

**A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION  
IN PATIENTS UNDERGOING MITRAL VALVE REPLACEMENT  
FOR RHEUMATIC MITRAL VALVE DISEASES**

*Dissertation submitted*

*in requisition of the partial fulfilment of*

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BRANCH I**

**CARDIO VASCULAR AND THORACIC SURGERY**

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GOVERNMENT GENERAL HOSPITAL  
CHENNAI – 600 003**



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**The Tamilnadu Dr. M.G.R. Medical University**



***“ learn to heal ”***

## CERTIFICATE

This is to certify that the dissertation entitled “**A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL VALVE DISEASES**” presented here is the original work done by **Dr. PRASANNA R.** in the department of Cardio Thoracic Surgery, Government General Hospital, Madras Medical college, Chennai 600003, in partial fulfilment of the University rules and regulations for the award of Branch-I *M.Ch Cardio Vascular and Thoracic Surgery* degree under our guidance and supervision during the academic period from 2009 - 2012.

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## **DECLARATION**

I, Dr. PRASANNA R. solemnly declare that this dissertation entitled, **“A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL VALVE DISEASES”** is a bonafide work done by me at the Department of Cardio Thoracic Surgery, Madras Medical College and Government General Hospital during the period 2009 – 2012 under the guidance and supervision of the Professor and Head of the Department of Cardio Thoracic Surgery of Madras Medical College and Government General Hospital, Prof. S.Manoharan M.S., M.Ch., This dissertation is submitted to The Tamil Nadu Dr. M.G.R Medical University, towards partial fulfilment of requirement for the award of M.Ch., Degree (Branch-I) in **Cardio Vascular & Thoracic Surgery**.

Place: Chennai

Date:

**Dr.PRASANNA R.**

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# **INTRODUCTION**



## INTRODUCTION

Rheumatic Heart disease has been one of the major health problems in developing countries like India. This is an autoimmune disease which occurs in the cardiac tissues due to streptococcal throat infection. Pancarditis and particularly vasculitis contributes the major complication following this disease. Mitral valve constitutes about 50% of the valve which gets affected due to rheumatic heart disease

The tricuspid valve is situated at the base of the heart. It separates right atrium from Right ventricle. It is defined as the Cinderella of cardiac valves.

The tricuspid Annulus shortens during systole when the tricuspid valve is competent. In left sided valve lesions (rheumatic heart diseases) right ventricular dilatation occurs in association with pulmonary hypertension, the tricuspid annulus also dilates and fails to shorten during systole. This Annular dilatation results in failure of leaflet coaptation resulting in tricuspid regurgitation.

Tricuspid regurgitation is mostly overlooked or missed in the presence of left sided valve lesion, mild tricuspid regurgitation may get corrected after correction of the left sided valve lesion but moderate and severe do not. My study is to highlight the importance of addressing tricuspid valve

concomitantly during mitral valve surgeries so as to improve the outcome and avoid right ventricular failure.

The concept of functional tricuspid regurgitation getting corrected after left sided valve pathology is corrected does not hold good for all cases of tricuspid regurgitation especially moderate and severe tricuspid regurgitation.

Tricuspid regurgitation if dealt with early even before right ventricular failure sets in has shown to give good results.so it is the early detection and management of tricuspid regurgitation on the surgeons part which improves the outcome.

About 200 cases of mitral valve replacement are done in Govt General Hospital Chennai in a year ,hence to improve the outcome and to alleviate the patient of symptoms of right ventricular failure and to avoid late tricuspid regurgitation after mitral valve replacement, it is best to address all cases of moderate /severe cases of functional tricuspid regurgitation secondary to left sided valve lesions concomitantly during mitral valve surgeries.

This prospective study is to study the management of tricuspid regurgitation in patients undergoing mitral valve replacement for rheumatic mitral valve diseases.

# **AIM OF THE STUDY**

## **AIM OF THE STUDY**

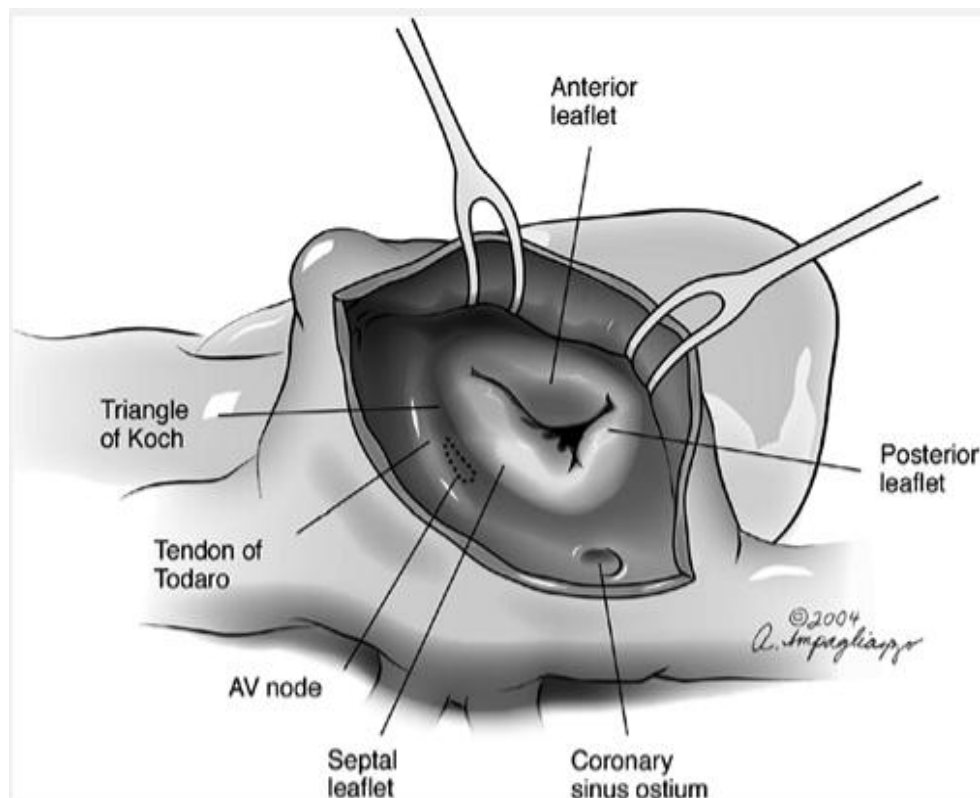
- ❖ To study the incidence of tricuspid regurgitation in rheumatic mitral valve diseases patients undergoing mitral valve replacement.
- ❖ To study the symptoms of tricuspid regurgitation.
- ❖ Evaluation of tricuspid regurgitation.
- ❖ Management of tricuspid regurgitation in patients undergoing mitral valve replacement for rheumatic mitral valve diseases.

