Tricuspid valve repair with Dacron band versus DeVega or segmental annuloplasty. Hospital outcome and short term results

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Background: The purpose of this study was to compare the hospital outcome and short term results of tricuspid valve (TV) repair with three repair techniques for functional tricuspid regurgitation (TR), namely, flexible Dacron band, DeVega and segmental annuloplasty.

Methods: A total of 60 patients underwent TV repair at National Heart Institute from January 2013 to November 2014, of which 20 had DeVega procedure (DV), 20 had a segmental annuloplasty (SA) procedure and 20 had a Dacron band (DB) procedure. Concomitant procedures done for rheumatic left sided valve pathology consisted of mitral valve replacement in 70% of patients, and double valve replacement in 30% of patients. Clinical and echocardiographic follow-up data were obtained. Follow-up was 100% complete and was concluded after one year.

Results: All demographic criteria and preoperative characteristics of the three studied groups were comparable except for preoperative right ventricular (RVEDD) size that was significantly bigger in Dacron band group as compared to the other two groups (3.18 ± 0.43 cm compared to 3.00 ± 0.33 cm (DV) and to 2.88 ± 0.35 cm (SA), p value of (0.045)). Similarly, all operative and postoperative criteria were comparable among the study groups. Noticeably, (RVEDD) size remodeled better postoperatively in (DB) group as compared to the other two groups, (2.54 ± 0.26 cm compared to 2.83 ± 0.31 cm (DV) and to 2.72 ± 0.29 cm (SA), mean difference values were group (0.64 ± 0.47 cm) for (DB) compared to (0.18 ± 0.29 cm) for (DV) or to (0.16 ± 0.45 cm) for (SA) with p value of 0.000. The majority of patients in each group did not have tricuspid regurgitation (TR) or mild degree (+1) of (TR) on discharge. After one year of follow-up, most of the patient had either no regurgitation or grade (+1 TR). Two patients (10%) in DV group and one patient (5%) in SA group had (+3 TR). There was no statistical significance in the incidence of hospital mortality, only one patient died in DB and one in DV group (5%) and no death happened after hospital mortality for the three groups after one year.

Conclusions: The three techniques are options to repair the tricuspid valve, however, placement of Dacron band in patients undergoing tricuspid valve repair is associated with better RV remodelling, and hence, a probable better right ventricular performance and better outcome of repair is expected. A higher number of patients are needed with longer follow up period to appreciate the effect on survival and rate of freedom from tricuspid regurgitation and re-intervention.

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1. Introduction

Secondary or functional TR refers to TR, usually seen in association with left-sided valve disease and occurring in the absence of any identifiable pathology of the tricuspid valve leaflets or chordae. The term “functional” has been used to describe this form of tricuspid regurgitation for several decades.1 Some authors like Braunwald et al. in 1967 recommended conservative treatment of functional tricuspid regurgitation2 as, by definition, it would be corrected when the left-sided valve is treated surgically. However, the excellent results of repaired tricuspid valve regurgitation during mitral valve surgery by Carpentier in 1974 made it very justifiable procedure.3 Moreover, Dreyfus et al. reported that patients who had tricuspid valve repair at the time...
of mitral valve surgery had better long-term results than those
who had not.6 An increasing wealth of observational data now sup-
ports surgical treatment of functional tricuspid regurgitation.

Consequently, early methods used to repair the tricuspid valve
by sutures (suture based techniques) such as “bicuspoidization”
described by Sharony et al.5 and “modified DeVega tricuspid annu-
loplasty” described by Antunes et al.8 One current method is
remodeling annuloplasty using a flexible band. The current study
was undertaken to examine the hospital and short-term outcome
of TV repair by suture based techniques versus flexible band
technique.

2. Patients and methods

From January 2013 to November 2014, a total of 60 patients
underwent TV repair at our institution, of which 20 had De Vega
procedure (DV), 20 had a segmental annuloplasty (SA) procedure
and 20 had a Dacron band (DB) procedure. Concomitant proce-
dures consisted of mitral valve replacement in 70% of patients,
and double valve replacement in 30% of patients.

