The Egyptian Cardiothoracic Surgeon

In Press

Original Article

Surgical Repair versus Conservative Treatment for Moderate Functional Tricuspid Regurgitation in Concomitant with Mitral Valve Surgery

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Abstract

Background: Management of moderate functional tricuspid regurgitation (FTR) secondary to left-sided valve lesion is controversial. The objective of this study was to compare the short-term results of surgical repair versus conservative treatment for moderate functional tricuspid regurgitation in concomitant with mitral valve surgery.

Methods: Our study included 60 patients with mitral valve lesion and moderate functional tricuspid regurgitation. Patients were divided into 2 groups; group A included 30 patients whose tricuspid valve disease were managed conservatively, and group B included 30 patients who had tricuspid valve band annuloplasty.

Results: Preoperative clinical and echocardiographic data were comparable between groups. There was no difference regarding mechanical ventilation time (6 .13 ± 3.02 vs. 7.01 ± 4.14 hours; p= 0.291), or intensive care unit stay (51.42 ± 12.1 vs. 52.31 ± 15.32 hours; p=0.614) in group A and B respectively. There was a significant improvement in the degree of tricuspid valve regurgitation in group B early postoperative (moderate tricuspid regurgitation reported in 22 (73.3%) vs. 4 (13.3%); p<0.001) and at 3 months (moderate tricuspid regurgitation 11 (36.7%) vs. 2 (6.7%); p<0.001) and 6 months follow up (moderate tricuspid regurgitation 10 (30%) vs. 2 (6.7%); p<0.001) in group A and B respectively. After 6-months, 20 (66.7%) patients in group A had dyspnea grade I compared to 26 (86.7%) patients in group B; p=0.021.

Conclusion: Although the correction of the left-sided lesion improved the degree of TR in some patients, concomitant repair of the tricuspid valve could produce better improvement in the clinical outcome when compared to the conservative approach.

KEYWORDS

Functional tricuspid regurgitation; Tricuspid annular dilatation; Tricuspid valve repair

Introduction

Functional tricuspid regurgitation (FTR) is commonly associated with left-sided heart disease, and it occurs secondary to tricuspid annular dilatation, which develops as a result of pulmonary hypertension [1]. Re-operative surgery for symptomatic tricuspid regurgitation after mitral valve surgery was associated with high mortality rates up to 32%, and the 5-year survival rate was less than 50% [2].

Most of the studies on the FTR investigated the role of concomitant tricuspid (TV) repair at the time of the initial mitral valve surgery in the presence of severe FTR. The aim of concomitant tricuspid valve repair is the prevention of progression of tricuspid regurgitation (TR) and

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right-side heart failure, and the current recommendation is to repair severe TR; however, moderate TR is controversial [3].

The aim of our research was to compare the effect of TV repair versus the conservative treatment for patients with moderate secondary TR on the prevention of subsequent progression of tricuspid regurgitation and right ventricular failure in the early postoperative period.

Patients and Methods:

Patients population:

This study included 60 patients with severe mitral valve pathology and moderate secondary tricuspid regurgitation who were operated upon between January 2016 and January 2019 for elective primary mitral valve surgery.

Patients were divided into 2 groups; group A included 30 patients who were managed conservatively, and group B included 30 patients who had tricuspid valve band annuloplasty. Patients who had concomitant cardiac surgery as aortic valve replacement or coronary artery bypass grafting, patients with primary pulmonary hypertension, re-operative cases, emergency surgery, or other associated co-morbidities (autoimmune diseases, renal impairment, and hepatic decompensation) were excluded from the study.

Preoperative parameters:

All patients were subjected to complete history taking including the New York Heart Association (NYHA) classification for dyspnea, full clinical examination including cardiac examination, routine laboratory tests, plain chest x-ray, ECG, echocardiography with detailed assessment of severity of tricuspid regurgitation, measurement of tricuspid annulus diameter, tricuspid annular plane systolic excursion (TAPSE), myocardial Performance Index (MPI), and pulmonary artery pressure.