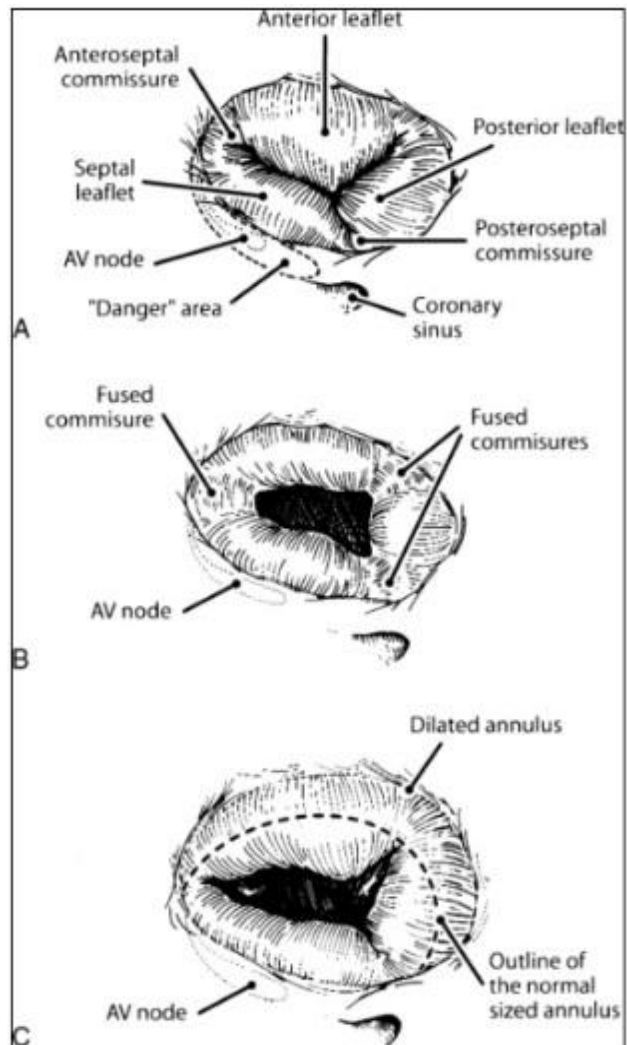
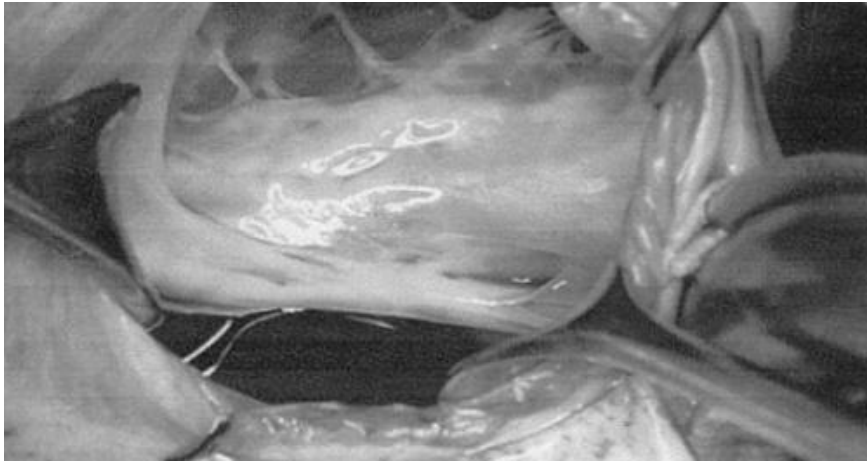
# **REVIEW OF LITERATURE**

# REVIEW OF LITERATURE

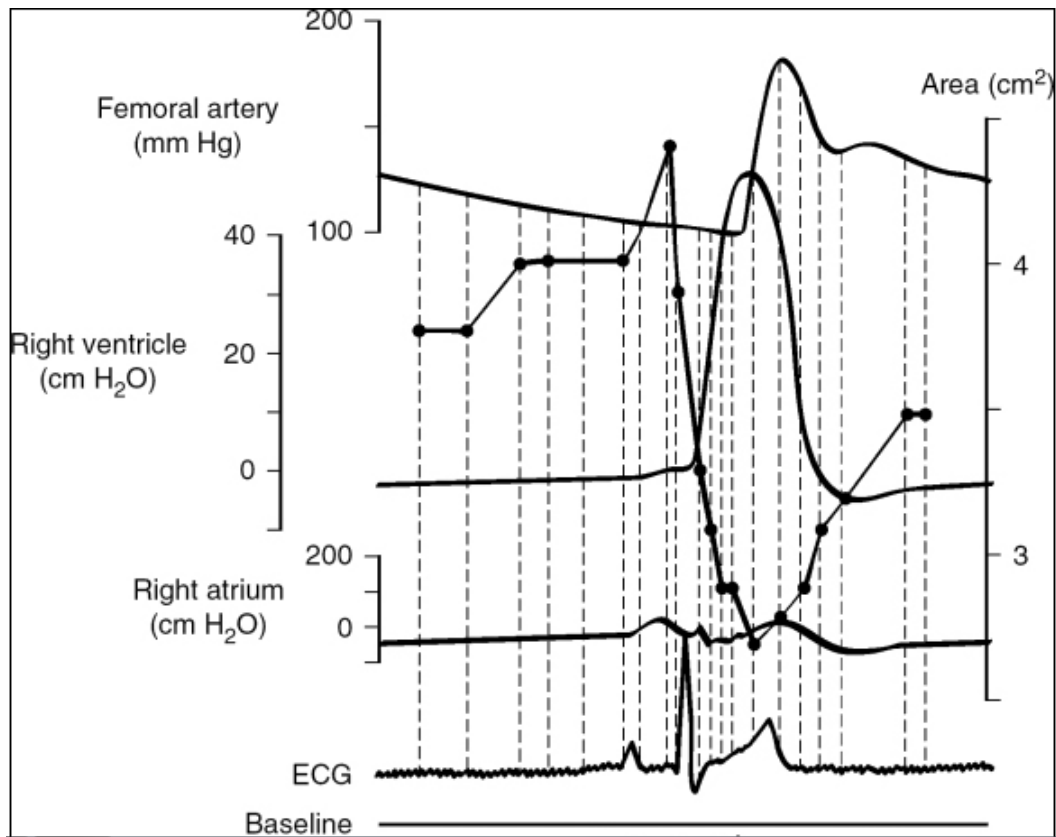
## ANATOMY

Tricuspid valve has 3 leaflets (1) Anterior (2) Posterior (3) Septal. The septal leaflet is attached to the base of interventricular septum. The tricuspid annulus is saddle shaped with its cantle to the mid point of the base of the posterior leaflet and its pommel corresponding to the area of the anteroseptal commissure. The absence of encircling fibrotic structure explains the large changes in tricuspid orifice during cardiac cycle and its early dilation in disease.





