



## IMPACT OF MODERATE FUNCTIONAL TRICUSPID VALVE REGURGITATION REPAIR DURING RHEUMATIC MITRAL VALVE SURGERY: AT MIDTERM RESULTS.

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### Abstract:

**Background:** the "forgotten valve" or "lost valve," as the tricuspid valve has received less attention as important as the other heart valves,. The prevalence of functional tricuspid regurgitation (FTR) has been reported to reach 25% to 30%, with left-sided valvular heart lesions. **Aim of the work:** to evaluate the Impact of moderate tricuspid valve regurgitation repair during rheumatic mitral valve surgery at midterm results. **Patients and Methods:** 60 patients were selected in our prospective randomized comparative study, by simple random sampling, which done between February 2018 and June 2020 at cardiothoracic surgery department at Zagazig University hospitals in Egypt. Two groups were created,30 patients were randomly assigned to Group I (Repair group), where they received mitral valve surgery and tricuspid valve repair using pericardial band, and 30 patients were randomly assigned to Group II (No-repair group), where they underwent mitral valve surgery alone. **Results:** Our research found a statistically significant difference in terms of echo findings at discharge, 6 months, and 18 months follow-up, with higher progression of the degree of tricuspid regurgitation being detected in the no-repair group compared to the repair group. Rehospitalization from congestive heart failure and the requirement for tricuspid valve reintervention are also significantly higher in the no-repair group. **Conclusion:** In patients with moderate functional tricuspid regurgitation undergoing rheumatic mitral valve surgery, repair of the tricuspid valve with pericardial band is recommended because it is associated with less statistically significant progression in echo findings of the degree of tricuspid regurgitation, rehospitalization due to C.H.F. and tricuspid valve reintervention compared to no-repair group at midterm results.

**Keywords:** functional moderate tricuspid regurgitation, surgical repair, rheumatic mitral valve surgery

**DOI Number:** [10.14704/nq.2020.18.10.NQ20229](https://doi.org/10.14704/nq.2020.18.10.NQ20229) **Neuro Quantology 2020; 18(10): 28-35**

**Abbreviation:** FTR: functional tricuspid regurgitation, N.Y.H.A.: New York heart association, C.H.F.: congestive heart failure, I.C.U: intensive care unit, T.V: tricuspid valve, M.V: mitral valve, pt :patient, PASP: pulmonary artery systolic pressure.





## INTRODUCTION:

Because of its underestimated in comparison to the other cardiac valves, the tricuspid valve is sometimes referred to as the "forgotten valve" or "lost valve."<sup>1</sup> Regurgitation of the tricuspid valve may be classified as either a functional (secondary) lesion or an organic (primary) lesion. In most cases, pulmonary hypertension and right ventricular (RV) dilatation lead to a functional lesion at a physiologically normal valve site. Left sided valvular disease is a common cause of this condition, while Eisenmenger's syndrome, RV infarction, and intrinsic pulmonary hypertension may all play a role as well. Tricuspid regurgitation is a common clinical manifestation of many disorders. Rheumatic fever is often linked to organic illness (in which there is a structural abnormalities of the valve), however it may occur for other reasons as well. Left sided valvular heart illness is the leading cause of functional tricuspid regurgitation (FTR).<sup>2</sup> FTR is seen in 25%-30% of patients undergoing procedures for left heart valve lesions.<sup>3</sup> At least 63% of patients with mitral stenosis had FTR classified as moderate to severe, according to other research. In patients having MV surgery for mitral regurgitation, the incidence of moderate or severe FTR is often between 8 and 45 percent.<sup>4</sup> Tricuspid valve coaptation deficit and tethering of leaflets occur due to right ventricular (RV) dilatation and annular dilatation. Conservative treatments have been recommended for individuals with FTR who are having left heart valve surgery in the past.<sup>5</sup> guidelines in patients with severe FTR, repairing or replacing the tricuspid valve at the same time as the left-sided valvular procedure has been shown to enhance long-term clinical outcomes

(class I indication)<sup>5</sup>. Nonetheless, there is ongoing debate over the best way of surgical dealing with FTR when regurgitation degree is moderate.