Clinical and echocardiographic follow-up data were obtained.
For echocardiographic assessment of tricuspid regurgitation,
echocardiographer used standard parasternal and apical views
(standard long-axis, 2-chamber, and 4-chamber images). Looking
at tricuspid valve morphology first to detect any flail or coaptation
defect as seen in some cases of severe degree of TR. Color flow was
applied in the apical views to evaluate TR. The maximal TR jet area
visualized using color Doppler flow mapping was used for TR quan-
tification, with a TR jet-to-right atrial area ratio of less than 10%
grade 1+, 10% to 20% = 2+, 20% to 40% = 3+, and greater than
40% = 4+. Systolic reversal of hepatic venous flow was also used
as a criterion for 4+ TR.

For statistical purposes grade 0 is translated to No regurgitation,
+1 is translated to mild, +2 is translated to Moderate, +3 is trans-
lated to moderate to severe and +4 is translated to Sever. The peak
systolic TR jet velocity was measured by continuous wave signal.
Lastly, vena contracta was measured to determine degree of TR,
if the measurement was 7 mm or more it is labeled as severe TR.
The Ethics Research Board of the National Heart Institute approved
this observational study.

2.1. Operative technique

TV repair was performed with an annuloplasty band (DB) in 20
patients and without a band in 40 patients either SA (20) or DV
(20)(no band). The choice of repair technique was at the attending
surgeon’s choice.

The annuloplasty band was made of Dacron material fashioned
to extend from the posteroseptal commissure to anteroseptal com-
missure according to septal leaflet sizer’s two notches (Edwards
M3 Tricuspid annuloplasty ring sizer) that correspond to the two
commissures. Therefore, the Dacron band was encircled around
the ring sizer’s two notches to determine its length after sizing of
the septal leaflet. The mostly used sizes were 30 mm and 32 mm.
Six to nine interrupted U sutures of 2/0 EthibondTM were usually
needed to stitch the tricuspid annulus from posteroseptal commiss-
sure to anteroseptal commissure. Stitches were taken perpendicu-
lar to the plane of the annulus and then were passed through the
presized Dacron band and tied in supra annular position after the
band is lowered down fixing the annulus to a new smaller size
position.

Patients undergoing TV repair without an annuloplasty band
underwent a classic DeVega procedure (single Ethibond suture
from the posteroseptal to the anteroseptal commissure with a
pledget at each end) or a modified DeVega (segmental annulo-

2.2. Follow-up

Hospital outcome for the patients was documented. Patient
clinical status and echocardiographic results were analyzed. All
patients and/or patient family members were contacted by tele-
phone and invited for postoperative follow up echocardiography
12 months after their operation. Follow-up was 100% complete.

2.3. Statistical analysis

Data were collected, revised, coded and entered to the Statistical
Package for Social Science (IBM SPSS) version 20. Qualitative
data were presented as number and percentages while quantita-
tive data were presented as mean, standard deviations and ranges.
The comparison between two groups with qualitative data was
done by using chi-square test and/or Fisher exact test was used
instead of chi-squared test when the expected count in any cell
was found less than 5. The comparison between more than two
independent groups regarding quantitative data with parametric
distribution was done by using One Way Analysis of Variance
(ANOVA). The confidence interval was set to 95% and the margin
of error accepted was set to 5%. So, the p-value was considered sig-
nificant as the following: P > 0.05: Non significant, P < 0.05: Signif-
icant, and P < 0.01: Highly significant.

2.4. Results

Demographic criteria of the three groups are listed in Table 1.
The mean age was 38.90 ± 11.84 years, 35.70 ± 10.70 years, and
34.75 ± 11.26 years for dacron band (DB) annuloplasty, devega
(DV) and segmental annuloplasty (SA) groups respectively (P value
of 0.48). Most of the patients were males in the three studied
groups, 55% for each of DB and DV groups and 65% for SA group
(P value of 0.76).