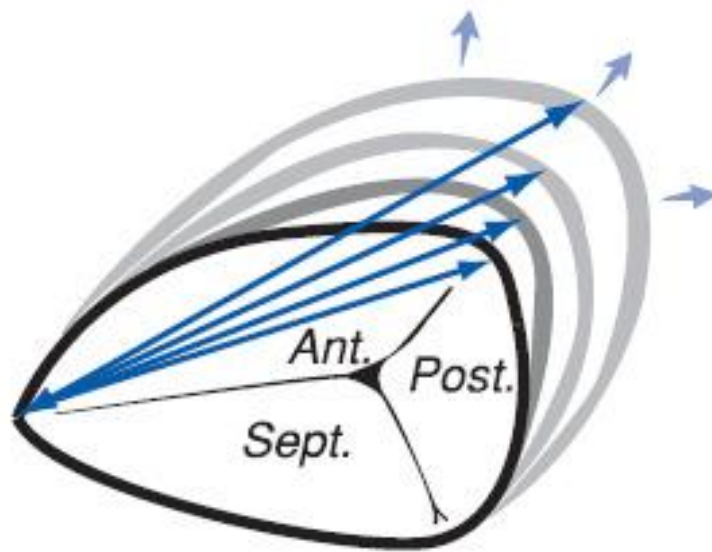
In a canine model Tsakins<sup>1</sup> and associates found that the size of this tricuspid orifice changed continuously during cardiac cycle.



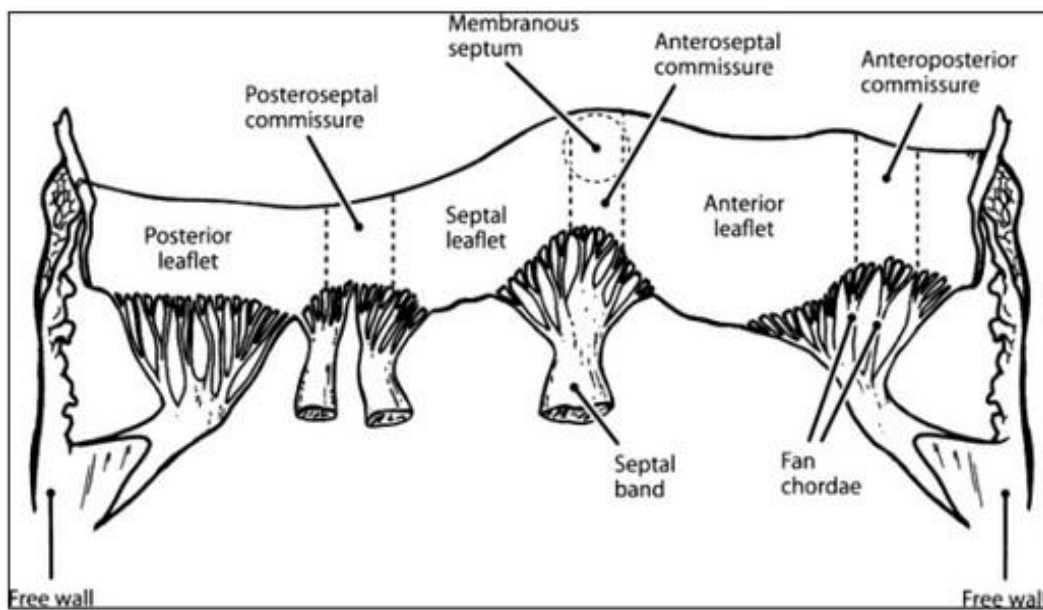
*Changes in tricuspid annulus area. Vertical lines indicate times of measurement. The area of the tricuspid annulus is reduced during atrial and ventricular contraction.*

The septal leaflet portion of the annulus does not lengthen much in this process because it is fixed between the right and left trigones and the atrial and ventricular septa. The remaining two thirds of the annulus lengthens greatly particularly that part giving origin to the posterior leaflet.





The anterior leaflet is largest followed by the posterior leaflet and the septal leaflet is the smallest.

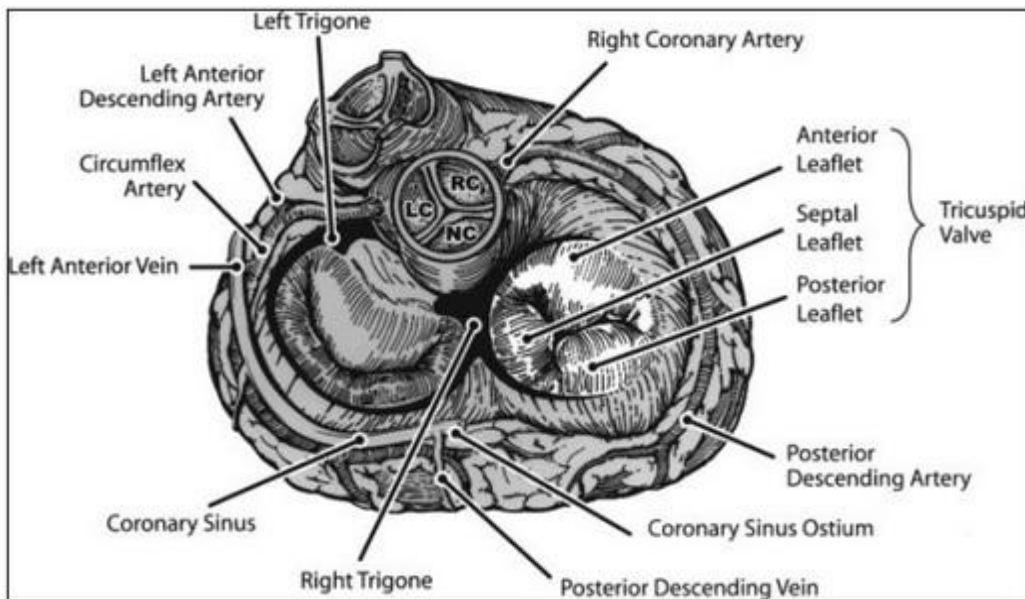
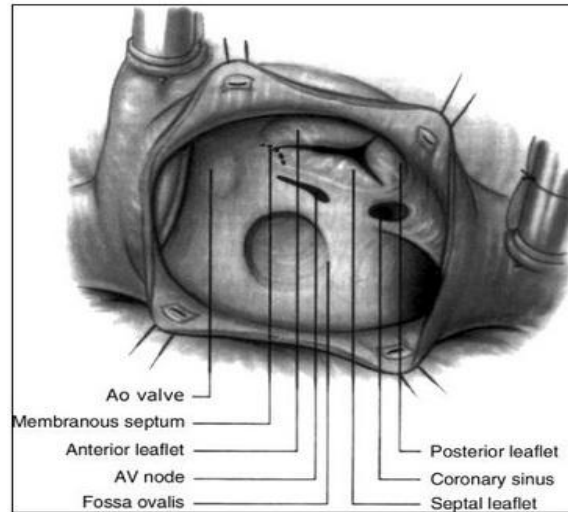


The leaflets are held down by the marginal and basal chords that arise from three papillary muscles.

