

ORIGINAL ARTICLE

Comparison of Dacron Band versus Segmental Annuloplasty in Treatment of Tricuspid Valve RepairASIF HASSAN¹, SAIRA GUL², WASIM RIAZ³, SHAHNOOR AZIZ⁴, BAHAR ALI⁵, FARHAN EJAZ⁶¹Postgraduate Resident, Cardiac Surgery, Punjab Institute of Cardiology, Lahore²Associate Professor Cardiac Surgery, Punjab Institute of Cardiology, Lahore³Associate Professor Cardiac Surgery, Punjab Institute of Cardiology, Lahore⁴Postgraduate Resident, Cardiac Surgery, Punjab Institute of Cardiology, Lahore⁵Postgraduate Resident, Cardiac Surgery, Punjab Institute of Cardiology, Lahore⁶Postgraduate Resident, Cardiac Surgery, Punjab Institute of Cardiology, Lahore

Correspondence to: Dr. Asif Hassan, Email: A_Hassan11@hotmail.com, Cell: 0300-4650011

ABSTRACT**Objective:** The objective of this study was to compare outcome of Dacron Band versus Segmental Annuloplasty in treatment of TV repair.**Study Design:** This was a randomized controlled trial.**Place and Duration:** This study was conducted at the Cardiac surgery Department, PIC, Jail Road, Lahore from 25 October 2021 to 25 Oct, 2022.**Methodology:** A total of 148 patients were enrolled in this study and divided into two groups equally. For categorical data like gender, and grades of Tricuspid regurgitation, frequency and percentages was used. For quantitative data mean \pm S.D was computed. P-value \leq 0.05 was taken as significant.**Results:** The mean age of the cases in Group-A was 47.97 ± 8.29 and in Group-B was 51.01 ± 7.78 . In our study post-operative RVEDD and TVPG found significant with p-value 0.044 and <0.01 respectively. Similarly, the p-value of follow-up RVSTDI and RVEDD was statistically significant with p-value 0.03 and 0.007 respectively.**Conclusion:** Both Dacron band and segmental annuloplasty techniques are available for TV repair; however, dacron band placement in TV repair patients is associated with better RV remodelling, and as a result, a more likely improvement in right ventricular function and a better repair outcome are predicted. After tricuspid valve surgery, dacron band implantation is correlated with a lower incidence of TR recurrence and enhanced long-term event-free survival. As a result, this method in tricuspid valve surgery should be used more frequently.**Keywords:** Segmental Annuloplasty, Dacron Band, TR, TV repair**INTRODUCTION**

The annulus, the three leaflets, the chordae, the papillary muscles, and the right ventricle are just a few of the intricately interconnected elements that make up the tricuspid valve, which is a complex dynamic mechanism.¹ Although it has always been thought of as being less important than the left-side heart valves, the "forgotten valve" nonetheless poses a significant challenge for cardiac surgeons, particularly in the most challenging clinical situations.² Around the world, millions of patients suffer from tricuspid valve disease.² According to reports, between 8% and 30% of people with left-sided valve dysfunction, particularly mitral, experience TR.³

TR is a common occurrence and is typically of a functional (FTR) character.⁴ It could be caused by the diseased left-sided cardiac valve, primary valve involvement, secondary pulmonary hypertension, or any combination of these.³ Secondary TR has a complicated pathophysiology that is inextricably linked to the structure and operation of the right ventricle. Therefore, it is crucial to use a systematic multimodality approach to diagnose annular size, RV function, and degree of pulmonary hypertension in addition to the severity of the TR.³

When treating the tricuspid valve, it is important to take into mind other adjacent structures such the coronary sinus ostium, the membranous septum, and the RCA.¹

Over the past few years, there has been a significant advancement in the assessment and management of TV disease. Tricuspid stenosis is rare, but TR is common, and it is typically secondary to RV remodeling-related annular dilatation and leaflet tethering.⁵ Patients with left-sided valvular disease frequently have TR, which is a sign of advanced chronic HF with a poor prognosis. Although it is still uncommon, isolated TV surgery has the highest mortality rate of all valve operations. Therefore, there is a clinical need for less intrusive therapy choices in these individuals that is largely unmet. Multiple percutaneous procedures, including as TV replacement and, more recently, repair, have been developed for treating severe TR. This has created a completely new management option for TR.⁶

The aim of this study was to scale and compare the outcome in right ventricle functioning and residual TR after DB versus SA in treatment of TV repair. It will also help to create the evidence based data and practice in local settings in Pakistan.