All preoperative characteristics were comparable between the
study groups apart from preoperative right ventricular (RVEDD)
size in cm that was significantly higher in DB group, (p value
of 0.009). The grade of tricuspid regurgitation, pulmonary hyperten-
sion and incidence of chronic atrial fibrillation (AF) was compara-
able between the study groups (p value of 0.49, 0.91, 0.81
respectively). The majority of patients were having severe (+4
TR) in the three groups (80% of DB and 65% of each of DV and SA
groups. P value of 0.49) and the average pulmonary hypertension
was 56 mmHg (P value of 0.91).

The operative details of the studied groups are also listed in
Table 1. The concomitant cardiac procedure was double valve
replacement in 30% of each DB and DV groups compared to 65%
in SA, MVR in 70% of DB and DV groups, and 65% in SA group. (p
value of 0.92). The operative, CBP, and cross clamp times were all
comparable (P values were 0.11, 0.73 and 0.34 respectively).
In-hospital outcome of TV repair performed in the three groups is listed in Table 2. On discharge there was a significant improvement of TR grade in the three groups with around half of patients with mild TR (grade +1), and 25% of DB compared to 40% of each of DV and SA groups who had no regurgitation (grade 0). Only 10% of each DB and SA groups compared to 15% of DV group had mild to moderate degree of TR (grade +1 to +2) (P value of 0.74). There was no statistical significance in the incidence of hospital mortality, only one patient died in DB and one in DV group (5%). There was no significant difference in the incidence of neurological complications whether stroke or coma, atrial fibrillation, postoperative low cardiac output syndrome, heart failure, renal failure, need for dialysis, respiratory complications, need for pacemaker, septic complications and reopening for bleeding between the three groups when compared together.

In this study, only one patient in DV group (5%) needed permanent pacemaker implantation as compared to other two groups, and p value is 0.36 by one way ANOVA test with no statistical significance.

Table 2 also demonstrates the short-term (one year) follow up of the study groups. Recurrent TR was insignificant for all followed up patients. The vast majority of patients remained in either no regurgitation (grade 0) or mild regurgitation (grade +1) during the follow-up, and 2 patients (10%) in DV group and one patient (5%) in SA group had moderate regurgitation (grade +2), however, none of them needed reoperation. Moreover, there were no cases reported of tricuspid stenosis.

As far as one year survival is concerned, no death happened after hospital mortality for the three groups.

Finally, Table 3 shows a comparison between the three repair techniques' performance after one year as regards to five criteria, namely the incidence of chronic AF, pulmonary hypertension, improvement in dyspnea class, end diastolic dimension of the right ventricle and degree of tricuspid regurgitation. The first three factors reflect the success of left sided rheumatic pathology correction and are known to affect recurrence of tricuspid regurgitation.

In this study, there was a significant decrease in postoperative pulmonary hypertension in the three groups when compared with preoperative values (P value of paired t test < 0.001). However, the mean difference of decrease in pulmonary hypertension was insignificant when the three groups compared together (13.15 ± 7.3 mmHg for DB, 9.85 ± 4.06 mmHg for DV and 11.55 ± 6.46 mmHg for SA, P value of 0.240).

While majority of patients were having preoperative NYHA class of 3 (55% of each of DB and SA and 65% of DV group), they were having mostly postoperative NYHA class of 1 (70% of DB, 55% of DV, 75% of SA). Pre and postoperative p value of NYHA class were 0.58 and 0.44 respectively.

Similarly, the incidence of chronic AF before and after the operation was not significant when the three repair techniques were compared together; p value was 1.00 on discharge and was 0.85 after one year of follow up. Thus, the three factors that can affect the recurrence of TR remained comparable between the study groups.

The recurrence of tricuspid regurgitation was insignificant for all study groups. Around half of patients in each group did not have TR on discharge and after one year of follow up most of the patients had either no regurgitation or grade +1 TR. Two patients (10%) in DV group and one patient (5%) in SA group had moderate (grade +2) TR (P value of 0.74 and 0.78 for pre and postoperative TR respectively).