Surgical technique:

All patients had mitral valve surgery through a median sternotomy and cardioplegia arrest and hypothermic cardiopulmonary bypass (CPB). The mitral valve was replaced or repaired through a left atriotomy incision along the interatrial groove. Patients in group B were subjected to tricuspid valve annuloplasty through right atriotomy using a Gore-Tex® band (W. L. Gore & Associates, Elkton, Maryland, USA) or a pericardial band treated with glutaraldehyde 0.6% and folded on itself. The used band was 6 cm long and 0.5 cm wide. We have used 5 or 6 2/0 polypropylene sutures to plicate the annulus after passing them through the band.

Table 1: Comparison of the preoperative data between both groups. Continuous variables are presented as mean and standard deviation and categorical variables as number and percent.

Variables		Group B (n = 30)	Group A (n = 30)	*P*- value
Age (year)		45.1±10.5	44.1±12. 18	0.751
Gender (M/F)		11/19	12/18	0.284
NYHA	**Class I**	4 (13.3%)	0 (0%)	0.161
	Class II	8 (26.7%)	7 (23.3%)	
	Class III	1 8 (60%)	23 (76.7%)	
Mitral valve regurgitation		8 (26.7%)	7 (23.3%)	0.172
Mitral valve stenosis		18 (60%)	20 (66.7%)	
Double mitral lesion		4 (13.3%)	3 (10 %)	
EF (%)		61.40±4.61	62.20±4.91	0.391
LAD (cm)		6.3±0.72	5.80±0.68	0.181
LVED (cm)		5.56±0.61	5.35±0.64	0.624
PAP (mmHg)		46.90±15.03	44.03±16.95	0.160
RVD (cm)		2.22±0.41	2.14±0.47	0.093

EF: ejection fraction; LAD: left atrial dimension; LVED: left ventricular end-diastolic diameter; PAP: pulmonary artery pressure; RVD: right ventricular diameter

Table 2: Comparison of the operative and postoperative variables between groups. Continuous variables are presented as mean and standard deviation and categorical variables as number and percent

Variables	Group B (n = 30)	Group A (n = 30)	P value
Bypass time (minutes)	97.51±30.2	82.01±21.40	0.011
Cross-clamp time (minutes)	62.82±18.52	60.11±14.54	0.245
Mechanical ventilation (hours)	7.01 ± 4.14	6 .13 ± 3.02	0.291
ICU stay time (hours)	52.31 ± 15.32	51.42 ± 12.1	0.614
Atrial fibrillation	2 (6.7%)	1 (3.3%)	0.554
Bleeding	3 (10.0%)	2 (6.7%)	0.640
Re-sternotomy	2 (6.7%)	1 (3.3%)	0.554
No or Trivial TR	14 (46.7%)	0	<0.001
Mild TR	12 (40.0%)	8 (26.7%)	
Moderate TR	4 (13.3%)	22 (73.3%)	

ICU: intensive care unit; TR: tricuspid regurgitation

The intraoperative assessment was done using a saline test and then trans-esophageal echocardiography (TEE) after coming off bypass

Operative parameters:

These included CPB, aortic cross-clamp times, weaning problems from CPB, and any intraoperative complications.

Postoperative parameters:

These included immediate postoperative parameters and data at 3- and 6-months period. Early data included; time of mechanical ventilation, mean arterial blood pressure, central venous pressure, inotropic support, the need for pulmonary vasodilators (milrinone or dobutamine, or sildenafil), amount of bleeding, ICU stay and the pre-discharge echocardiography with a detailed assessment of the right side.

All patients were evaluated at 3- and 6-months interval clinically for dyspnea and right-side heart failure and with echocardiography with the assessment of the degree of tricuspid valve regurgitation, the diameter of the tricuspid valve annulus, tricuspid annular plane systolic excursion (TAPSE), myocardial performance index (MPI) and pulmonary artery pressure.

Statistical Analysis

Data were analyzed using IBM SPSS software package version 20.0 (IBM Corp, Belmont, Calf, USA). Continuous variables were presented as mean and standard deviation and categorical variables as number and percent. Categorical data were compared using Chi-square (x2) or Fisher exact test when appropriate and continuous data with a t-test. A P-value of less than 0.05 was considered significant.