MATERIAL AND METHODS

This was a randomized controlled trial, conducted at the Cardiac surgery Department, PIC, Jail Road, Lahore from 25 October 2021 to 25 Oct, 2022. A total of 148 patients were enrolled in this study following inclusion criteria.

Operational Definition: Outcome: It was measured on postoperative and on follow up**Postoperative:** On postoperative, surgery time, CPB time and cross clamp time, RVEDD size was measured in cm and TR was measured in its grades (0 to +4).**Follow up:** On follow up grades of TR and RVEDD was measured immediately post op before discharge and at 6th month.**Inclusion Criteria:** All cases aged 18-80 years. Mitral stenosis and mixed mitral disease with predominantly stenotic valves Both genders. All cases needed tricuspid valve repair.**Exclusion criteria:** Preoperative renal failure. Severe Mitral Regurgitation having TR. LVEF $<$ 30%. Right Ventricular Dysfunction. Tri stenosis. Previous history of cardiac procedure. Obese cases**Data Collection:** All data was collected by me after taking written informed consent from patients or attendants meeting inclusion criteria. A total of 148 patients were enrolled in this study and were equally divided into two groups (n=74 in each group). The data was collected from enrolled patients of Punjab institute of cardiology. The choice of repair technique was randomized.

The annuloplasty band was made of Dacron material and was designed to reach from the posteroseptal commissure to the antero-septal commissure. As a result, after sizing the septal leaflet, the DB was wrapped around the ring sizer's two notches to determine its length. The most popular sizes were 30 and 32 mm. All cases were compared for postoperative outcome like, surgery time, CPB time and cross clamp time, right ventricular (RVEDD) size and TR was measured in its grades (0 to +4) before discharge

and on 6th month follow up grades of TR and RV size and function was compared.

Statistical Analysis: SPSS version 24 was used to enter and analyzed collected data. For categorical data like gender, and grades of Tricuspid regurgitation, frequency and percentages was used. For quantitative data like age, surgery time, CPB time and cross clamp time, right ventricular (RVEDD) size mean ± S.D was used. Independent sample t-test was applied to compare quantitative outcome. Chi-square test was used to compare categorical data i.e TR in both groups. P-value ≤ 0.05 was taken as significant.

RESULTS

The mean age of the cases in Group-A was 47.97 ± 8.29 and in Group-B was 51.01 ± 7.78 with insignificant p-value. In our study the mean height was 1.66 ± 7.27, weight 73.24 ± 1.12, and BMI 26.13 ± 3.26, in Group-A while mean height, weight and BMI in Group-B was 1.69 ± 8.95, 73.20 ± 1.22, and 25.16 ± 3.39 respectively. The mean of CPB time Group-A 77.78 ± 1.10 was and in Group-B was 73.78 ± 1.11. Similarly the mean of cross clamp time in Group-A was 50.53 ± 1.25 and in Group-B was 51.86 ± 1.37 with insignificant p-value 1.00. The mean of surgery time in Group-A was 168.45 ± 17.29 and in Group-B was 155.64 ± 15.76 with insignificant p-value 0.08. (Table 1)

Table 1: Descriptive Statistics of Demographics and Intra-operative variables

	Dacron Band (Group A)	Segmental annuloplasty (Group B)
Age	47.97 ± 8.29	51.01 ± 7.78
Height (cm)	1.66 ± 7.27	1.69 ± 8.95
Weight (kg)	73.24 ± 1.12	73.20 ± 1.22
BMI (kg/m ²)	26.13 ± 3.26	25.16 ± 3.39
CPB time	77.78 ± 1.10	73.78 ± 1.11
Cross Clamp time	50.53 ± 1.25	51.86 ± 1.37
Surgery Time	168.45 ± 17.29	155.64 ± 15.76

Table 2: Comparison of post-operative outcomes in both Groups.