At last, reverse remodeling of the right ventricle end diastolic dimension is shown, and the mean difference of decrease in RVEDD is listed in Table 2. On discharge there was a significant improvement in dyspnea class, end diastolic dimension of the right ventricle and degree of tricuspid regurgitation. The first three factors reflect the success of left sided rheumatic pathology correction and are known to affect recurrence of tricuspid regurgitation.

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was highest in DB group (0.64 ± 0.47 cm) compared to DV group (0.18 ± 0.29 cm) or to SA group (0.16 ± 0.45 cm) with p value of 0.000\(^{d}\) denoting that RV reverse remodeling happened significantly in DB compared to other repair techniques.

3. Discussion

TR is a significant clinical problem that may be undertreated by surgeons.\(^{7}\) Moderate and severe TR have been associated with poor short-term and long-term survival, independent of ventricular function and pulmonary arterial pressure.\(^{8}\) Similar to other reports, we operated upon patients having secondary (functional) regurgitation, caused by progressive annular dilation and decreased leaflet coaptation secondary to rheumatic left sided valve pathology.

Some authors hypothesized that the cause of secondary TR is mainly due to dilation of tricuspid annulus which results from a remodeling process of the right ventricle (RV) due to chronic pressure overload.\(^{9}\) Therefore, treatment of left sided valve lesion alone only decreases the afterload, but has nothing to do with tricuspid dilatation or preload or right ventricular function.\(^{4}\) Consequently, complete reverse RV remodeling may not occur, and normalization of pulmonary artery pressures alone will not eliminate TR in many patients.\(^{10}\)

In patients with concomitant mitral valve disease, correcting the mitral valve lesion without treating the TV may improve mild TR.\(^{11}\) However, if moderate or severe TR left untreated, TR may persist or even worsen after mitral valve surgery, leading to progressive heart failure and death.\(^{12,13}\) In addition, reoperation for residual TR carries significant risks and may impose a poor prognosis.\(^{14–16}\) It has, therefore, been recommended by some experts that a more aggressive approach should be taken in cardiac surgery patients with concomitant TR.\(^{7,12,13,17}\)

As an alternative approach to the intraoperative assessment of the tricuspid annulus diameter, echocardiographic measurement of the tricuspid annulus diameter has been used.\(^{18}\) A tricuspid annulus diameter of 40 mm or more has been demonstrated to be equivalent to 7 cm intraoperatively.\(^{18}\)

The optimal technique to repair the TV remains uncertain. Despite the fact that bicuspidization results are reasonable especially for rheumatic patients, it is now rarely performed.\(^{19,20}\)

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### Table 2

Hospital outcome and 1 year follow-up of the studied groups.