## AIM:

The purpose of this study was to evaluate the impact of surgical repairing of moderate tricuspid regurgitation at the same time of rheumatic mitral valve surgery at midterm results.

## PATIENTS AND METHOD:

60 patients were selected in our prospective randomized comparative study, by simple random sampling. The study was authorized by the research ethics council of the Faculty of Medicine at Zagazig University, and written informed permission was collected from all patients. The research was conducted in accordance with the World's Code of Ethics.

Declaration of Helsinki, developed by the World Medical Association, for use in human research. Patients were divided into two groups at cardiothoracic surgery department at Zagazig University Hospitals in Egypt between February 2018 and June 2020.

- **Group I:** 30 patients underwent mitral valve surgery plus tricuspid valve repair (Repair group).
- **Group II:** 30 patients underwent mitral valve surgery only (No-repair group).





**Inclusion criteria:** Individuals with rheumatic mitral valve disease needing first-time surgery with moderate functional tricuspid valve regurgitation.

**Exclusion criteria:** Systolic dysfunction of the left ventricle (ejection fraction > 50%). Mitral valve re-operation, mitral regurgitation caused by ischemia, Diseases of the organic tricuspid valve, Chronic lung disease patient with mild or sever TR, patients with double valve-lesion and those with reduced RV systolic function

### **Preoperative measures:**

Both the patient's medical history and physical condition were examined. The patient had full of laboratory tests, including echocardiography. The preoperative assessment, anesthetic medicines, and surgical teams were identical in both groups.

### **Surgical Technique:**

In all patients had mitral valve surgery while under cold blood cardioplegic arrest and cardiopulmonary bypass (CPB). Further protection for the myocardium was provided by a systemic cooling that was mild to moderate (28-30 degrees Celsius) and by the use of topical ice. Mitral valve disease was corrected only either by repair or replacement in no-repair group, In repair group TV repair occurred After the removal of the aortic cross clamp, on beating heart through right atriotomy. In order to reconstruct the annulus, an autologous pericardial band of 10-12 centimeters in length and 6-8 millimeters in width was cut , then shaped using an annuplasty ring sizer. Sutures made of interrupted U-shaped (2-0) ethibond were used to connect the TV annulus to the atrial surface of the

band, which was subsequently attached to the pericardium. Intraoperative transoesophageal echocardiography and saline injection into the right ventricle were used to assess tricuspid valve competence; if the patient had more than mild TR, a second look was done. follow up: Pre-discharge, six-month, and 18-month echo follow up were performed by the same cardiologist on both groups of patients.

### **STATISTICAL ANALYSIS:**

The software program SPSS version 20.0 was used to complete the analysis; categorical variables were represented using numbers and percentages, while continuous data were summarized using means and standard deviations; data were gathered and recorded into Microsoft excel sheets. For statistical significance, a two-tailed p-value of less than 0.05 was used.

### **RESULTS:**

#### **Patients' demographics:**

Our patients' average age was 43±9 in the first group and 42±8 in the second was no statically significant difference between the two groups. The percentage of female patients was no statically significant difference between the two groups, with 73.3 % (22 patients) in Group 1 and 66.7% (20 patients) in Group 2, as regard N.Y.H.A classes was no statically significant difference between the two groups, The first group included 76.7% (23 patients) with atrial fibrillation while the second group had 83.3% (25 patients) with this condition, with no statistically significant difference between the two groups. Patients in the first group had Lt atrium sizes of 6.5±0.8 cm, while those in the second group had Lt atrium sizes of 7.1±0.7 cm and there





no statistically significant difference between the two groups, as regard pulmonary artery systolic pressure (60.6±9.1 mm Hg vs. 61.9±8.1 mm Hg)

there was no statistically significant difference between the groups and Right ventricle diameter (cm) was found to be 2.9±0.2 in the first group and 2.8±0.4 in the second group; there was no statistically significant difference between the two groups (table1).