The Anteroseptal commissure is very close to the non coronary sinus of the Aortic valve.

The Right coronary artery runs parallel to the segment of the annulus corresponding to the Right ventricular free wall.

The ostium of the coronary sinus is placed above the posterior septal commissure and is closely related to the bundle.



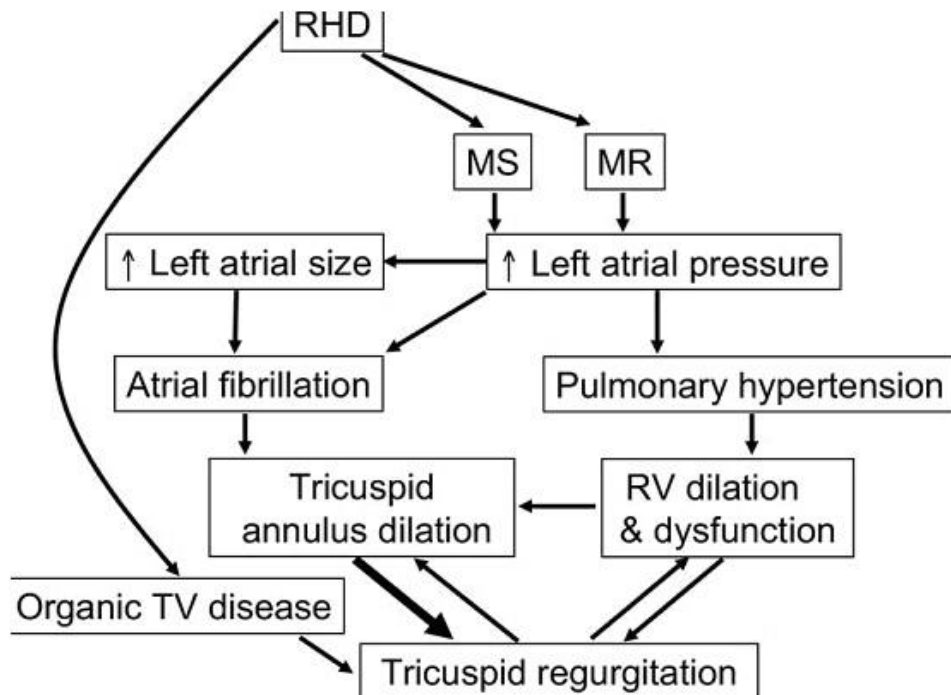
## **PATHOPHYSIOLOGY**

Tricuspid Regurgitation has been classified into

- (1) Organic TR
- (2) Functional TR.

In organic lesions the valve apparatus is macroscopically abnormal.

In Functional regurgitation there is only annular dilatation with normal leaflets and subvalvular apparatus.



In autopsy study of patients with pure regurgitation waller et al <sup>7</sup> reported 47% of all tricuspid regurgitation were functional.

The total perimeter of the normal annulus is approximately 100-120mm in case of functional TR the circumference can reach 150-170mm.

Clinically the most common cause of annular dilatation is right ventricular pressure overload secondary to rheumatic mitral valve disease.

Although surgery of left sided valve lesions can abolish functional TR it cannot resolve the right ventricular dysfunction.

In CCF the presence of TR indicates poor outcome<sup>2</sup>

## DIAGNOSIS

Very little clinical criteria exist to determine the presence and degree of tricuspid regurgitation. The absence of clinical signs does not exonerate the surgeon from suspecting and treating it.



**Chest X-Ray**

TR regresses spontaneously after correction on left sided valve lesion in some patients; other patients require re-operation only to repair a previously ignored tricuspid valve.

Tricuspid symptoms are mostly extracardiac, it is mostly silent, the patient only complains of asthenia.

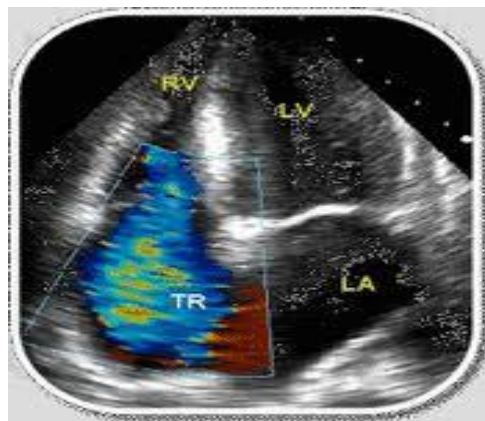


**ECG**

The digital exploration of tricuspid valve through right atrium and to decide upon the treatment based on regurgitation has been abandoned.

Right heart catheterization and ventriculography has been superseded by 2d colour Doppler echocardiography, as it is noninvasive and reliable.

In patients under general anaesthesia change on blood volume secondary to diuretic administration, vascular tone can reduce the degree of TR.

