

DE VEGA'S TRICUSPID ANNULOPLASTY FOR SEVERE TRICUSPID REGURGITATION - EARLY AND MIDTERM FOLLOW UP

Abdul Malik¹, Imran Khan Khalil², Syed Murad Ali³, Riaz Anwar Khan⁴,
Ajab Khan⁵, Gibran⁶, Naseemullah⁷

¹⁻⁷ Department of Cardiovascular Surgery, Lady Reading Hospital, Peshawar - Pakistan

Address for Correspondence:

Dr. Abdul Malik,
Assistant Professor,
Department of Cardiovascular Surgery, Lady Reading Hospital, Peshawar - Pakistan

E-mail: malik119pk@yahoo.com

Date Received: December 20, 2011

Date Revised: January 18, 2012

Date Accepted: January 26, 2012

Contribution

All the authors contributed significantly to the research that resulted in the submitted manuscript.

All authors declare no conflict of interest.

ABSTRACT

Objective: To assess early and midterm outcome of De Vega's Repair of Tricuspid Valve in Severe Tricuspid Regurgitation (TR).

Methodology: This was a prospective observational study conducted from January 2007 to June 2011, at Cardiovascular department PGMI, Lady Reading Hospital Peshawar. De Vega's surgical repair of tricuspid valve was done in severe tricuspid regurgitation patients with mitral valve replacement (MVR) or with double valve replacement [DVR=MVR+ AVR (Aortic valve replacement)]. Pre operative and post operative early (with in 1 month) and midterm (at 6 month) follow up data was collected and analyzed on the basis of New York Heart Association (NYHA) functional status and echocardiographic finding. The outcome of De Vega's repair was assessed.

Results: Total study population was 160, with age ranging from 14-52 years (mean age 21 years). Out of these 160 patients 89 (55.60%) patients were female and 71 (44.40%) were male. Preoperative diagnosis of 118 patients was related to pure mitral valve disease, and 42 cases were having aortic valve disease along with mitral disease. All patients had severe TR. Patients who were free from TR in MVR group were 81.3% and 75.0% patient were TR free in DVR group at 6 months follow up and the repair was intact on echocardiography.

Conclusion: De Vega's repair in Severe TR is a safe and economical procedure in our setup.

Key Words: Tricuspid valve, Tricuspid annuloplasty; De Vega's annuloplasty, Tricuspid Regurgitation.

INTRODUCTION

Significant tricuspid regurgitation (TR) leads to functional impairment and is an independent predictor of reduced event free and overall survival.¹ Therefore, an evidence based approach is necessary for the diagnosis and treatment of tricuspid regurgitation.² Tricuspid regurgitation can be classified into two basic categories, primary and secondary TR. The primary TR refers to the condition in which the disease process affects the valve apparatus causing its thickening and scarring. Secondary TR occurs due to tricuspid annular dilation, right heart failure and pulmonary hypertension.² The most common cause of TR is dilation of the right ventricle causing functional TR.³ Thus left sided heart disease including Mitral valve disease, cardiomyopathy or right ventricular (RV) dysfunction due to pulmonary disease (Corpulmonale) will lead to functional TR.⁴ RV dilation can lead to papillary muscle displacement. The normal saddle shaped Tricuspid Annulus becomes flatter, larger and more circular causing functional TR. Similarly Increased RV pressure also worsen tricuspid regurgitation.⁵ Two dimensional and Doppler Echocardiography allows for comprehensive assessment of TR severity and mechanism.² Cardiac MRI may be implied when echo images are inadequate.¹ Although mild to moderate degree of TR can be well tolerated for many years,³ uncorrected severe TR and dilated annulus with associated Mitral valve disease have poor prognosis with high mortality and increased morbidity.^{6,7} Increasing TR consistently reduces right ventricular function.⁸ So surgical intervention in the form of valve repair or replacement is necessary. TV repair or an annuloplasty is favored over prosthetic implant.³ Correction of tricuspid regurgitation improves clinical outcomes.¹

