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Original Research Article

De Vega annuloplasty versus ring annuloplasty for repair of functional tricuspid regurgitation

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ABSTRACT

Background: Tricuspid insufficiency (TI) is a functional insufficiency in most of the cases and associated with the dilatation of the annulus and remolding. Pulmonary hypertension and right ventricular volume overload due to chronic aortic or / and mitral valve disease in most of the time causes the functional tricuspid insufficiency. Despite the different techniques used to repair the tricuspid valve, the recurrent TR is still occurring in 20- 30 % of the patients and the development of late TR is an important complication of left heart surgery. Our study aims to compare the long-term outcome of ring annuloplasty with De Vega annnuloplasty in patients with secondary tricuspid regurgitation (TR).
Methods: A retrospective study of 320 patients who underwent tricuspid valve repair surgery for secondary tricuspid regurgitation from January 2002 to December 2010 at Queen Alia Heart Institute (QAHI). Patients were divided into two groups, in group (1) (n=180) patients had an annuloplasty ring. Group (2) (n=140) patients had De Vega procedure (no ring). The procedures were performed in association with mitral valve surgery in 78% of patients, aortic valve surgery in 15% and combined aortic and mitral valve surgery in 7% of patients. TR grade, NYHA functional class and Pulmonary artery pressure were nearly similar and no significant preoperative difference between the two groups.
Results: Echocardiographic and clinical follow up were done for all patients. The duration of procedure for both De Vega and ring annuloplasty were nearly similar. The overall survival in ring group at 5year was 83.9% versus 77.9% in De Vega group. Freedom from residual and recurrent TR, event free survival and long-term survival were significantly better in the ring group and also the tricuspid valve reoperation were less in the ring group.
Conclusions: The implantation of annuloplasty ring results in lower incidence of residual or recurrent of tricuspid regurgitation, improved the event-free survival and long-term survival when compared with the sewing techniques such as De Vega.

Keywords: Cardiac surgery, De Vega, incompetence, repair, ring, tricuspid valve, outcome

INTRODUCTION

Echocardiographically, 80-90% of the population can have a minimal to mild grade Tricuspid valve regurgitation (TI). In this "physiological" TI there are no morphological changes. The right ventricle (RV) and the right atrium (RA) are of normal size. A moderate to severe TI is found in 0.8% of the population with increasing prevalence at age.[1,2] Patients with a Significant TI have a markedly reduced life expectancy, even if the hemodynamic is often well tolerated over a long period of time.[3] Functional tricuspid regurgitation is most commonly due to pulmonary hypertension and right

ventricular volume overload caused by left sided valvular lesion, the chronic volume and pressure load of the right ventricle leads to RV dilatation and Dysfunction. The tricuspid valve annulus dilates in the septal-lateral direction in the region of the free RV wall. As the dilatation increases, the valve ring becomes planar and rather circular and tricuspid regurgitation results. It's highly recommended to surgically manage a moderate to severe tricuspid regurgitation so as to achieve early and late clinical outcome.[4,5] Because if not corrected, TR may worsen over time leading to sever symptoms and will have negative impact on the functional state and survival.[6-8]

Functional TR secondary to annular dilation can be repaired with annuloplasty ring or without (De Vega).[9,10] Comparing the long-term outcome of TV repair with annuloplasty ring or DE VEGA annuloplasty was the aim of our study.

METHODS

This retrospective study analyzed the medical records of 320 patients who underwent tricuspid valve annuloplasty for significant secondary tricuspid regurgitation and dilatation of right sided cardiac chamber due to left sided valve disease at Queen Alia Heart Institutes (QAHI) between January 2002 and December 2010.

Patients were divided into two groups, in group (1) (n=180) annuloplasty ring was the procedure of repair and in group (2) (n=140) De Vega annuloplasty was the procedure of repair. 175 patients were male, and 145 patients were femal with the age ranged from 45 to 75. The severity of TR, the ventricular function and the pulmonary artery systolic pressure were assessed echocardiographicaly prior to surgery.

Operative techniques

All patients underwent tricuspid valve surgery conducted with cardiopulmonary bypass (CPB) under standard anesthesia protocol. Heparin and protamin were given as usual in a body weight based equation. During CPB the target mean perfusion pressure was 65mmHg, body temperature was drifted to 32°C. Intermittent cold crystalloid cardioplegia was delivered antegradely through the aortic root.

Two-dimensional transthoracic and Doppler echocardiographies were used to assess the degree of tricuspid regurgitation and right heart dilatation, and intra-operatively by means of transesophageal echocardiography. A systolic pulmonary artery pressure more than 59mmHG is defined as pulmonary hypertension and diagnosis was made by Doppler echocardiography.

Tricuspid regurgitation grade, pulmonary artery pressure and NYHA functional class were almost similar in the two groups preoperatively. All the cases of tricuspid incompetence were functional and all the patients with tricuspid stenosis were excluded from the study.

In the case of De Vega technique, the annulus is gathered in the region of the anterior and posterior leaflet by double layers of polyproline suture. The suture is started near the commissure between the anterior and septal leaflet and pierced along the anterior leaflet. In the region of the commissure between posterior and septal leaflet, the suture is guided by Teflon and pierced parallel to the first suture. Now, the annulus is reduced by pulling the two filaments under digital control until tricuspid valve regurgitation is no longer present.

