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Original Article

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

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ABSTRACT

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 ± 0.311 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.

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 regurgitation[2] 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

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of mitral valve surgery had better long-term results than those who had not.[4] An increasing wealth of observational data now supports surgical treatment of functional tricuspid regurgitation.

Consequently, early methods used to repair the tricuspid valve by sutures (suture based techniques) such as "bicuspidization" described by Sharony et al.[5] and "modified DeVega tricuspid annuloplasty" described by Antunes et al.[6] 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 procedures 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 quantification, 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 translated 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 commissure 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 Ethibond® were usually needed to stitch the tricuspid annulus from posteroseptal commissure to anteroseptal commissure. Stitches were taken perpendicular 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 annuloplasty) (2 pledgeted polypropylene sutures taken from posteroseptal commissure to the middle of anterior leaflet and the second one from the middle of anterior leaflet to the anteroseptal commissure, the pledgets of each suture were tied separately). All methods of repair were followed by saline test intraoperatively and the repair technique is considered successful if equal to or less than mild regurgitation was encountered. No failure was encountered intraoperatively for any method of tricuspid repair.

Concomitant procedures consisted of mitral valve replacement in 70% of patients, and double valve replacement in 30% of patients. TV repair was performed before performing other concomitant cardiac procedures, always with the heart beating after going into cardiopulmonary bypass and fasting of superior and inferior vena cava snares while patient is worm and before cross clamp application.

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 telephone 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 quantitative data were presented as mean, standard deviations and ranges. The comparison between two groups with qualitative data was done by using ***chi-squared 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 significant as the following: $P > 0.05$: Non significant, $P < 0.05$: Significant, 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 hypertension and incidence of chronic atrial fibrillation (AF) was comparable 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 mmgh (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).

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