While some authors favor Tricuspid Repair on the basis of severity of tricuspid regurgitation⁹, others are in favor of repair based on annular dilation irrespective of the severity of tricuspid regurgitation.^{10,11} Thus during Mitral valve surgery, tricuspid valve annuloplasty should be performed for annular dilation or moderate to severe TR.^{12,13} Techniques used to deal with dilated Tricuspid annulus include Bicuspidization, De Vega's repair or flexible rings.^{14,15} De Vega's repair is superior to bicuspidization¹⁶ and comparable to rings annuloplasty in long term patient survival.¹⁷ De Vega's Repair significantly reduces the progression of Tricuspid regurgitation.¹⁸ The De Vega's technique also can be employed for mild to moderate annular dilatation. In case of functional Tricuspid regurgitation, the annuloplasty provides a competent tricuspid valve during the early and late postoperative course while the heart remodels after surgical treatment of the left-sided valvular lesions.^{19,20}

The objective of this study was to assess early and mid term outcomes of De Vega's repair of Tricuspid Valve in Severe

Tricuspid Regurgitation (TR) in our set up.

METHODOLOGY

This study was conducted in the Department of Cardiovascular Surgery, Postgraduate Medical Institute, Lady Reading Hospital Peshawar from January 2007 to June 2011. All the patients who had tricuspid valve repair for severe tricuspid regurgitation (functional), either with mitral valve replacement (MVR) or with double valve replacement (DVR), were involved in this study. The study was approved by hospital ethical committee.

The New York Heart Association (NYHA) functional class was recorded at the time of admission. The echocardiogram was done (by the same operator) taking the standard views and the tricuspid severity was graded according to the jet area and jet area to right atrial area ratio. The tricuspid regurgitation severity was graded as none, mild (TR+1), moderate (TR+2) and severe (TR+3). Moderate tricuspid regurgitation was defined as jet area 5-10cm² and jet area to right atrial area ratio of 20-40% in apical four chamber view. The pulmonary artery systolic pressure was determined using the modified Bernoulli's formula with 10mmHg added for right atrial pressure.

All patients underwent either mitral valve replacement or double valve replacement (according to diagnoses) with tricuspid valve repair under general anesthesia with standard median sternotomy. Routine cardiopulmonary bypass with single aortic and bicaval cannulas. Cold antegrade cardioplegia was used for arresting the heart. Heart was further covered with topical ice slush. Cardioplegia was repeated after every 20-25 minutes once the heart was fully arrested. The mitral valve was corrected through the left atrium. After closing the left atrium, right atrium was opened to inspect the tricuspid valve. Assessment of TR+3 was made. De Vega's tricuspid annuloplasty was performed in all cases for severe TR which consisted of two separate semi circular sutures of 4/0 prolene run in the anterior and lateral aspect of tricuspid valve and tied on both sides on pledgets over a dilator of size 28 mm to 30 mm in the valve to avoid purse string effects. Re-warming was started while closing the right atrium in case of tricuspid valve repair. De-airing was done through aortic root before declamping of aorta. The outcome of De Vega's repair was assessed in terms of early (within 1 month) and mid term (at 6 month) follow up. Immediate post operative follow up included wound infection (superficial and sternal), reopening, stroke, acute renal failure (ARF) and mortality, while at 6 month follow up mortality, NYHA class, echocardiographic parameters were assessed. All this data was recorded on preformed structured proforma.

Statistical analysis was performed using statistical package for social sciences (SPSS) version 16. Numerical variables

were presented as mean \pm SD. Categorical variables were presented as frequencies and percentages.

RESULTS

Total study population was 160, with age ranging from 14-52 years (mean age 21 years). Out of these 160 patients 89 (55.60%) patients were female and 71 (44.40%) were male. Preoperative diagnosis of 118 patients was related to pure mitral valve disease, and 42 cases were having aortic valve disease along with mitral disease. All patients had severe TR, right ventricular pressure ranged from 65mmHg to 110 mmHg with a mean of 85 mmHg. Patients with fractional shortening $<$ 25% were 70 (43.75%) while patients with fractional shortening $>$ 25% were 90 (56.25%) (Table 1).

Post operative complications seen were superficial wound infection, sternal wound infection, reopening for bleeding and reopening for low cardiac output. Six patients died in the immediate post op period (Table 2).

In the follow up 8 patients were lost (including the mortality

of 6 cases) and in the remaining 152 cases, 113 were those who had mitral valve replacement and 39 cases had double valve replacement. Mortality was 5.3% and 7.6% in MVR and DVR group, respectively. Dyspnea functional class according to New York Heart Association (NYHA) improved from III to II in most of the patients. The fractional shortening of $<$ 25% was seen in 9 (08.4%) patients among MVR group and in 05 (13.8%) patients among DVR group. Echocardiographic TR freedom was present in 81.3% in MVR group and 75.0% in DVR group (Table 3).