**Table (1): Preoperative demographic data and clinical status of both groups.**

variable	Repair group	No-Repair group	P-value
Age (year)	43±9	42±8	N.S
Female	22 pt (73.3%)	20 pt (66.7%)	N.S
<b>N.Y.H.A class</b>			
I.	22 pt	23 pt	N.S
II.	6 pt	5 pt	N.S
III.	2 pt	1 pt	N.S
Atrial fibrillation	23 pt (76.7%)	25 pt (83.3%)	N.S
Lt atrium size(cm)	6.5±0.8	7.1±0.7	N.S
PASP (mm hg)	60.6±9.1	61.9±8.1	N.S
Rt ventricle diameter(cm)	2.9±0.2	2.8±0.4	N.S

As regard intra and postoperative data of patients in both groups, Mitral valve surgery type as replacement with 83.3% of patients in the first group and 86.7% of patients in the second group was no statistically significant difference between the two groups while repair with 16.6% of patients in the first group and 13.3% of patients in the second group was no statistically significant difference between the two groups. Cross clamp time (min) that found 60.5±20.3 in first group and 62.3±25.5 in second group without significant difference between both groups, Cardiopulmonary bypass time(min)that found 75±15 in first group and 78±14 in second group without significant difference between both groups, Re exploration for bleeding 6.6% (2 patients) in first group and 9.9% (3 patients) in second group without

significant difference between both groups while for other causes represented 6.6% (2 patients) in first group and 3.3% (1 patients) in second group without significant difference between both groups and rates of permanent pacemaker insertion, there was no statistically significant difference between the two groups (9.9% )in the first group, , and (3.3%) in the second group,. The duration of ICU stay (hours) for the first group was 48±12, whereas for the second group was 45±10, This difference is not statistically significant. Hospitalization stay (days) was similar across the two groups (8±2 in the first and 7±3 in the second), failing to reach statistical significance. Operative mortality not significantly difference between the groups, coming in at 3.3% (1 patient) in both (table 2).





**Table (2): Intra and postoperative data of Patients in both groups.**

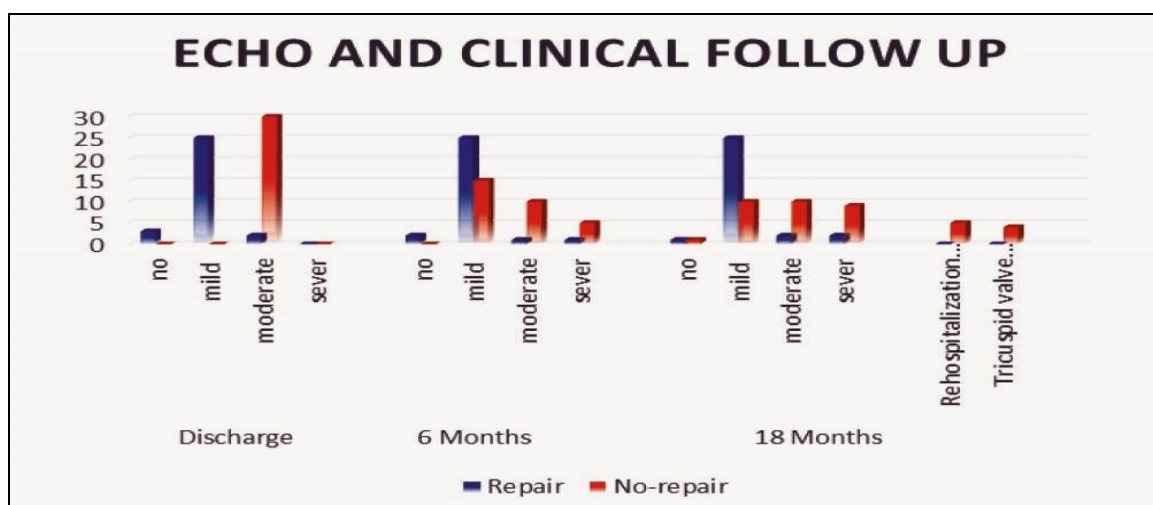
Variable	Repair group	No-Repair group	P- value
<b>Mitral valve surgery</b>			
<b>Repair</b>	5(16.6%)	4(13.3%)	N.S
<b>Replacement</b>	25(83.3%)	26(86.7%)	N.S
<b>Cross clamp time(min)</b>	60.5±20.3	62.3±25.5	N.S
<b>Cardiopulmonary bypass time (min)</b>	75±15	78±14	N.S
<b>Re exploration</b>			
<b>bleeding</b>	2(6.6%)	3(9.9%)	N.S
<b>Other</b>	2(6.6%)	1(3.3%)	N.S
<b>Permanent pacemaker insertion</b>	3(9.9%)	1(3.3%)	N.S
<b>I.C.U. stay(hours)</b>	48±12	45±10	N.S
<b>Hospital stay(days)</b>	8±2	7±3	N.S
<b>Operative mortality</b>	1(3.3%)	1(3.3%)	N.S