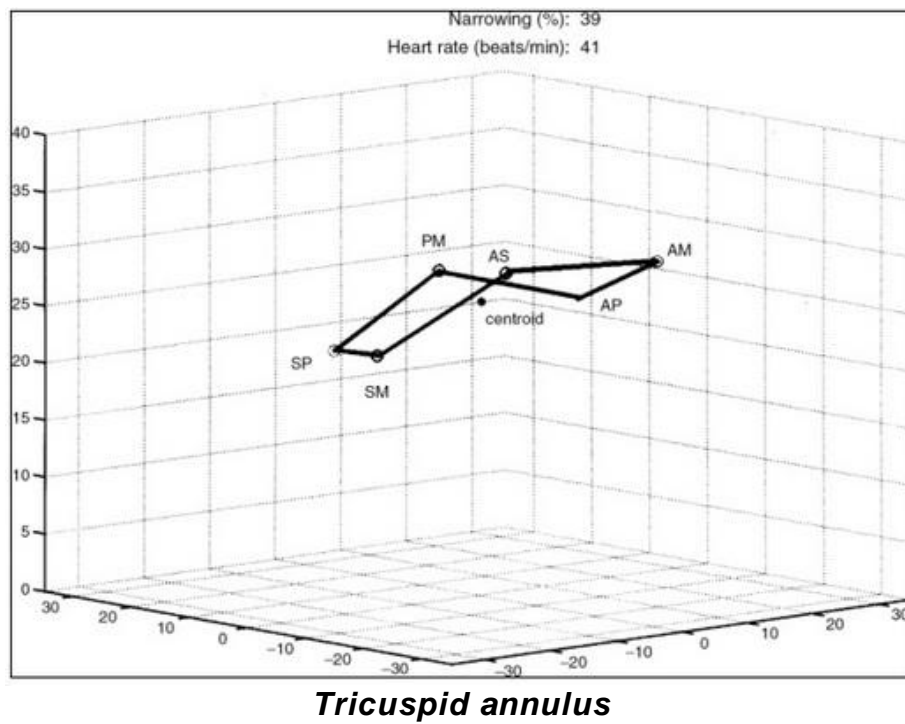


**Echo**

Contrast echocardiography is a very reliable method for detection of TR and the presence of PFO. It involves injecting saline with micro-bubbles in a peripheral vein while observing the presence of air-bubbles in right atrium during systole.<sup>3</sup>



Since the tricuspid annulus is not circular it is difficult to get an exact measurement of the diameter of tricuspid annulus. the tricuspid annulus is saddle shaped.



The regression of TR after repair or replacement of left sided valve lesion is unpredictable at best.

## **TR SEVERITY AS DETERMINED BY ECHO MEASUREMENT OF ANNULAR DIAMETER**

A correlation exists between tricuspid annulus diameter and TR severity. Normal tricuspid valve annulus diameter in adults is 28 mm ( $\pm 5$ mm) in the 4 chamber view. Significant tricuspid annular dilation is defined by a diastolic diameter of 21 mm/square meter of body surface area (35 mm). A systolic tricuspid diameter  $>3.2$  cm or a diastolic tricuspid annulus diameter  $>3.4$  cm are often markers of more significant TR.

## **VENA CONTRACTA WIDTH MEASUREMENT OF TR**

Severe TR is defined as vena contracta (the narrowest central flow region of a jet that occurs at, or just downstream to, the orifice of a regurgitant valve) width  $>0.7$ . In case of multiple jets, the respective values of the vena contracta width are not additive.

## **ECHO DOPPLER MEASUREMENT OF TR**

An effective regurgitant orifice area greater than or equal to 40 mm/square meter of body surface area or a regurgitant volume of greater than or equal to 45 ml indicates severe TR. Proximal isovelocity surface area (PISA) radius 1 to 4 mm (mild), 5 to 8 mm (moderate), greater than 9 mm (severe).. The PISA method may underestimate the severity of TR by 30% and is also less accurate in eccentric jets.

## DOPLER COLOUR FLOW JET MEASUREMENT OF TR

Colour flow imaging should only be used for diagnosing TR. The colour flow area of the regurgitant jet is not recommended to measure the severity of TR. A more quantitative approach is required when more than a small central TR jet is observed.

## INFERIOR VENA CAVA FLOW REVERSAL MEASUREMENT OF TR

The systolic hepatic flow reversal is specific for severe TR. It represents the strongest additional parameter for evaluating the severity of TR.

### *Echocardiographic and Doppler parameters used in grading tricuspid regurgitation severity*

Parameter	Mild	Moderate	Severe
Tricuspid valve	Usually normal	Normal or abnormal	Abnormal/Flail leaflet/Poor coaptation
RV/RA/IVC size	Normal	Normal or dilated	Usually dilated
Jet area-central jets (cm <sup>2</sup> )	< 5	5-10	> 10
VC width (cm)	Not defined	Not defined, but < 0.7	> 0.7
PISA radius (cm)	≤ 0.5	0.6-0.9	> 0.9
Jet density and contour–CW	Soft and parabolic	Dense, variable contour	Dense, triangular with early peaking
Hepatic vein flow	Systolic dominance	Systolic blunting	Systolic reversal

Severe lesions are usually treated but real or erroneously labeled lesions are missed. The problem often lies in the absence of a detailed pre-operative search for tricuspid disease.



Initially it was believed that TR can resolve after diseased mitral valve has been replaced, newer studies suggest that ignoring a diseased tricuspid valve at the time of surgery for left sided pathology will interfere with the eventual outcome of the patient.

**Incidence of TR in MV disease:** Tricuspid regurgitation is frequently present in patients with MV disease with long standing pulmonary hypertension.

Tricuspid regurgitation predicts poor outcome in all left sided valve surgeries.

Patients with preoperative TR should have thier TR repaired during left sided surgeries to prevent the progression of TR and avoid reoperations.

Groves et al.<sup>35</sup> have shown that patients TR following mitral valve replacement show decrease in oxygen consumption, exercise duration, and anaerobic threshold compared with patients without tricuspid regurgitation inspite of having good LV and prosthetic valve function.

Patients with TR have reduced exercise capacity and fall into NYHA class III or IV

The normal TA is saddle-shaped, extending superiorly in an anteroposterior orientation and inferiorly in a mediolateral orientation. With the development of functional TR, the tricuspid annulus becomes dilated and

more planar and circular <sup>43</sup>. Antunes and Barlow <sup>31</sup> proved that rheumatic process involving the tricuspid annulus weakens it.

The distance between the base of the septal and the base of the lateral TV leaflets is taken as the normal tricuspid annulus diameter by echocardiography in the 4- chamber view which is  $2.8 \pm 0.5$  cm <sup>41</sup>.

TR resolved in patients with chronic pulmonary hypertension because of thrombus in the pulmonary artery pulmonary after endarterectomy was done and in patients who had underwent balloon mitral valvotomy for mitral valve diseases, but tricuspid annulus remained the same This shows that TA dilation occurring as result of pulmonary hypertension did not reverse after pulmonary hypertension has settled and this explains the mechanism of late TR in mitral valve diseases.

Detailed history and physical signs are necessary to suggest significant TR.

- ❖ Deep y descent on CVP
- ❖ Systolic murmur in the tricuspid area
- ❖ Pulsatile liver
- ❖ Pedal edema
- ❖ Elevated jugular venous pressure
- ❖ Elevated liver function test
- ❖ 2D echo

Right-sided heart failure symptoms are peripheral edema, ascites, congestive liver and spleen, pulsatile liver and pleural effusions. Patients with TR have the presenting symptoms of reduced cardiac output which includes fatigue and weakness .