DISCUSSION

Significant tricuspid regurgitation (TR) can contribute to increased morbidity and mortality in patients undergoing surgery for left side valvular disease,²¹ therefore an aggressive repair of accompanying TR should be performed at the time of initial left sided valvular surgery.¹⁸ The optimal technique to repair the TV remains uncertain. Bicuspidalization (ie, plication of the posterior leaflet) is now rarely performed even though reported outcomes have been

Table 1: Pre-Operative Echo Findings/ NYHA Status

Echo Findings/NYHA Status	No. of Patients
TR+3	160
RV pressure (65 mmHg to 110 mmHg with a mean of 85 mmHg)	160
Fractional shortening $<$ 25	70 (43.75%)
Fractional Shortening $>$ 25	90 (56.25%)
NYHA Status	
II	030 (18.75%)
III	130 (81.25%)
IV	00

Table 2: Early (with in 30 days) Post Operative Complications

Complications	No. of Patients
Superficial Wound infection	01 (0.625%)
Sternal Wound Infection	01 (0.625%)
Reopening for Bleeding/ low cardiac output	07(04.37%)
CVA	01 (0.625%)
ARF	01(0.625%)
Mortality	06 (03.70%)

Table 3: Post-operative Follow-up at 6 Month

Parameters	Mitral Valve Replacement(MVR)	Double Valve Replacement(DVR)
Lost to Follow up	05	03
Clinical Status		
NYHA-I	10 (09.30%)	04 (11.11%)
NYHA-II	93 (86.91%)	31(86.11%)
NYHA-III	04 (03.73%)	01 (02.77%)
NYHA-IV	Nil	Nil
Echo Findings		
No TR	87 (81.3%)	27 (75.0%)
TR+1	19(17.7%)	05 (13.8%)
TR+2	01 (0.93%)	03 (08.3%)
TR+3	Nil	01 (02.7%)
Fractional shortening < 25%	09 (08.4%)	05 (13.8%)
Fractional shortening > 25%	98(91.5%)	31 (86.1%)
RV Pressure Mean	20 mm of Hg	22 mm of Hg
Mortality	06 (5.3%)	03 (7.6%)

reasonable, especially for rheumatic patients.²² The De Vega's²³ suture annuloplasty technique involves plication of the annulus surrounding the anterior and posterior leaflets and is the most commonly used TV repair technique.²⁴ A number of series have reported its short and long-term success.²⁵⁻²⁷ The advantage of using rigid or flexible ring over the De Vega's technique is that it is more durable. Especially when there is associated pulmonary artery hypertension the ring gives far better results. It has been noted that the De Vega's repair gives way to the high pressure and TR increases rapidly.²⁸ We conducted this study to evaluate the outcomes of De Vega's annuloplasty for severe TR in our local setup.

In the present study population was relatively younger with female predominance which follows the same pattern as in literature for rheumatic heart disease,^{5,8-10} except for Dreyfus et al where most patient were with mix non rheumatic etiology.¹³ Regarding pre-operative clinical status most of our patients were in NYHA class III which was almost the same in various studies in patients undergoing annuloplasty for TR.^{8,10}

The immediate follow up of patients with De Vega's annuloplasty for severe tricuspid regurgitation shows the mortality of 3.7%, which is the same as in study by Morishita et al, reporting 3.4%.²⁷ Reoperation was performed in 4.37%

of patient, which is reported in very less number of studies. McCarthy et al reported the risk of reoperation 4.2% per year at 30 days.²⁸ The incidence of stroke, acute renal failure (ARF), and wound infection was all negligible, mainly because of advancement in surgical procedure, postoperative care and use of broad spectrum antibiotics.

