Index > 21mm/m^2) based on preoperative TTE (Trans-thoracic Echocardiography) findings and the type of procedure was the surgeon's decision on table. Organic tricuspid valve diseases were excluded. Techniques routinely involved in the repair procedures included tricuspid prosthetic ring Annuloplasty (MC3) and De Vega suture annuloplasty. Intra operative Transesophageal Echocardiography (TEE) and saline infusion tests revealed no more than mild TR. Postoperatively all the patient had routine TTE before hospital discharge (considered as immediate post op period).

Table 1: Pre-operative characteristics.

Variables	Total (n=80)	Ring annuloplasty(n=55)	De vega annuloplasty(n=25)
Age in years	38-65(27.13)		
Female	34(42.5%)	23(41.8%)	11(44%)
Male	46(57.5%)	32(58.2%)	14(56%)
LVEF>45%	51(63.75%)	46(83.63%)	5(20%)
LVEF<45%	29(36.25%)	9(16.37%)	20(80%)
RV Dysfunction			
Severe	3(3.75%)	2(3.63%)	1(4%)
Moderate	8(10%)	6(10.90%)	2(8%)
Mild	10(12.5%)	5(9.09%)	5(20%)
PAH			
Sev PAH	5(6.25%)	5(9.09%)	0(0%)
Mod PAH	30(37.5%)	20(36.36%)	10(20%)
Mild PAH	45(56.25%)	30(54.5%)	15(30%)

The recorded patient follows up was present till 6 months post-operatively (in the form of another TTE and clinical data sheet) at the time of data collection for this study. Eight patients (10%) were lost to in hospital mortality and eight patients (10%) were lost to follow-up. The follow up was 88.8% complete. No late deaths or cardiac reoperations occurred during follow up.

RESULTS

Mortality: In hospital mortality was 10%. Mortality in ring annuloplasty group is 9% and De Vega group is 12%.

Freedom from residual significant TR (moderate or severe): Severe and moderate TR regressed in both groups. In immediate post-operative period 96% of patients in De Vega group and 91.65% in ring annuloplasty group had less than significant residual TR, but in early follow up period (at 6 months) 86.67% of patients in the ring annuloplasty group and 78.95% of patients in the De Vega group showed freedom from significant residual TR. There was no statistically significant difference in residual significant TR when ring annuloplasty was compared to De Vega repair (p=0.42 prior to discharge and p=0.44 at 6-month follow-up).

Event free survival which is defined as freedom from valve thrombosis, thromboembolism structural valve dysfunction, major bleeding events, endocarditis, TV re-operation during follow up, which was 100% in the present study, however the followup is too short to comment on this aspect. Improvement in NYHA status (NYHA I, NYHA II accepted as improvement): There was significant improvement in NYHA status

(p=0.00001) after ring annuloplasty. There was also significant improvement in NYHA status (p=0.000074) after De Vega repair. There was no prosthesis/valve related mortality in the follow-up period.

Table 2: Immediate post-operative outcomes.