During inspiration, this finding is accentuated because of the physiologic increase in venous return, which is called carvalo sign. The cardiac auscultatory examination shows a third heart sound s3 which increases with inspiration and decrease with Valsalva manoeuvre, P2 is loud if pulmonary hypertension has developed, and a parasternal pansystolic murmur is present which increases with inspiration.

Impressive jugular venous distention with s wave or fused c and v waves followed by a prominent y descent, is present in jugular venous pressure.

In the late stages, these patients are cachexic, cyanosed, and jaundiced. Atrial fibrillation is common in these patients.

Cardiomegaly, right atrial and right ventricular hypertrophy, a prominent azygous vein, pleural effusion, and upward tenting of diaphragma owing to ascites are seen in chest x-ray.

The degree of regurgitation is assessed both preoperatively and intraoperatively by echocardiography, structural abnormalities of the valve, pulmonary artery pressures (PAPs), and right ventricular function can also be obtained by echocardiography.

The atrial septum is shifted to the left and paradoxical septal motion is present with right ventricular diastolic overload. Doppler and colourflow studies help to identify systolic right ventricular to right atrial jet with inferior vena cava and hepatic vein flow reversal.

Contrast enhanced echo which is obtained by injecting 5 ml of saline injection into the right ventricle producing microcavities in right atrium that are visible on echo, demonstrating to-and-fro motion across the valve orifice and reversal into the inferior vena cava and hepatic veins. ASD or patent foramen ovale should be ruled out.

Echo can also show endocarditic lesions and vegetations, the valve may be destroyed, and septic pulmonary embolus are a common feature. In Carcinoid syndrome the valve leaflets are thickened and retracted and are in semiopen position throughout the cardiac cycle.

Increased right atrial and right ventricular end-diastolic pressure are demonstrated by cardiac catheterisation. the jugular venous pressure tracing has an absent x descent, prominent v wave, and "ventricularization" of the right atrial tracing,

Left sided lesions leading to secondary TR show increased pulmonary artery pressures of over 60 mm Hg usually. (mitral and/or aortic) valve repair or replacement is performed on arrested heart with antegrade/retrograde cold cardioplegia, moderate systemic hypothermia by core cooling, and topical cold saline surface cooling.

Left atrium is opened through a left atrial incision posterior to the intra-atrial septum or through a transseptal incision. The transseptal incision is particularly useful when a prior aortic valve prosthesis is in place or in reoperations.

In a reoperative setting, the tricuspid valve is approached through a small right thoracotomy and has the advantage of avoiding adhesions and possible injury to the right ventricle during repeat sternotomy.

After the cross clamp is removed and the heart picks up in sinus rhythm, the tricuspid valve is addressed. During tricuspid valve suturing, misplacement of a suture adversely affecting the bundle should be assessed immediately and corrected.

The Cox-Maze technique or ablation of atrial tissue using an energy source like cryo can be added if atrial fibrillation is present.

Graves et al<sup>19</sup> reported persistence of TR in 38% of patients with isolated MVR. A widely cited report suggested that TR can resolve after diseased mitral valve has been replaced.

King and colleagues reported 65% of patients returning for tricuspid procedure late after mitral valve replacement, these patients had only mild TR at the time of initial operation.<sup>17</sup>

## **Management of TR in MV disease.**

Mild tricuspid regurgitation is managed conservatively with diuretics and aldosterone antagonist to bring down the fluid overload and to decrease hepatic and splanchnic congestion. liver function test has to be continuously monitored and followed.

Late TR in mitral valve diseases can lead to reoperations for tricuspid valve if moderate TR is ignored during mitral valve surgery.

Tricuspid valve is amenable to repair and hence considering the complications of prosthetic valve repair is better than valve replacement. There are different varieties of prosthetic valve available in the market.

Prosthetic valves need anticoagulation where as bioprosthetic valves do not need anticoagulation but they tend to degenerate with time.

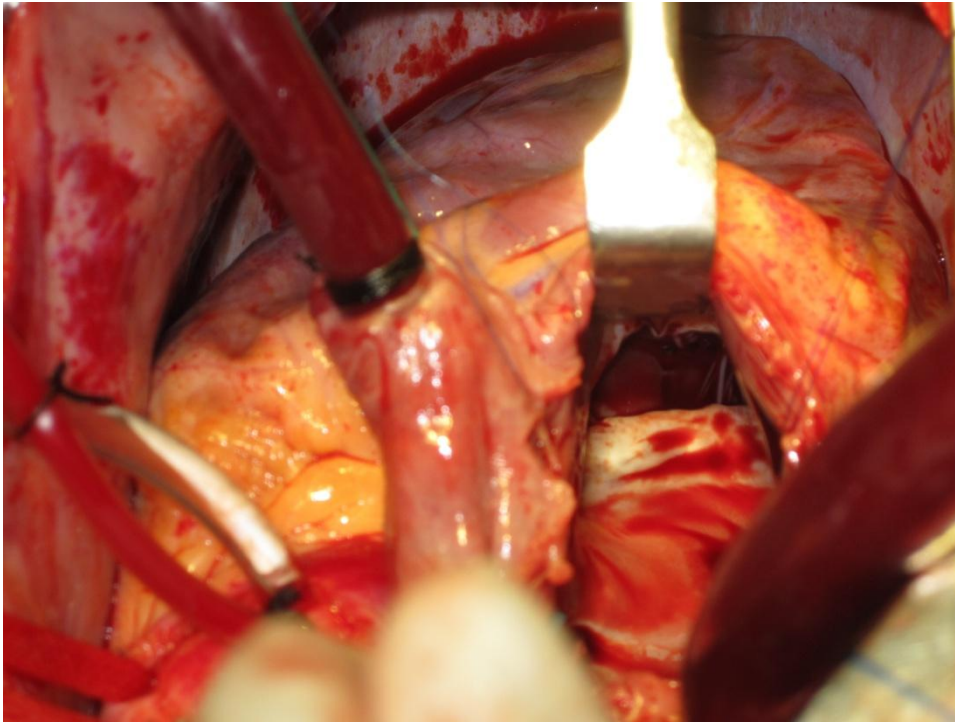
Tang et al showed in their study tricuspid valve repair with an annuloplasty ring resulted in significant improvement and long-term survival a free of recurrent TR compared with De Vega suture annuloplasty.<sup>47</sup> In severe organic TR Tricuspid valve is not repairable and hence it as to be replaced.

modified De Vega repair with pledgeted sutures in patients with functional tricuspid regurgitation has had good results in the hands of experienced surgeons.

McCarthy et al.<sup>48</sup> assessed the durability of TV repair which showed ring annuloplasty repair was better than De Vega repair.