As regard tricuspid regurgitation Echo follow up at postoperative; pre discharge there no regurgitation in 10 % (3 pt) in first group and 0 % (0 pt) in second group, mild regurgitation in 83.3% (25 pt) in first group and 0 % (0 pt) in second group, moderate regurgitation in 6.7% (2 pt) in first group and 100 % (30 pt) in second group, severe regurgitation no patients in both groups with highly significant difference between both groups. Echo follow up after 6 months there no regurgitation in 6.7% (2 pt) in first group and 0 % (0 pt) in second group, there mild regurgitation in 83.3% (25 pt) in first group and 50 % (15 pt) in second group, there moderate regurgitation in 3.3% (1 pt) in first group and 33.3 % (10 pt) in second group , there severe regurgitation in 3.3% (1 pt) in first group and 16.7 % (5 pt) in second group

with significant difference between both groups, . Echo follow up after 18 months there no regurgitation in 3.3% (1 pt) in first group and 3.3 % (1 pt) in second group, mild regurgitation in 83.3% (25 pt) in first group and 33.3 % (10 pt) in second group , moderate regurgitation in 6.7% (2 pt) in first group and 33.3 % (10 pt) in second group without significant difference between both groups, sever regurgitation in 6.7% (2 pt) in first group and 30 % (9 pt) in second group with significant difference between both groups ,as regard clinical follow up data in both re hospitalization from C.H.F. and tricuspid valve reintervention is (0,0 patient) in first group and (5,4 pt) respectively in second group with significant difference between both groups: Figure (1)







**Figure (1):** Echo and clinical follow up data.

## DISCUSSION

FTR is usually linked to mitral valve (MV) disease, and it has been found that having a sever TR is a sign of a poor prognosis after surgery to correct MV disease<sup>4</sup>. In patients who have significant functional TR, it has been hypothesized that repairing or replacing the tricuspid valve (TV) at the same time as surgery on the mitral valve (MV) would boost long-term clinical outcomes<sup>4</sup>. With MV surgery, it is not quite known whether or not it is necessary to repair mild to moderate functional TR. Functional TR may grow worse even after a good MV operation, despite the fact that FTR can get improve without TV correction after a successful MV surgery. So ,TR should be surgically corrected even if moderate ,till now surgeons avoid correction of secondary TR based on wrong concept that TR will improve without correction after correction of the primary pathology in the mitral valve. This way of management still used in many centers up to date<sup>6</sup>.

The etiology of MV illness, which produces TR, explains why it is expected that patient survival would worsen as TR become worse. This is because MV disease causes TR. Several risk factors, including ischemic heart disease, rheumatic heart disease, and dilated cardiomyopathy, have been linked to the development of MV illness., which raises the pressure in the left atrium. This can cause high blood pressure in the lungs and a widening of the left atrium, which can lead to atrial fibrillation and a widening of the tricuspid annulus. Pulmonary hypertension causes the RV to get bigger and work less well. The degree of TR depends on how much the tricuspid annulus dilates, how much the RV dilates, and how much the heart's function is affected by after-load. TR can also be caused by tricuspid valve disease that is caused by rheumatic heart disease. As TR gets worse, the right ventricle gets bigger and works less well. This causes the tricuspid annulus to get bigger, which makes right heart failure get worse in a cycle<sup>7</sup>. In our study, all of the people we looked at had dyspnea. Functional tricuspid insufficiency almost always goes hand in hand with disease of the mitral valve.