At 6 month follow up, clinical status of majority of patients improved from NYHA III to NYHA II, only 04 (3.73%) and 01 (2.7%) patients in mitral and double valve replacement group remain in NYHA class III, respectively. This improvement in functional class is in accordance with the previous studies on De Vega's annuloplasty for TR.^{25,27} Pradhan et al, has observed the same improvement in patients functional class undergoing De Vega's annuloplasty for moderate secondary TR.²⁹ A large number of patient transformed from severe TR+3 to mild TR+1 at 6 month follow up, this was illustrated by Wei et al thus making a plea for De Vega's annuloplasty in functional TR.³⁰ We are generally relying on the De Vega's technique due to its simplicity and cost effectiveness. The clinical improvement in the functional class of the patients along with freedom from TR in 81.3% in MVR group and 75% in DVR group on echocardiography favour the use of De Vega's technique. Some small studies have supported the same finding with 80% and 48% TR free survival 6 months post operatively.^{31,29}

De Vega's tricuspid annuloplasty is a reasonable procedure for functional TR in low socioeconomic setup, regarding the simplicity, procedural outcomes at early and 6 month follow up and inexpensiveness (only cost of 4/0/ prolene suture). It does not cause any disturbance of pathway of bundle or valve while achieving reduction in ring size and bicuspidization.

Limitations of the study were; that it was a non-randomized study. The follow up period of 6 month was short compared to the natural history of progression of tricuspid regurgitation, and the repair result only reflects on the early outcomes of De Vega's repair. Further studies with large sample size, with long follow up period and with comparison to other techniques available for management of tricuspid regurgitation will clarify the utility of De Vega's technique for TR.

CONCLUSION

Severe tricuspid regurgitation (functional) decreases in severity in patients undergoing De Vega's annuloplasty along with mitral valve replacement in rheumatic heart disease patients. De Vega's surgical repair for severe TR still holds its place in our setup because of economy and safety.

REFERENCES

1. Irwin RB, Luckie M, Khattar RS. Tricuspid regurgitation: contemporary management of a neglected valvular lesion. *Postgrad Med J* 2010;86:648-55.
2. Bhave NM, Ward RP. Echocardiographic assessment and clinical management of tricuspid regurgitation. *Curr Cardiol Rep* 2011;13:258-64.
3. Nair D, Griffin BP. Tricuspid valve disease, pulmonary valve disease and drug induced valve disease. In: Griffin BP. *Manual of cardiovascular medicine*. 3rd ed. Philadelphia: Wolter Kluwer; 2008. p. 239-50.
4. Hung J. The pathogenesis of functional tricuspid regurgitation. *Semin Thorac Cardiovasc Surg* 2010;22:76-8.
5. Fukuda S, Gillinov AM, McCarthy PM, Stewart WJ, Song JM, Kihara T, et al. Determinants of recurrent or residual functional tricuspid regurgitation after tricuspid annuloplasty. *Circulation* 2006;114:1582-7.
6. Nath J, Foster E, Heidenreich PA. Impact of tricuspid regurgitation on long-term survival. *J Am Coll Cardiol* 2004;43:405-9.
7. Bernal JM, Gutierrez-Morlote J, Llorca J, San Jose JM, Morales D, et al. Tricuspid valve repair: an old disease, a modern experience. *Ann Thorac Surg* 2004;78:2069-74.
8. Smid M, Cech J, Rokyta R, Roucka P, Hajek T. Mild to moderate functional tricuspid regurgitation: retrospective comparison of surgical and conservative treatment. *Cardiol Res Pract* 2010;2010:143878.
9. Chan V, Burwash IG, Lam BK, Auyeung T, Tran A, Mesana TG, et al. Clinical and echocardiographic impact of functional tricuspid regurgitation repair at the time of mitral valve replacement. *Ann Thorac Surg* 2009;88:1209-15.
10. Dreyfus GD, Corbi PJ, Chan KM, Bahrami T. Secondary tricuspid regurgitation or dilatation: which should be the criteria for surgical repair? *Ann Thorac Surg* 2005;79:127-32.
11. Fukuda N, Oki T, Iuchi A, Tabata T, Yamada H, Ito S, et al. Tricuspid inflow and regurgitant flow dynamics after mitral valve replacement: differences relating to surgical repair of the tricuspid valve. *J Heart Valve Dis* 1997;6:184-8.
12. Anyanwu AC, Chikwe J, Adams DH. Tricuspid valve repair for treatment and prevention of secondary tricuspid regurgitation in patients undergoing mitral valve surgery. *Curr Cardiol Rep* 2008;10:110-7.
13. Bonow RO, Carabello BA, Chatterjee K, de Leon AC Jr, Faxon DP, Freed MD, et al. ACC/AHA 2006 guidelines for the management of patients with valvular heart disease. *Journal of the American College of Cardiology* 2006;48:1-148.
14. Tagusari O. Tricuspid annuloplasty. *Kyobu Geka* 2010;63:677-80.
15. Raja SG, Dreyfus GD. Surgery for functional tricuspid regurgitation: current techniques, outcomes and emerging concepts. *Expert Rev Cardiovasc Ther* 2009;7:73-84.
16. Raja SG, Naqshband MS, Abid AR, Akhtar RP, Waheed A, Khan JS. Functional tricuspid regurgitation in rheumatic heart disease: surgical options. *Ann Thorac Cardiovasc Surg* 2010;16:417.
17. Carrier M, Pellerin M, Guertin MC, Bouchard D, Hébert Y, Perrault LP, et al. Twenty-five years' clinical experience with repair of tricuspid insufficiency. *J Heart Valve Dis* 2004;13:952-6.
18. Wang G, Sun Z, Xia J, Deng Y, Chen J, Su G, et al. Predictors of secondary tricuspid regurgitation after left-sided valve replacement. *Surg Today* 2008;38:778-83.
19. Shemin RJ. Tricuspid valve disease. In: Cohn LH, editor. *Cardiac surgery in the adult*. New York: McGraw-Hill; 2008. p. 1111-28.
20. Xiao XJ, Huang HL, Zhang JF, Wu RB, He JG, Lu C, et al. Surgical treatment of late tricuspid regurgitation after