Groups	Pre-operative findings	Post-operative findings
Ring annuloplasty group (n = 55) MVR + TV repair = 31 MV Rep + TV Rep = 11 DVR + TV Rep = 5 ASD + TV Rep = 8	Severe TR = 48 (87.27%)	1 (1.8%)
	Moderate TR = 7 (12.72%)	4 (7.27%)
	Mild TR = 0 (0%)	13 (23.63%)
	LVEF <45% = 9 (16.36%)	21 (38.18%)
	LVEF >45% = 46 (83.63%)	34 (61.81%)
	RV dysfunction	
	Mild = 5 (9.09%)	13 (23.63%)
	Moderate = 6 (10.90%)	10 (18.18%)
	Severe = 2 (3.63%)	5 (9.09%)
	PAH	
	Severe = 5 (9.09%)	7 (12.72%)
	Mod = 20 (36.36%)	6 (10.90%)
	Mild = 30 (54.54%)	18 (32.72%)
	No = 0 (0%)	24 (43.63%)
	LV dysfunction	
	Severe = 0 (0%)	4 (7.27%)
	Mod = 9 (16.36%)	15 (27.27%)
	Mild = 5 (9.09%)	13 (23.63%)
De vega annuloplasty (n = 25) MVR + TV Rep = 17 MV rep + TV Rep = 2 DVR + TV Rep = 3 ASD + TV Rep = 3	Severe TR = 16 (64%)	0 (0%)
	Moderate TR = 9 (36%)	1 (4%)
	Mild = 0 (0%)	10 (40%)
	LVEF <45% = 20 (80%)	9 (36%)
	LVEF >45% = 5 (20%)	16 (64%)
	RV dysfunction	
	Mild = 5 (20%)	11 (44%)
	Moderate = 2 (8%)	4 (16%)
	Severe = 1 (4%)	3 (12%)
	PAH	
	Severe = 0 (0%)	5 (20%)
	Mod = 10 (40%)	3 (12%)
	Mild = 15 (60%)	9 (36%)
	No = 0 (0%)	8 (32%)
	LV dysfunction	
	Severe = 0 (0%)	2 (8%)
	Moderate = 4 (16%)	8 (32%)
	Mild = 16 (64%)	14 (56%)

DISCUSSION

Tricuspid valve repair for TR can be challenging with respect to indications and choice of optimum surgical technique. According to AHA/ACC guidelines 2017 update, intervention for TR is indicated in patients with severe TR, moderate TR with either tricuspid annular dilatation (greater than 4 cm) or Tricuspid index greater than 21 mm/m^2.[9] Management options include conservative treatment, repair or replacement. Adequate physiologic and anatomic correction influences long term results of the repair.[10] From surgical point of view, several techniques are available to correct TR. De Vega annuloplasty is considered to be simple, easy, effective and least expensive of them, but recurrence and reoperation rate has been reported in 34% and 10% of survivors, at mid-term follow up.[11] De Vega annuloplasty has been criticized for being unpredictable and unreliable, perhaps due to the long suture line, which breaks or slides through the tissue as the annulus dilates.[12] Several studies have indeed found the simple suture annuloplasty to be a risk factor for tricuspid failure.[13,14] This has not been so in the present study. A prospective randomized study of 159 patients conducted by Rivera et al comparing the De

Vega technique to Carpentier ring annuloplasty demonstrated a higher recurrence of moderate and severe TR in De Vega group at 45 months follow up (Carpentier 4 of 40, De Vega 14 of 41; p<0.01).[14] A similar small group study in 45 patients by Matsuyama et al showed a 45% recurrence of 2+ to 3+ TR in De Vega compared with only 6% in the Carpentier repair group (p=0.027). Freedom from moderate and severe TR at a mean follow up of 39±23 month was 45% in the De Vega group and 94% in the Carpientier group.[16]

Table 3: Out comes in the 6 months follow up.