The simultaneous valve lesion will make the clinical picture much worse the vast majority of the time. So, the symptoms are consistent with a lesion on the left side of the body that is growing worse<sup>7</sup>.

Left-sided heart failure gets better when tricuspid insufficiency develops because it act as decompressive vent for this failure<sup>7</sup>.

The results of our study showed no statistically significant variations in the pre-operative demographic data and clinical status between the two groups. Pre- and post-operative data showed no statistically significant differences between the two groups. Our statistics are consistent with the findings of the research that was conducted by Nath and colleagues<sup>8</sup>. During the follow-up echo findings that were performed in our study at the time of postoperative discharge, which served as our baseline for comparison, we observed changes in both groups. These changes manifested themselves as tricuspid regurgitation either form of progression or regression.

Echo data in repair group at discharge shows successful repair of moderate tricuspid regurgitation in form of regression of the degree of regurgitation in 10 % of patients to no regurgitation and 83.3 % of patients to mild regurgitation and only 6.7 % of patients fixed moderate regurgitation with no patients with severe regurgitation while in no repair group at discharge shows 100 % of patients fixed moderate regurgitation as preoperative echo findings, Echo data in repair group at 6 months follow up shows progression of the degree of regurgitation in 6.7 % of patients to no regurgitation and 83.3 % of patients to mild regurgitation and only 6.7 % of patients fixed moderate

regurgitation , 3.3 % of patients with severe regurgitation while in no repair group at 6 months follow up shows progression of the degree of regurgitation in 16.7 % of patients to sever regurgitation and only 50 % of patients fixed moderate regurgitation and regression in 33.3 % of patients with mild regurgitation , Echo data in repair group at 18 months follow up shows progression of the degree of regurgitation in 3.3 % of patients to no regurgitation and 83.3 % of patients to mild regurgitation and only 6.7 % of patients fixed moderate regurgitation , 6.7 % of patients with severe regurgitation while in no repair group at 18 months follow up shows progression of the degree of regurgitation in 30 % of patients to sever regurgitation and only 33.3 % of patients fixed moderate regurgitation , regression in 33.3 % of patients with mild regurgitation and 3.3 % of patients to no regurgitation. increase in the percentage of patients with moderate regurgitation or even progression to sever form from time of discharge 6.7 % to time of 18 months follow up 13.4 % reflect failure of repair and recurrence of moderate regurgitation or even progression to sever regurgitation also during the total duration of the study the percentage of patients need rehospitalization from C.H.F. and tricuspid valve reintervention are 16.6 % and 13.3 % respectively in no-repair group with no patients in repair group this findings agree with many studies ,Fawzy et al concluded that TV repair for moderate TR in patients performing rheumatic MV surgery at same time not linked with increased operative risk. Postoperative low cardiac output syndrome and late TV reinterventions and rehospitalization for CHF were lower with TV repair. So, it is beneficial for patients performing rheumatic MV





surgery<sup>9</sup>. Functional TR is often linked with MV disease, and, functional TR should improve after the correction of MV lesion this is the old concept that has largely been accepted by many surgeons. This has led to traditional non-surgical management of functional TR<sup>10</sup>, Kim et al demonstrate support the correction of mild-to-moderate functional TR at the time of MV surgery to keep TV function and improve results of surgery<sup>10</sup>, Song et al say that multiple clinical variables were independent risk factors for progression of late substantial TR. Early surgical intervention for TR in the patients with these risk factors may be acceptable, even though they have only mild TR<sup>10</sup>, Navia et al say A TV repair for moderate TR at the same time of surgery for degenerative left-sided heart valve disease is accepted to prevent its progression and development of right ventricle dysfunction, especially for patients with right ventricle remodeling and evidence of right ventricular failure, and for patients with advanced left-sided disease requiring mitral valve replacement<sup>10</sup>. while many studies support conservative management of functional moderate tricuspid regurgitation during mitral valve surgery and suggest regression of the degree of regurgitation after surgical correction of mitral valve pathology Sallam et al, more than 70% of patients show improvement in tricuspid regurgitation degree with less intra operative and post-operative complication and with less intraoperative mortality<sup>4</sup>, Yeates et al concluded that conservative management group of moderate TR Preoperative TR 2+, non-TVR group had more better functional class and mid-term survival in comparison to the TVR group as regard both quality of life and echocardiographic data this may be explained by the conservative group