	Dacron Band Mean ± S.D	Segmental Annuloplasty Mean ± S.D	P-Value
Right ventricular (RVEDD) size	2.90 ± 0.34	3.27 ± 0.45	0.044
RVSTDI	15.86 ± 4.23	14.73 ± 2.65	0.67
TVPG	1.70 ± 0.76	2.42 ± 0.51	<0.01
TR (0 +4) (Range)	45-66	40-65	
No Trivial	29 (40%)	18(25%)	0.54
Mild	37(50%)	48(65%)	
Mild-Moderate	8(10%)	8(10%)	

In our study post-operative RVEDD size was higher in SA group with significant p-value 0.044. In our study the p-value of post-operative grade of TR was insignificant 0.54. The majority of patients found with mild TR in both groups (50% vs 65%). In our study p-value of post-operative RVSTDI was statistically insignificant 0.67, showing no difference in RVSTDI in both groups. In our study mean of post-operative TVPG was significantly higher in segmental annuloplasty group 2.42 ± 0.51 with significant p-value <0.01. (Table 2)

Table 3: Comparison of Follow up (6 months) outcomes in both Groups

	Dacron Band Mean ± S.D	Segmental Annuloplasty Mean ± S.D	P-Value
RVSTDI	13.26 ± 5.26	9.33 ± 3.54	0.03
TVPG	1.50 ± 0.46	2.12 ± 0.41	0.02
Right ventricular (RVEDD) size	1.23 ± 0.28	2.45 ± 0.29	0.007
No Trivial	37 (50%)	35(47%)	0.097
Mild	33(45%)	30(41%)	
Mild-Moderate	4(5%)	3(4%)	
Moderate	0(0%)	5(7%)	
Died	0(0%)	1(1%)	

In our study p-value of follow-up RVSTDI was statistically significant 0.03 showing statistically higher mean of RVSTDI in

Dacron band group i.e., 13.26 ± 5.26. The mean value of TVPG was also significantly higher in the same group 2.12 ± 0.41 with significant p-value 0.02. Similarly, RVEDD was significantly greater in SA group 2.45 ± 0.29 vs 1.23 ± 0.28 in Dacron band with significant p-value 0.007. In our study after follow-up grade of tricuspid regurgitation, showed no significant difference between the groups, p-value=0.097. (Table 3)

DISCUSSION

TR is an important clinical concern that surgeons may overlook.⁷ TR of moderate to severe severity has been linked to poor short- and long-term survival, regardless of ventricular performance or PA pressure.⁸ We operated on individuals with secondary (functional) regurgitation, as reported in prior papers. Some writers postulated that secondary TR is caused primarily by tricuspid annulus dilatation, which occurs from a remodelling process of the RV caused by prolonged pressure burden.⁹ As a result, treating a left sided valve lesion alone reduces afterload but has no effect on tricuspid dilatation (TD), preload, or RV performance. As a result, complete reverse RV remodelling may not occur, and pulmonary artery pressure normalization alone will not remove TR in many individuals. In patients with concomitant MV disease, correcting the MV defect without treating the TV may relieve mild TR. If moderate or severe TR is not treated, it may remain or worsen following MV surgery, leading to HF and death.¹⁰ As a result, some doctors have advocated for a more aggressive approach in cardiac surgery patients with simultaneous TR.¹¹ Echocardiographic evaluation of the tricuspid annulus diameter (TAD) has been used as an alternative way to surgical assessment of the TAD. Intraoperatively, a TAD of 40 mm or greater is equivalent to 7 cm.¹² The best way to fix the TV is still unknown. Regardless of the fact that bicuspidization produces acceptable results, particularly in rheumatic patients, procedure is now rarely used. The segmental annuloplasty procedure is widely utilized TV repair technique. Several researches reported on its short and long-term success. Other researchers, however, have documented a rather significant recurrence rate for the segmental annuloplasty approach, particularly in patients with severe tricuspid annular dilatation.

We performed the current study to compare results of DB versus SA in treatment of TV repair. In our study the mean age of the cases in Group-A (Dacron Band) was 47.97 ± 8.29 and in Group-B (Segmental annuloplasty) was 51.01 ± 7.78 with insignificant p-value. In a study by Abdelgawad (2017) the mean age of the cases in Dacron Band was 38.90 ± 11.84 while in segmental annuloplasty group was 34.75 ± 11.26.