Dreyfus et al.<sup>27</sup> showed the utility of TV ring annuloplasty during MV surgery and the importance of tricuspid annulus/diameter as a criterion for TV repair. They studied patients undergoing MV repair (65% degenerative and only 14% rheumatic MV disease). The TV annulus diameter was measured intraoperatively with a scale from the anteroposterior commissure to the anteroseptal commissure. They used Carpentier-Edwards ring for all cases of tricuspid regurgitation with dilated annulus was 7 cm in diameter (equivalent to 4 cm by echocardiography).

These results show that the tricuspid annulus diameter limit for repair should have been set lower, somewhere between 3.0 and 4.0 cm. It is best to set the normal TA at 3.0 cm. a limit of 2.1 cm/m<sup>2</sup> (equivalent to 3.6 cm for an average person) as suggested by Groves et al.<sup>19</sup>. They relied on a study by Chopra et al, who found this diameter to best differentiate severe from nonsevere TR. The threshold should be lower with increasing degrees of TR and in rheumatic patients.



**Tricuspid annular dilatation**

Prospective, randomized trials are needed to get a better idea of this cutoff point. On the basis of the available information and personal experience, it is believed that prophylactic tricuspid valve repair should be performed in patients undergoing MVR regardless of TR severity whenever the TV annulus is  $>3.5$  cm, especially in rheumatic TR.

Early on, when patients presented only with few symptoms, the high-risk of surgery was not taken seriously. Later, when symptoms demand surgery, RV dysfunction has already set in and is irreversible.

Treatment of patients who develop late isolated TR after MVR is difficult and mainly conservative for mild tricuspid regurgitation. Antifailure therapy with loop diuretic drugs and aldosterone antagonist are the mainstay of therapy and might delay TR progression. In some patients in whom surgery



is not an option, chronic dialysis is useful, in treating volume overload and improving quality of life. Right ventricular function is very difficult to estimate by echocardiography.

Tissue Doppler imaging is useful in identifying patients with preserved RV function (tricuspid systolic annular velocity  $\geq 9.5$  cm/s). Right ventricular function is assessed by newer techniques such as 3-dimensional echocardiography and Doppler study such as the RV myocardial performance index (MPI) and isovolumic acceleration index (IVA), magnetic resonance imaging might prove useful in the future and might help to find the ideal timing of surgery so as to avoid RV dysfunction which can be irreversible.

Kay et al showed satisfactory results after bicuspidization.<sup>18</sup> Barratt and boyes in chapter 11 suggest that TR progresses if the primary left sided valve disease progresses. Carpentier et al found no TR postoperatively in 68% of patients with preoperative moderate to severe TR after concomitant tricuspid valve surgery.<sup>19</sup>



**CarpentierRing**

Reoperation after carpentier ring annuloplasty is not necessary as proved by a 3 year follow up. Nikano et al reported after suture annuloplasty 94% patients were free of reoperation 10 years later.<sup>20</sup>

Goldman et al injected 5ml of dns or saline into right ventricle to generate echogenic contrast. TR was quantified for a scale of 0-4+ based on eyeballing.

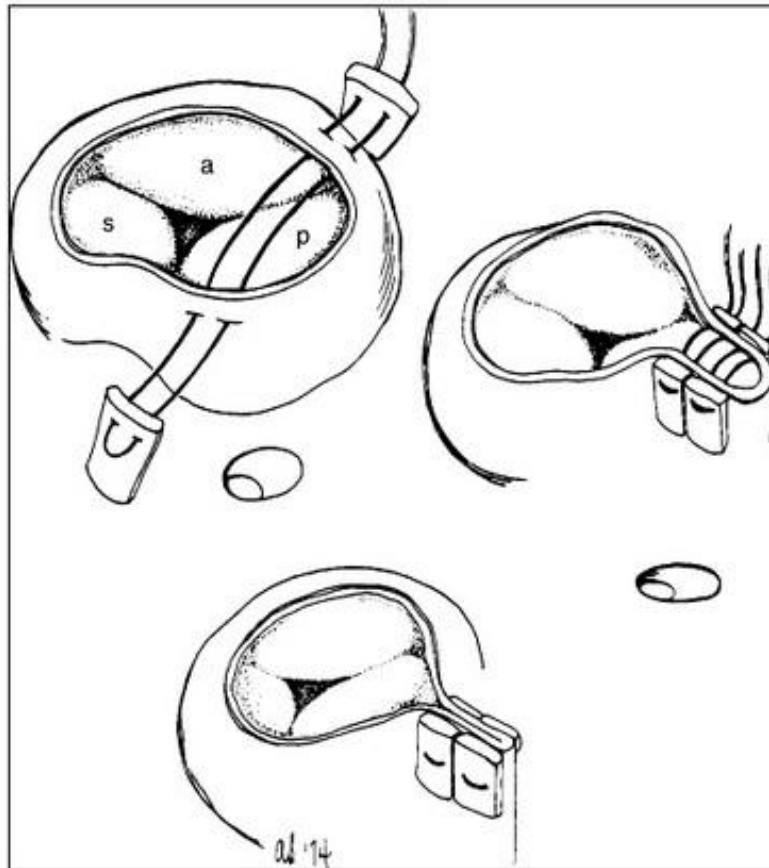
Carlos M.G.Duran et al have suggested  $27\text{mm/m}^2$  as the critical diameter above which functional TR always appeared. Goldman et al have suggested 30mm as the cut off point between absent/mild TR and moderate /severe TR.



Cosgrove annuloplasty

First closed tricuspid commissurotomy was done in 1952 by Charles bailey<sup>6</sup>. Wooler et al<sup>99</sup>/kay et al<sup>7</sup> did the earliest of annuloplasties at the level of the base of posterior leaflet. Extendedtransatrialseptal incision was described by guiraudon et al.<sup>5</sup>