has the higher levels of TR in this group allowed the RV to decompress compared with the TVR group<sup>11</sup>, Chan et al say In patients undergoing MVR, tricuspid repair is indicated when TR more than 2+ to relieve heart failure symptoms, but without substantially improving survival in this population. TR of 2+ or less may not require repair. Echocardiographic tricuspid annular dimensions alone, in the absence of significant ( $\leq$  1+) TR preoperatively, should not indicated for tricuspid repair<sup>12</sup>, this may be explained by the conservative group has the higher levels of tricuspid regurgitation in this group allowed the right ventricle to decompress compared with the TVR group. It is mandatory to carefully to evaluate tricuspid valve especially tricuspid annulus diameter in patients with MV disease. Mitral valve surgery or balloon valvotomy should be done before right ventricular dysfunction, severe tricuspid regurgitation, or advanced heart failure has happened. This is similar to the current approach of performing MV repair before the occurrence of left ventricular dysfunction or repairing an atrial septal defect before the right ventricular dysfunction has happened<sup>12</sup>, This is explain why there was a substantial difference in functional outcome between repair and without repair group. Both of these groups had tricuspid regurgitation 2+, with the majority of patients in each group classed as a moderate level of TR; however, this means that significant annular dilatation, right ventricular dilatation and dysfunction has happened now, and this injury is likely to be permanent<sup>13</sup>, Thus, patients who have progressed further along this pathway and exhibit more severe tricuspid regurgitation are more likely to have heart failure compared with patients with a lesser degree of







tricuspid regurgitation, Ro et al demonstrate Early or late clinical benefits of TV repair for mild-to-moderate TR at the same time of mitral valve surgery were not confirmed over a long-term follow-up of 959 patients. multiple preoperative issues and the Maze procedure for AF look as if to be more significant than TV repair in global clinical results<sup>14</sup>. Yilmaz and colleagues analyzed changes in the degree of functional TR in 699 patients who underwent MV repair for degenerative MV disease. Their data demonstrated that the progression of TR in patients undergoing MV repair is unusual, and that coexistent TR did not affect late mortality. The authors emphasized the significance of preoperative co morbidities in the determination of clinical outcomes rather than the presence of functional TR<sup>15</sup>. The factors known to result in the persistence or progression of TR are age, female gender, preoperative left ventricular and RV function, and atrial fibrillation. Atrial fibrillation has long been recognized as an important predictor of the development of TR. Enlarged left and right atria predispose to atrial fibrillation and, in turn, could influence the development of tricuspid incompetence<sup>16</sup>. As regard pathophysiology of the development of tricuspid regurgitation stage due to mitral valve disease either reversible or irreversible changes occurred in addition to presence or absence of factors that results in progression of tricuspid regurgitation may explain our study results in both groups in form of either progression or regression of moderate regurgitation after surgical correction of mitral valve pathology but we suggest that tricuspid repair with pericardial band in moderate functional tricuspid regurgitation during rheumatic mitral valve surgery is beneficial as

associated with less significant progression of tricuspid regurgitation after 6 and 18 month follow up echo in addition to significant reduction in rate of rehospitalization due to C.H.F. and rate of tricuspid valve reintervention in comparison to no-repair group

## CONCLUSION:

Tricuspid valve repair with pericardial band in moderate functional tricuspid regurgitation during rheumatic mitral valve surgery is recommended as associated with less statical significant progression of both of echo finding of the degree of tricuspid regurgitation and in form of less statical significant of rehospitalization due to C.H.F. and tricuspid valve reintervention in comparison to no-repair at midterm results.

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