- left cardiac valve replacement. *Heart Lung Circ* 2004;13:65-9.
21. Boyaci A, Gokce V, Topaloglu S, Korkmaz S, Goksel S. Out come of significant functional tricuspid regurgitation late after mitral valve replacement for predominant rheumatic mitral stenosis. *Angiology* 2007;58:336-42.
 22. Katircioglu SF, Yamak B, Ulus AT, Ozsoyler I, Yildiz U, Mavitas B, et al. Treatment of functional tricuspid regurgitation by bicuspidalization annuloplasty during mitral valve surgery. *J Heart Valve Dis* 1997; 6: 631-5.
 23. De Vega NG. Selective, adjustable and permanent annuloplasty. An original technic for the treatment of tricuspid insufficiency. *Rev Esp Cardiol* 1972;25:555-6.
 24. Yada I, Tani K, Shimono T, Shikano K, Okabe M, Kusagawa M. Preoperative evaluation and surgical treatment for tricuspid regurgitation associated with acquired valvular heart disease. *J Cardiovasc Surg* 1990; 31:771-7.
 25. Chidambaram M, Abdulali SA, Baliga BG, Ionescu MI. Long-term results of De Vega's tricuspid annuloplasty. *Ann Thorac Surg* 1987; 43: 185-8.
 26. Abe T, Tukamoto M, Yanagiya M, Morikawa M, Watanabe N, Komatsu S. De Vega's annuloplasty for acquired tricuspid disease: early and late results in 110 patients. *Ann Thorac Surg* 1989; 48: 670-6.
 27. Morishita A, Kitamura M, Noji S, Aomi S, Endo M, Koyanagi H. Long-term results after De Vega's tricuspid annuloplasty. *J Cardiovasc Surg (Torino)* 2002; 43: 773-7.
 28. McCarthy PM, Bhudia SK, Rajeswaran J, Hoercher KJ, Lytle BW, Cosgrove DM, et al. Tricuspid valve repair: durability and risk factors for failure. *J Thorac Cardiovasc Surg* 2004;127:674-85.
 29. Pradhan S, Gautam NC, Singh YM, Shakya S, Timala RB, Sharma J, et al. Tricuspid valve repair: De Vega's 's tricuspid annuloplasty in moderate secondary tricuspid regurgitation. *Kathmandu Univ Med J (KUMJ)* 2011;9:64-8.
 30. Wei J, Chang CY, Lee FY, Lai WY. De Vega's semicircular annuloplasty for tricuspid valve regurgitation. *Ann Thorac Surg* 1993;55(2):482-5.
 31. Khan RA, Malik A, Aslam S, Rehman K, Waseem N, Nawab J, et al. Devaga's tricuspid valve annuloplasty: still a good alternative in our set up. *J Postgrad Med Inst* 2004;18:620-5.