In ring annuloplasty, the prosthetic ring was placed using multiple interrupted pledgeted 2-0 ethibond sutures. Follow up was achieved in 91% of the patients postoperatively by echocardiography at hospital discharge and almost every 6months after leaving the hospital.

RESULTS

The main demographic characteristics of the patients between the two groups have no significant differences. Also in the term of age, NYHA class, left atrial size, left ventricular ejection fraction and PASP there were no significant difference. There was no statistically significant difference in the duration of CPB, the mean aortic clamping time, intensive care unit stay and extubation time. Also, there's no difference in follow-up duration for the two groups.

Table 1: Comparison between ring and de Vega repair of tricuspid valve.

Type of tv repair	Ring	De vega
Number of patients (%)	180	140
30day mortality, (%)	3, (1.6%)	8, (5.7%)
Tricuspid valve related mortality, (%)	0, (0%)	10, (14 %)
Overall survival (at 5 years follow up)	151 (83.9%)	109 (77.9%)

The 30days mortality rate in the De Vega group was 5.7% (8 patients). Sudden cardiac arrest in 2 patients and low cardiac output syndrome in 6 patients were the causes of death in this group.

In the DE Vega group the causes of late death were one cardiac failure and two severe bleeding due to warfarin therapy.In the ring annuloplasty group the 30 days mortality was 1.6% one died of cardiac rupture and two died of heart failure.

Including operative death, 78% was the overall survival in De Vega group compared to 84% overall survival in the ring group. Tricuspid valve related mortality was 14% in De Vega group 0% in Ring group.

The risk factors for tricuspid valve incompetence recurrence were; the annuloplasty type (De Vega), preoperative PASP and low left ventricular ejection fraction.

DISCUSSION

Most studies of tricuspid valve repair have focused on the indication for intervention, the technique of surgery, survival rates and reoperation rates.[7,8] Few studies have evaluated the clinical outcomes and quality of life after tricuspid valve annuloplasty.[9-11] Functional TI with concomitant left sided lesions such mitral or aortic valve disease is associated with high mortality and increased risk of adverse events.[12-14]

In patient with secondary TR concomitant with mitral or aortic valve(s) lesion(s) without treating the tricuspid valve may improve or even alleviate mild TR; however, uncorrected moderate and severe TR me persist or even worsen after mitral valve surgery leading to progressive heart failure and death.[15] In addition, reoperation for residual TR carries significant risks and may suggest poor prognosis.[15,16] So, the recommendation is a more aggressive treatment in cardiac patients with concomitant tricuspid regurgitation.[15-17]

We show in our study that using ring anuloplasty effectively alleviated TI recurrence and that the quality of life in patients with rheumatic mitral and aortic valve disease is improved. Bernal et al. believed that annuloplasty ring were more effective than De Vega procedure in preventing late TI after mitral valve repair for rheumatic heart disease.[18]

Our study also demonstrated that ring annuloplasty had more efficacies in restoring and maintaining tricuspid valve function immediately after surgery and also in the long term, which indicates that ring annuloplasty is more durable method for TI repair.

Left side valvular pathology of rheumatic heart disease origin, is often difficult to repair due to marked thickening and calcification of the valve tissue; so most of the patients received mitral valve replacement rather than repair. This in turn could completely change the native ring structure and subsequently affect the geometrical shape of native tricuspid annulus. In this condition maintaining the geometrical shape of the dilated tricuspid annulus through annuloplasty ring may be of paramount importance to ensure durable repair effect.

Also, in rheumatic mitral valve disease, left atrial pressure and PASP increase over time in nearly all patients; this leads to pressure overload of the right ventricle and induce right ventricular enlargement.[18] It has been shown that ring annuloplasty remodels the annulus, decreases tension on suture lines, increases leaflet cooptation, and prevents recurrent annular dilatation, all reasons to prefer prosthetic over simple suture annuloplasty in the presence of risk factors for tricuspid repair failure, such as significant right heart dilatation and dysfunction.[17-20] If the PASP is markedly increased or the annulus moderately dilated, relatively minor leaflet disease may lead to functional TI.[19-21] Rheumatic heart disease (RHD) patients tend to have poor right heart function even before the occurrence of functional TI therefore the correction of even mild or moderate TI in these patients necessitates a more stable and durable annuloplasty method.[22] Thus, the ring annuloplasty technique may be selected as the primary choice for correction of functional TI in RHD patients.[23,24]

Our study shows that the use of ring annuloplasty alleviated TI recurrence effectively and improved the quality of life in patients with rheumatic mitral and /or aortic valve disease, and that De Vega repair had negative impact on the rate of freedom from TI recurrence. A prospective randomized study of 159 patients conducted by Rivera et al comparing De Vega suture to ring anuloplasty demonstrated higher recurrence of moderate and sever TR in the De Vega group.[25,26]

Similarly, a study of 790 patients by McCarthy et al reported an earlier recurrence and progressive increase of moderate and severe TR after De Vega repair compared with ring annuloplasty.[26,27]

The retrospective nature of the study and the single centre design are the major limitations

CONCLUSION

The reconstruction of the tricuspid valve with the Annuloplasty ring is highly recommended because it can be done with low rate of residual insufficiencies, a low reoperative rate and improved long-term survival and event free survival.

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