Groups	Pre op	Follow up
Ring group (n=45)	Severe TR = 38 (84.44%)	0 (0%)
	Moderate TR = 7 (15.55%)	6 (13.33%)
	Mild TR = 0 (0%)	18 (40%)
	LVEF <45% = 5 (11.11%)	5 (11.11%)
	LVEF >45% = 40 (88.88%)	40 (88.88%)
	RV dysfunction	
	Mild = 5 (11.11%)	16 (35.55%)
	Moderate = 4 (8.88%)	3 (6.66%)
	Severe = 0 (0%)	0 (0%)
	PAH	
	Severe = 4 (8.88%)	1 (2.22%)
	Mod = 14 (31.11%)	7 (15.55%)
	Mild = 27 (60%)	19 (42.22%)
	No = 0 (0%)	18 (40.01%)
	LV dysfunction	
	Severe = 0 (0%)	0 (0%)
	Mod = 0 (0%)	3 (6.66%)
	Mild = 24 (53.33%)	34 (61.81%)
	NYHA	NYHA
	I = 0 (0%)	I = 35 (77.77%)
	II = 6 (13.33%)	II = 9 (20%)
	III = 28 (62.22%)	III = 1 (2.22%)
	IV = 11(24.44%)	IV = 0 (0%)
Devega group(n=19)	Severe TR = 11 (57.89%)	0 (0%)
	Moderate TR = 7 (36.84%)	4 (21.05%)
	Mild TR = 1 (5.26%)	4 (21.05%)
	LVEF <45% = 3 (15.78%)	3 (15.78%)
	LVEF>45% = 16 (84.21%)	16 (84.21%)
	RV dysfunction	
	Mild = 5 (26.31%)	8 (42.10%)
	Moderate = 1 (5.26%)	3 (15.78%)
	Severe = 0 (0%)	0 (0%)
	PAH	
	Severe = 1 (5.26%)	0 (0%)
	Mod = 7 (36.84%)	2 (10.52%)
	Mild = 11 (57.89%)	8 (42.10%)
	No = 0 (0%)	9 (47.38%)
	LV dysfunction	
	Severe = 0 (0%)	0 (0%)
	Mod = 9 (47.36%)	3 (15.78%)
	Mild = 5 (26.31%)	13 (68.42%)
	NYHA	NYHA
	I = 0 (0%) II = 3 (15.78%)	I = 14 (73.68%) II = 4 (21.05%)
	III = 13 (68.42%)	III = 1 (5.26%)
	IV = 3 (15.78%)	IV = 0 (0%)

Bernal et al showed lesser re-operation rate after ring annuloplasty compared to De Vega repair.[17] Tang et al showed lower TR recurrence rates in patients receiving prosthetic ring annuloplasty with better long term and event free survival.[2] Carrier et al showed similar results between ring annuloplasty and De Vega.[18]

In the present study, Patients with higher right ventricular systolic pressure in preoperative period showed residual significant TR in both the groups, but the larger annular index diameter showed no such association with residual significant TR in early postoperative period. Present results revealed no significant difference in the 2 techniques, Ring annuloplasty and De Vega Repair, with respect to residual significant TR, neither in immediate follow-up (p=0.42) nor at 6-month follow-up (p=0.44), similar to the results of Carrier etal.[18] In survivors, NYHA class improved in both the groups (Table 3) (Table 4).

Table 4: Impact of Tricuspid index diameter, LV function and RVSP on Residual significant TR.

Follow up	Index diam (mm/m2)	Mean LVEF(%)			RVSP (mm Hg)
		Pre op	post op	follow up	
Ring group (17.65mo) (10-41)	24.45	55.5	38.15	51.23	
Residual Significant TR (13.33%)	23.8	58.5	45	50	72
Non-significant TR (86.67%)	23.4	54.91	34.68	52.85	58.4
De vega group (27.16mo) (10-42)	23.62	54.2	35.7	51.38	
Residual Significant TR (21.05%)	22.25	57.5	51.2	51.2	57.5
Non-significant TR (78.95%)	26.12	57.2	32.46	48	49.8

These results could be attributed to meticulous surgical techniques applied to both ring annuloplasty and De Vega repair and standardized post-operative management and follow-up.

CONCLUSION

The choice regarding which technique to address TV regurgitation can be a difficult one with literature available on various techniques. Present study shows similar results with both the techniques of TV repair, prosthetic ring annuloplasty and DeVega repair, when applied to functionally significant TR in a pre-dominantly rheumatic population. However, further studies with much larger sample size are required before an apt conclusion can be reached as to the efficacy of ring annuloplasty compared to DeVega repair.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Bhagwan J, Guha S, Gupta A, Padhy AK, Grover V, Gupta VK. A comparative analysis between ring annuloplasty and de vega annuloplasty in functional tricuspid regurgitation. Int Surg J 2018;5:2131-6.