| Hospital outcome                                      | Flexible band | Devega Seg. ann. | Test value | P-value |
|-------------------------------------------------------|---------------|------------------|------------|---------|
| Predischarge tricuspid regurgitation grade (0 to +4)   |               |                  |            |         |
| No-trivial                                            | 5             | 6                | 5          | 1.955   |
| Mild (1)                                              | 12            | 10               | 13         | 0.400   |
| Mild to moderate (1–2)                                | 2             | 10               | 2          | 0.100   |
| Predischarge ejection fraction (%)                    | Mean ± SD     |                  |            |         |
| Range                                                 | 52.63 ± 5.84  | 52.65 ± 7.69     | 53.70 ± 6.15 | 0.169* |
| AF on discharge                                       | No            |                  |            |         |
| No                                                    | 13            | 12               | 12         | 0.304   |
| Yes                                                   | 6             | 7                | 8          | 0.304   |
| LCOP                                                  | No            |                  |            |         |
| No                                                    | 17            | 16               | 16         | 0.223   |
| Yes                                                   | 3             | 4                | 4          | 0.200   |
| HF                                                    | No            |                  |            |         |
| No                                                    | 17            | 17               | 17         | 0.000   |
| Yes                                                   | 8             | 8                | 8          | 1.000   |
| Reopening for bleeding                                | No            |                  |            |         |
| No                                                    | 18            | 18               | 18         | 0.333   |
| Yes                                                   | 2             | 2                | 2          | 0.333   |
| Respiratory complications                             | No            |                  |            |         |
| No                                                    | 17            | 16               | 16         | 0.240   |
| Yes                                                   | 3             | 4                | 4          | 0.240   |
| Septic complications                                 | No            |                  |            |         |
| No                                                    | 19            | 19               | 20         | 1.034   |
| Yes                                                   | 1             | 1                | 0          | 0.000   |
| RF                                                    | No            |                  |            |         |
| No                                                    | 19            | 20               | 20         | 2.034   |
| Yes                                                   | 1             | 0                | 0          | 0.000   |
| Multiorgan failure                                   | No            |                  |            |         |
| No                                                    | 19            | 20               | 20         | 2.034   |
| Yes                                                   | 1             | 0                | 0          | 0.000   |
| Pacemaker                                             | No            |                  |            |         |
| No                                                    | 20            | 19               | 20         | 2.034   |
| Yes                                                   | 0             | 1                | 0          | 0.000   |
| One year follow-up                                   |               |                  |            |         |
| AF after 1 Year                                       | No            |                  |            |         |
| No                                                    | 8             | 9                | 8          | 0.227   |
| Yes                                                   | 11            | 10               | 12         | 0.892   |
| RVEDD (cm)                                            | Mean ± SD     |                  |            |         |
| Range                                                 | 2.54 ± 0.26   | 2.83 ± 0.31      | 2.72 ± 0.29 | 5.190* |
| NYHA                                                  | Mean ± SD     |                  |            |         |
| Range                                                 | 2.3–3.2       | 2.2–3.4          | 2.4–3.3    |         |
| EF (%)                                                | Mean ± SD     |                  |            |         |
| Range                                                 | 55.35 ± 6.88  | 54.47 ± 5.06     | 55.30 ± 4.70 | 0.147* |
| TR grade (0 to +4)                                    | No-trivial    |                  |            |         |
| No                                                    | 7             | 7                | 7          | 0.400   |
| Mild (1)                                              | 10            | 6                | 8          | 4.758   |
| Moderate (2)                                          | 2             | 4                | 3          | 0.783   |
| Died                                                  | 1             | 1                | 0          | 0.000   |
| Need for reoperation                                 | No            |                  |            |         |
| No                                                    | 19            | 19               | 20         | NA      |
| Yes                                                   | 0             | 0                | 0          | NA      |

NA: Not applicable.

LCOP: Low cardiac output syndrome, HF: Heart failure, RF: Renal failure, RVEDD: Right ventricular end diastolic dimension, NYHA: New York Heart Functional Association Class, TR: Tricuspid regurgitation.

* One Way Analysis of Variance (ANOVA) test.

# Significant.
As far as the DeVega suture annuloplasty is concerned, it is the most commonly used TV repair technique.21 A number of series have reported its short and long-term success.22–24 However, other investigators have reported a relatively high recurrence rate for the DeVega technique,7,25 particularly in patients with severe tricuspid annular dilation and/or pulmonary hypertension.19 It has been recommended that such patients undergo TV repair with an annuloplasty ring.7,25–33 We therefore undertook the current study to compare hospital outcome and short-term results in patients undergoing TV repair with three repair techniques.