There were 54 (72.97%) male and 20 (27.03) females in Group-A while 48 (64.86%) male and 26 (35.14%) females in Group-B. Similarly Abdelgawad (2017) enrolled 11(55%) male and 9(45%) females in Dacron band group while 7(35%) females and 13 (65%) males in segmental annuloplasty group.¹³

In our study the mean height was 1.66 ± 7.27, weight 73.24 ± 1.12, and BMI 26.13 ± 3.26, in Group-A while mean height, weight and BMI in Group-B was 1.69 ± 8.95, 73.20 ± 1.22, and 25.16 ± 3.39 respectively. In our data there were 52 (35.14%) hypertensive and 22(14.86%) non-hypertensive patients were in Group-A while 44 (29.73%) hypertensive and 30 (20.27%) non-hypertensive patients were in Group-B. In our data no patient was found obese having BMI > 30kg/m² all the patients in Group-A and B were non-obese. From the total of 148 31(20.95%) diabetic and 43(29.05%) non-diabetics were in Group-A while 45 (30.41%) diabetic and 29 (19.59%) non- diabetics were in Group-B.

The mean of CPB time Group-A 77.78 ± 1.10 was and in Group-B was 73.78 ± 1.11 with p-value <0.001. Similarly the mean of cross clamp time in Group-A was 50.53 ± 1.25 and in Group-B was 51.86 ± 1.37 with p-value 1.00. The mean of surgery time in Group-A was 168.45 ± 17.29 and in Group-B was 155.64 ± 15.76 with p-value 0.08. The mean CPB time in a previous study by Abdelgawad (2017) was 64.10 ± 13.46 in Dacron band versus 67.25 ± 13.54 in segmental annuloplasty group with insignificant p-value 0.732. Cross clamp time observed was 42.50 ± 11.74 versus

50.05 ± 21.23 p-value=0.346. Surgery time noted was 144.80 ± 21.32 versus 158.10 ± 19.63. Results were almost consistent with our findings.¹³

In our study post-operative RVEDD size was significantly higher in SA group 3.27± 0.45 group with p-value 0.044. In a study by Abdelgawad (2017) the mean of RVEDD in segmental annuloplasty group was 2.88 ± 0.35 while in Dacron band it was 3.18 ± 0.43 with significant p-value 0.045. More patients were having mild TR in both groups (50% vs 65%). Abdelgawad (2017) found 5 (25%) no trivial 12(65%) mild TR, 2(10%) mild to moderate TR in Dacron band while 5(40%) no trivial, 13 (50%) mild TR and 2 (10%) mild to moderate TR in segmental annuloplasty group with insignificant p-value like our results 0.744.¹³

In our study p-value of post-operative RVSTDI was statistically insignificant 0.67, showing no difference in RVSTDI in both groups. In our study mean of post-operative TVPG was significantly higher in segmental annuloplasty group 2.42 ± 0.51 with significant p-value <0.01. In our study p-value of follow-up RVSTDI was statistically significant 0.03 showing statistically higher mean of RVSTDI in Dacron band group i.e., 13.26 ± 5.26. The mean value of TVPG was also significantly higher in the same group 2.12 ± 0.41 with significant p-value 0.02.

Similarly, RVEDD size was higher in SA group 2.45± 0.29 vs 1.23 ± 0.28 in DB with significant p-value 0.007. In our study after follow-up grade of tricuspid regurgitation, showed no significant difference between the groups, p-value=0.097. A previous research by Abdelgawad (2017) found follow up RVEDD 2.54 ± 0.26 in Dacron band versus 2.72 ± 0.29 with significant p-value 0.009 after 1 year of follow up.¹³

In our study after follow-up grade of TR, showed no difference p-value=0.097. Similarly research conducted by Abdelgawad (2017) found insignificant follow up TR (0 +4) in this research 0.783.

All of these findings suggest that, as compared to suture-based treatments, an annuloplasty is recommended in TV repair patients. However, it is unclear if SA is preferable to or equivalent to DB repair in terms of long-term outcomes, because the first has been found to minimize the likelihood of suture dehiscence and recurrent TR.¹⁴ Nonetheless, we expected the tricuspid annuloplasty band to provide a significant benefit, and our findings have resulted in a change in surgical practice at our institution.

CONCLUSION

Both Dacron band and segmental annuloplasty techniques are available for TV repair; however, dacron band placement in TV repair patients is associated with better RV remodelling, and as a result, a more likely improvement in right ventricular function and a better repair outcome are predicted. After tricuspid valve surgery, dacron band implantation is correlated with a lower incidence of TR recurrence and enhanced long-term event-free survival. As a result, this method in tricuspid valve surgery should be used more frequently.