Results

Preoperative Data:

The mean age in group A was 45.1 ± 10.5 years, and 44.1 ± 12.18 in group B (p=0.735). In group A, 11 patients (36.7%) had sinus rhythm, and 19 patients (63.3 %) had atrial fibrillation (AF). In group B, 10 patients (30.9%) had sinus rhythm and 20 patients (66.7%) had AF (p= 0.787). Preoperative variables are presented in Table 1.

Intraoperative data:

Total CPB time was significantly longer in group B; 97.51 ± 30.2 minutes versus 82.01 ± 21.40 minutes in group A (P = 0.011). However, there was no significant difference regarding the cross-clamp time (62.82 ± 18.52 versus 60.11 ± 14.54 minutes for group A versus B, respectively; P= 0.245). In group A, one patient (3.3%) required high support (adrenaline 150 nanogram/kg/min and dobutamine 15 μg/kg/min).

Early postoperative data:

There was no significant difference between both groups regarding postoperative mechanical ventilation or ICU stay times. Early postoperative complications were non-significant between both groups. Tricuspid regurgitation was more significant in group A (Table 2).

Table 3: Comparison of the postoperative outcomes after 3 months. Continuous variables are presented as mean and standard deviation and categorical variables as number and percent.

		Group B (n=30)	Group A (n=30)	P-value
NYHA	Class I	26 (86.7%)	19 (63.3%)	0.041
	Class II	1 (3.4%)	7 (23.3%)	
	Class III	0	4 (13.3%)	
TR	No or Trivial	17 (58.6%)	3 (10%)	<0.001
	Mild	9 (30%)	14 (46.7%)	
	Moderate	2 (6.7%)	11 (36.7%)	
	More than Moderate	1 (3.3%)	2 (6.7%)	
EF (%)		67.30 ± 2.72	65.50± 2.40	0.147
LAD (cm)		5.29± 0.45	5.21± 0.38	0.712
LVED (cm)		5.12± 0.54	5.07± 0.52	0.621
PAP (mmHg)		32.60± 5.74	31.8± 7.2	0.821
RVD (cm)		2.07± 0.41	2.12± 0.53	0.054

EF: ejection fraction; LAD: left atrial dimension; LVED: left ventricular end-diastolic diameter; PAP: pulmonary artery pressure; RVD: right ventricular diameter; TR: tricuspid regurgitation

Follow-up data:

After 3-months follow-up, both groups have shown improvement in the functional NYHA class. Group B showed more improvement in the degree of TR with a statistically highly significant difference (Table 3). Follow-up data after 6 months are shown in Table 4.

Discussion

Patients with more than moderate tricuspid regurgitation should have concomitant repair during mitral valve surgery. However, the management of moderate tricuspid regurgitation secondary to left side valve lesions is controversial. In this study, we compared the outcome of mitral valve surgery with concomitant moderate tricuspid in patients who had tricuspid valve repair versus those who had conservative management. Rheumatic patients presented the majority of our patients, which is not well presented in the literature [4, 5]. Atrial fibrillation is commonly associated with mitral valve disease. Song and coworkers reported that 37.5% of their patients had AF before surgery, 22.2% of them underwent a concomitant maze

Table 4: Comparison of the postoperative outcomes after 3 months. Continuous variables are presented as mean and standard deviation and categorical variables as number and percent

		Group B (n=30)	Group A (n=30)	P-value
NYHA	Class I	26 (86.7%)	20 (66.7%)	0.021
	Class II	1 (3.4%)	7 (23.3%)	
	Class III	0	3 (10%)	
TR	No or Trivial	19 (66.5%)	5 (16.7%)	<0.001
	Mild	8 (26.7 %)	14 (46.7%)	
	Moderate	2 (6.7%)	10 (30%)	
	More than moderate	0	1 (6.7%)	
EF (%)		5.27±0.34	5.18±0.36	0.147
LAD (cm)		5.12±0.54	5.03±0.55	0.561
LVED (cm)		27.6±5.80	28.6±7.9	0.582
PAP (mmHg)		2.06±0.34	2.10±0.50	0.521
RVD (cm)		5.27±0.34	5.18±0.36	0.081

EF: ejection fraction; LAD: left atrial dimension; LVED: left ventricular end-diastolic diameter; PAP: pulmonary artery pressure; RVD: right ventricular diameter; TR: tricuspid regurgitation

procedure [6]. In addition, Chikwe and colleagues reported that patients with concomitant TVR were almost twice as likely to have a history of AF compared with patients in the isolated mitral valve group [7].