We elected to use dacron band as a flexible band to repair the tricuspid valve, the benefits of a flexible band, include the following:

1. Better early postoperative LV systolic function over patients with a rigid ring.28
2. Allows annular size and configuration to adapt to changes throughout cardiac cycle.
3. Better diastolic blood flow across the mitral valve, particularly during exercise.29
4. Flexible annuloplasty repair devices place less stress on the sutures during systole, minimizing the likelihood of dehiscence.30

In comparing the three repair techniques together, there was a significant improvement of the dyspnea class of patients, decrease in pulmonary hypertension, and non progression of tricuspid regurgitation grade. The first two factors improved after correcting the left sided rheumatic valve pathology and the third one is due to success of tricuspid valve repair. However, Dacron band annuloplasty confers significant improvements over segmental annuloplasty in right ventricular reverse remodeling, and a similar finding was found by some authors18 which for sure means better outcome of the repair.

Moreover, atrial fibrillation has been demonstrated as a main risk factor for progression of functional TR after mitral valve disease.10 and in this study its incidence was comparable between the three groups both on discharge and after one year excluding its role in the progression, recurrence or development of new tricuspid regurgitation.

Dreyfus et al. in 2005 found that TV annuloplasty has been associated with a higher rate of pacemaker requirement. In contrary to his finding, no patients had DB implantation in this study required a pacemaker, and the only patient needed pacemaker implantation was in DV group.4

| Pul HTN (mmHg) | Dacron band | DeVega | Seg ann | Test value | P-value |
|---------------|-------------|--------|---------|------------|--------|
| Before Mean ± SD | 56.30 ± 9.67 | 55.15 ± 10.15 | 56.30 ± 10.78 | 0.085* | 0.919 |
| Range | 40–75 | 33–75 | 33–77 |  |
| After Mean ± SD | 43.15 ± 6.85 | 45.30 ± 8.07 | 44.75 ± 7.65 | 0.439* | 0.647 |
| Range | 30–50 | 30–60 | 30–60 |  |
| Mean difference | 13.15 ± 7.3 | 9.85 ± 4.06 | 11.55 ± 6.46 | 1.465* | 0.240 |

| RVEDD (cm) | Dacron band | DeVega | Seg ann | Test value | P-value |
|-------------|-------------|--------|---------|------------|--------|
| Before Mean ± SD | 3.18 ± 0.43 | 3.00 ± 0.33 | 2.88 ± 0.35 | 3.286* | 0.045* |
| Range | 2.5–4 | 2.6–3.7 | 2.4–3.5 |  |
| After Mean ± SD | 2.54 ± 0.26 | 2.83 ± 0.31 | 2.72 ± 0.29 | 5.190* | 0.009* |
| Range | 2.3–3.2 | 2.2–3.4 | 2.4–3.3 |  |
| Mean difference | 0.64 ± 0.47 | 0.18 ± 0.29 | 0.16 ± 0.45 | 8.717* | 0.000* |

| Predischarge TR grade (0 to +4) | No-trivial | Mild (1) | Mild to moderate (1–2) | Test value | P-value |
|-------------------------------|-----------|---------|----------------------|------------|--------|
| No-trivial | 5 (25%) | 12 (63%) | 2 (10%) | 1.955* | 0.744 |
| Mild (1) | 6 (40%) | 10 (45%) | 3 (15%) | 4.758* | 0.783 |
| Mild to moderate (1–2) | 7 (35%) | 10 (50%) | 2 (10%) |  |
| 1 year after | No-trivial | Mild (1) | Mild to moderate (1–2) | Test value | P-value |
| No-trivial | 7 (35%) | 6 (30%) | 4 (20%) |  |
| Mild (1) | 8 (40%) | 3 (15%) | 1 (5%) | |
| Mild to moderate (1–2) | 2 (10%) | 6 (30%) | 2 (10%) |  |
| Died | 5 (25%) | 4 (20%) | 0 (0%) |  |

| AF on discharge | No | Yes | Test value | P-value |
|-----------------|----|----|------------|--------|
| No | 11 (70%) | 8 (68.42%) | 0.000* | 1.000 |
| Yes | 13 (63.16%) | 6 (31.58%) | 0.304 | 0.858 |

| AF after 1 Year | No | Yes | Test value | P-value |
|-----------------|----|----|------------|--------|
| No | 8 (73%) | 6 (63.16%) |  |
| Yes | 12 (60%) | 7 (36.84%) | 0.050 |