Recommendations:It is necessary to conduct further researches with a large number of participants so that conclusive results are obtained to make a conclusion which technique is better for patients.

Conflict of interest:The authors have no conflicts of interest to declare.

Funding:None

Ethical Approval:Not Applicable

REFERENCES

- Buzzatti N, De Bonis M, Moat N. Anatomy of the Tricuspid Valve, Pathophysiology of Functional Tricuspid Regurgitation, and Implications for Percutaneous Therapies. *Interventional Cardiology Clinics*. 2017 Oct 21;7(1):1-11.
- Belluschi I, Del Forno B, Lapenna E, Nisi T, Iaci G, Ferrara D, Castiglioni A, Alfieri O, De Bonis M. Surgical techniques for tricuspid valve disease. *Frontiers in Cardiovascular Medicine*. 2018 Aug 28;5:118.
- Antunes MJ, Rodríguez-Palomares J, Prendergast B, De Bonis M, Rosenhek R, Al-Attar N, Barili F, Casselman F, Folliguet T, Iung B, Lancellotti P. Management of tricuspid valve regurgitation: position statement of the European Society of Cardiology Working Groups of Cardiovascular Surgery and Valvular Heart Disease. *European Journal of Cardio-Thoracic Surgery*. 2017 Dec 1;52(6):1022-30.
- Van Praet KM, Stamm C, Starck CT, Sündermann S, Meyer A, Montagner M, Nazari-Shafti TZ, Unbehaun A, Jacobs S, Falk V, Kempfert J. An overview of surgical treatment modalities and emerging transcatheter interventions in the management of tricuspid valve regurgitation. *Expert Review of Cardiovascular Therapy*. 2018 Feb 1;16(2):75-89.
- Pozzoli A, Elisabetta L, Vicentini L, Alfieri O, De Bonis M. Surgical indication for functional tricuspid regurgitation at initial operation: judging from long term outcomes. *General thoracic and cardiovascular surgery*. 2016 Sep;64(9):509-16.
- Asmarats L, Puri R, Latib A, Navia JL, Rodés-Cabau J. Transcatheter tricuspid valve interventions: landscape, challenges, and future directions. *Journal of the American College of Cardiology*. 2018 Jun 26;71(25):2935-56.
- Jeganathan R, Armstrong S, Al-Alao B, David T. The risk and outcomes of reoperative tricuspid valve surgery. *The Annals of Thoracic Surgery*. 2013 Jan 1;95(1):119-24.
- Nath J, Foster E, Heidenreich PA. Impact of tricuspid regurgitation on long-term survival. *Journal of the American College of Cardiology*. 2004 Feb 4;43(3):405-9.
- Song ZZ. Echocardiographic insights into atrial and ventricular mechanisms of functional tricuspid regurgitation. *American heart journal*. 2007 Jul;154(1):e9-11.
- Kusajima K, Fujita T, Hata H, Shimahara Y, Miura S, Kobayashi J. Long-term echocardiographic follow-up of untreated 2+ functional tricuspid regurgitation in patients undergoing mitral valve surgery. *Interactive Cardiovascular and Thoracic Surgery*. 2016 Jul 1;23(1):96-103.
- Mas PT, Rodríguez-Palomares JF, Antunes MJ. Secondary tricuspid valve regurgitation: a forgotten entity. *Heart*. 2015 Nov 15;101(22):1840-8.
- Popal MS, Fu JT, Hu QM, Luo TG, Zheng S, Meng X. Intraoperative method based on tricuspid annular circumference in patients with mild or no tricuspid regurgitation during left-sided cardiac valve surgery for the prophylactic tricuspid annuloplasty. *Journal of Thoracic Disease*. 2018 Jun;10(6):3670.
- Abdelgawad A, Ramadan M, Arafat H, Aziz AA. Tricuspid valve repair with Dacron band versus DeVega or segmental annuloplasty. Hospital outcome and short term results. *The Egyptian Heart Journal*. 2017 Dec 1;69(4):241-6.
- Antunes MJ, Girdwood RW. Tricuspid annuloplasty: a modified technique. *The Annals of Thoracic Surgery*. 1983 Jun 1;35(6):676-8.