In our operative results, we found that the CPB time was significantly longer in group B, and this was attributed to the time given for tricuspid repair. The cross-clamp time was not significantly different as the tricuspid repair was done after the removal of the cross-clamp. These data were similar to Pradhan and colleagues who found that the DeVega annuloplasty did not significantly prolong the cross-clamp time as compared to those with mitral valve replacement only [3]. However, Ro and colleagues reported that cardiopulmonary bypass and aortic cross-clamp times were significantly longer in the repair group than in the control group [8].

Mechanical ventilation, ICU stay, and morbidity were not significant between both groups. Our results agreed with the study of Pradhan and coworkers [3]. Ro and colleagues reported that the operative mortality rate was 1.0%. They also have found no significant differences in early mortality or major morbidity rates between both groups [9]. Chikwe and coworkers reported that overall operative mortality was 0.6% [7].

The difference between groups regarding the degree of TR became evident during the follow-up. Similarly, Gürsoy and coworkers have studied 66 patients with mild tricuspid insufficiency who underwent mitral valve replacement without addressing the TV and revealed that mild FTR might advance to moderate (24.2%) or severe (27.3%) grade in more than half of the patients [1]. Furthermore, Pradhan and colleagues studied 43 patients with moderate functional TR who underwent mitral valve surgery and found that eleven (47.8%) patients in the DeVega group and only five (25%) of the non-repair group had a trace or less TR with a significant difference between both groups [3].

However, Ro and colleagues studied 959 patients with mild-to-moderate functional TR who underwent mitral valve surgery, with 431 of them offered TV repair and followed them for a median period of 64.6 months and concluded that concomitant TV repair was not associated with better clinical outcomes [5]. In a recent study by David and associates, they have found that preoperative moderate TR was associated with postoperative TR of moderate or severe degree after MV repair for degenerative diseases, and they believe that TV annuloplasty was appropriate in these patients [9].

Regarding the method of repair, Chang and colleagues compared the use of band versus suture repair and have reported that the mean TR grade dropped significantly after surgery, was maintained for up to 3 years, and increased gradually from 3 to 5 years postoperatively. These findings are similar to ours despite our short period of follow up. Furthermore, they have concluded that the mean TR improved in the band group and got worse in the suture group after 5 years, and the percentage of patients with TR equal to or greater than grade III was higher in the suture group than in the band group [10].

We have found a significant difference in the functional class with better improvement in the repair group. Our results were supported by the study of Pradhan and colleagues who found that at three month's review after surgery, four patients were in NYHA II amongst those without tricuspid repair, whilst the rest were in NYHA I [3]. Additionally, DeMeester and coworkers reported that NYHA functional class was significantly better compared with preoperatively in all patients, at 6 months follow-up [11].

In agreement with our data at the three-months follow up, Pradhan and colleagues found that left ventricular dimensions, left ventricular function, and valve prosthetic valve function were similar between groups [3].

Moreover, our 6-months follow up data were supported by many studies regarding the improvement in the degree of TR and functional

status. Ghanta and colleagues found that both bicuspidization and ring annuloplasty produced an effective, durable repair at 3 years postoperatively. Significant 3 or 4 residual TR occurred in 8% of patients early after operation for all types of annuloplasty [4]. These results are similar to a previous study performed by McCarthy and colleagues in their study of 790 patients where they found that 14% of patients had 3 or 4 residual TR early after operation for all annuloplasty types, but ring repairs (Carpentier semirigid ring and Cosgrove-Edwards flexible band) provided a more durable repair than suture annuloplasty over an 8-year period [2].

Study limitations

There are several limitations to this study, including the small sample size and short-term follow-up.

Conclusion

Although the correction of the left-sided lesion improved the degree of TR in some patients, concomitant repair of the tricuspid valve could produce better improvement in the clinical outcome when compared to the conservative approach.

Conflict of interest: Authors declare no conflict of interest.

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