| Preoperative NYHA | No-trivial | Mild (1) | Mild to moderate (1–2) | Test value | P-value |
|------------------|-----------|---------|----------------------|------------|--------|
| No-trivial | 5 (25%) | 3 (15%) | 2 (10%) | 2.829* | 0.587 |
| Mild (1) | 11 (55%) | 13 (65%) | 11 (55%) |  |
| Mild to moderate (1–2) | 4 (20%) | 4 (20%) | 7 (35%) |  |

| Postoperative NYHA | No-trivial | Mild (1) | Mild to moderate (1–2) | Test value | P-value |
|--------------------|-----------|---------|----------------------|------------|--------|
| No-trivial | 14 (70%) | 11 (55%) | 15 (75%) | 5.775* | 0.449 |
| Mild (1) | 6 (30%) | 6 (30%) | 5 (25%) |  |
| Mild to moderate (1–2) | 0 (0%) | 2 (10%) | 0 (0%) |  |

| Died | 1 (5%) | 1 (5%) | 0 (0%) |  |

Pul HTN: Pulmonary hypertension, RVEDD: Right ventricular end diastolic dimension, TR: Tricuspid regurgitation, AF: Atrial fibrillation.

* One Way Analysis of Variance (ANOVA) test.
Chi-squared test.
# Significant.
Highly significant.
Several other studies support our finding of the superiority of TV repair with an annuloplasty ring.\textsuperscript{7,12,24–26} A prospective randomized study of 159 patients conducted by Rivera et al.\textsuperscript{25} comparing the DevVega suture to Carpentier ring annuloplasty demonstrated a higher recurrence of moderate and severe TR in the DevVega group at 45-month follow-up. Similarly, in a study of 790 patients who underwent TV repair for secondary TR, McCarthy et al. reported that TR recurred early and progressed to moderate and severe degree after pericardial and DevVega suture repairs ($P = 0.002$ and $P = 0.06$, respectively, compared with the Carpentier ring).\textsuperscript{7} A similar study in 45 patients by Matsuyama et al. showed a 45% recurrence of 2+ to 3+ TR in DevVega compared with only 6% in the Carpentier repair group ($P = 0.027$).\textsuperscript{22} Freedom from moderate and severe TR at a mean follow-up of 39 ± 23 months was 45% in the DevVega group and 94% in the Carpentier group.

Other studies have demonstrated similar results.\textsuperscript{26,27,31,32} All these findings suggest that an annuloplasty band or ring is recommended in patients undergoing TV repair, particularly in those with more severe TR, to avoid future recurrence as compared to merely suture based techniques.

However, whether segmental annuloplasty is better than or equal to dacron band repair on long-term results is unclear because the former technique has been reported to lower the risk of suture dehiscence and recurrent TR.\textsuperscript{7} Nevertheless, we expected to find a marked benefit of tricuspid annuloplasty band and our results have prompted a change in surgical practice at our institution.

4. Study limitations

Our study has several limitations. One limitation of our study is that TV repair technique could be biased by surgeon preference and lack of randomization. The fact that patients who received an annuloplasty band exhibited better short-term results further supports our conclusions that annuloplasty band should be used more frequently in TV repair surgery.

Moreover, small number of the three study groups, short period of follow-up and use of right ventricular end diastolic dimension alone to show reverse remodeling process are other limitations in this study. Might be better if we use right ventricle long and short axis measurements as some authors did.\textsuperscript{18}

5. Conclusion

The three techniques are options to repair the tricuspid valve, however, placement of Dacron band in patients undergoing tricuspid valve repair is associated with better RV remodeling, and hence, a probable better right ventricular performance and better outcome of repair is expected. A higher number of patients are needed with longer follow up period to appreciate the effect on survival and rate of freedom from tricuspid regurgitation and re-intervention.

Disclosures

None.

Conflicts of interest

None declared.

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