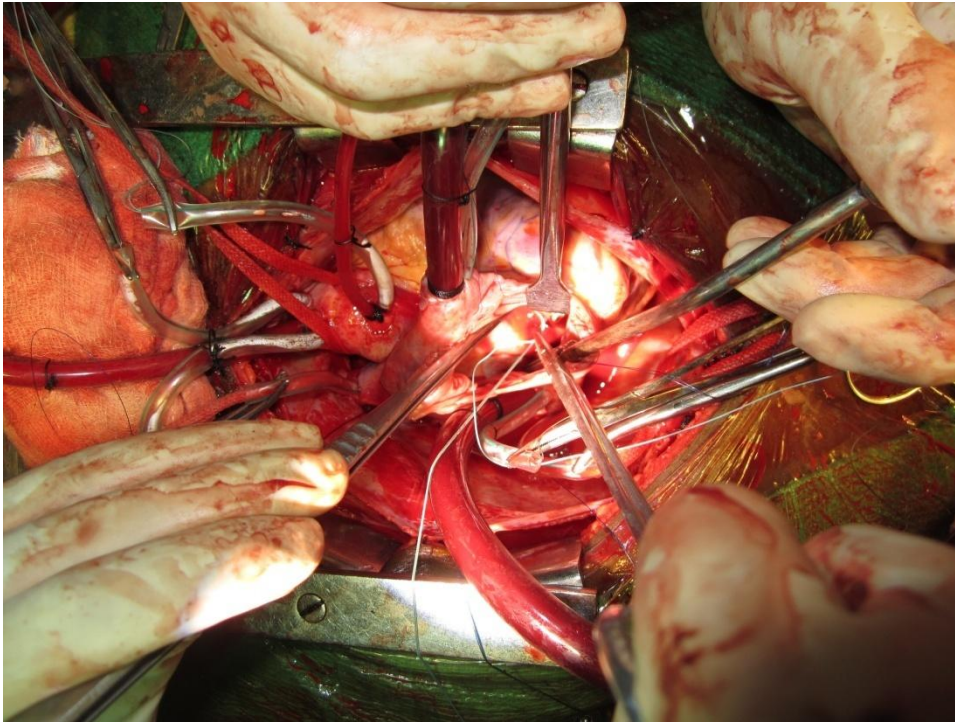
Cabrol<sup>12</sup> and devega<sup>22</sup> independently described encircling suture to narrow annulus running along the base of anterior and posterior leaflets anchored in anteroseptal and posteroseptalcommissures.



***Kay's Procedure***

Kay annuloplasty basically involves plication of the annulus in the region of the posterior leaflet . This narrows the annulus and basically obliterates the posterior leaflet of the tricuspid valve

The Devega annuloplasty is a tricuspid repair in which two limbs of a pledgetted stitch are brought around the annulus of the septal and anterior leaflet. The stitch is tightened such that only two gloved fingers may be passed through the tricuspid orifice. The conduction tissue adjacent to the septal annulus is totally avoided.



#### DEVEGA REPAIR

Certainly patients undergoing second mitral valve operations with associated 2+ or greater tricuspid TR, patients with long-standing left atrial hypertension, typically rheumatic patients with 2+ or greater TR, and anyone likely to have persistent pulmonary hypertension and 2+ or greater TR should be strongly considered for concomitant tricuspid repair as part of their planned cardiac procedure.

Tricuspid valve repair in carefully selected patients may improve forward flow and improve the marked venous congestion that these patients suffer.

In the rare patient with isolated tricuspid insufficiency, surgical correction is warranted when symptoms are refractory to maximal medical

therapy. Often these patients will have difficult-to-treat congestive heart failure with significant peripheral edema and clinically significant passive congestion of the liver. Intensified diuretic administration often results in rise in blood urea nitrogen (BUN) and creatinine rather than improvement in the patient's clinical status.

In considering repair of the tricuspid valve, the DeVegaannuloplasty technique is used not frequently. This technique would be considered in cases that tricuspid regurgitation is secondary to a left-sided process and the amount of tricuspid regurgitation is 2+ or less by echocardiography with colour flow Doppler.

For the DeVegaannuloplasty , 3-0 Prolene double-arm pledgeted sutures are used. The inner suture line is begun approximately 3 mm off of the tricuspid annulus. The bites are approximately 3 mm in depth and 5 mm in length, skipping 5 mm between bites. This inner suture line proceeds in a clockwise fashion around the annulus to the posteroseptal commissure. The outer suture line is 3 mm outside the first and is placed in a similar fashion, in a clockwise direction to the posteroseptal commissure. A second Teflon pledget is passed onto the free ends of the suture. The suture is tightened down over a tricuspid ring sizer. A No. 29 sizer is generally adequate.

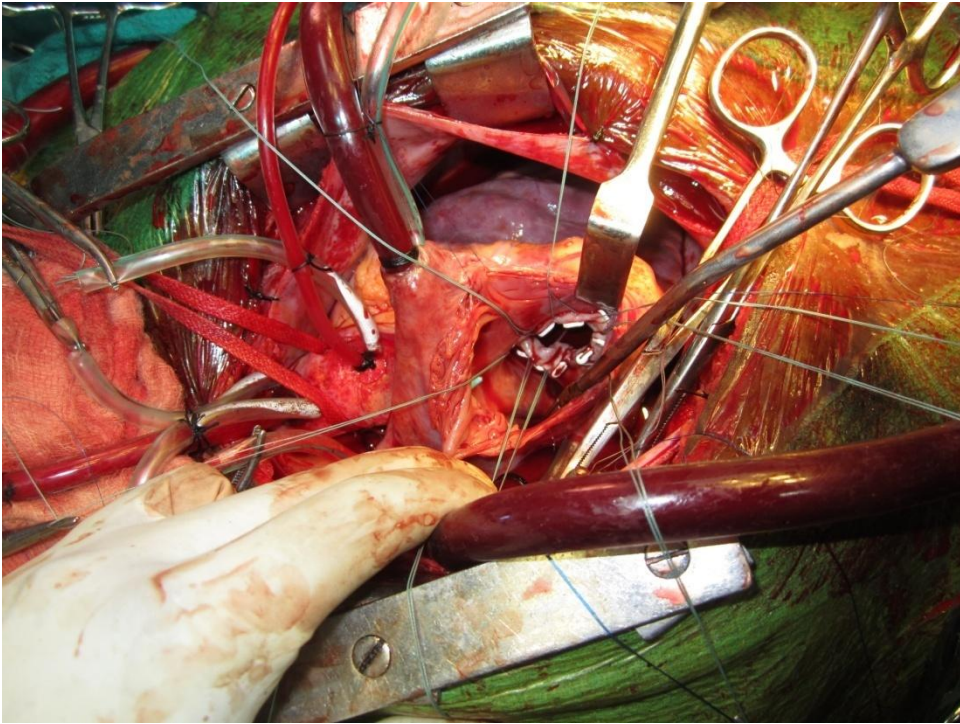
The overwhelming majority of tricuspid valves are repaired. The basic techniques for repair include bicuspidization, annular plication and various types of annuloplasty, i.e., ring annuloplasty, linear reduction annuloplasty, and so-called suture annuloplasty. The most common repair is likely the

DeVega suture annuloplasty in which a continuous monofilament prolene suture is run from the base of the junction of the septal leaflet, pledged on each end circumferentially, and the annulus is reduced. The ring-type annuloplasty places a ring structure into the non-septal portion of the tricuspid valve annulus. Another technique is called a multi-pledget technique, which was very much like the DeVega technique except instead of a single set of pledgets at either end, the same suture was ran through multiple pledgets to keep it from cutting though the fragile annular tissue.

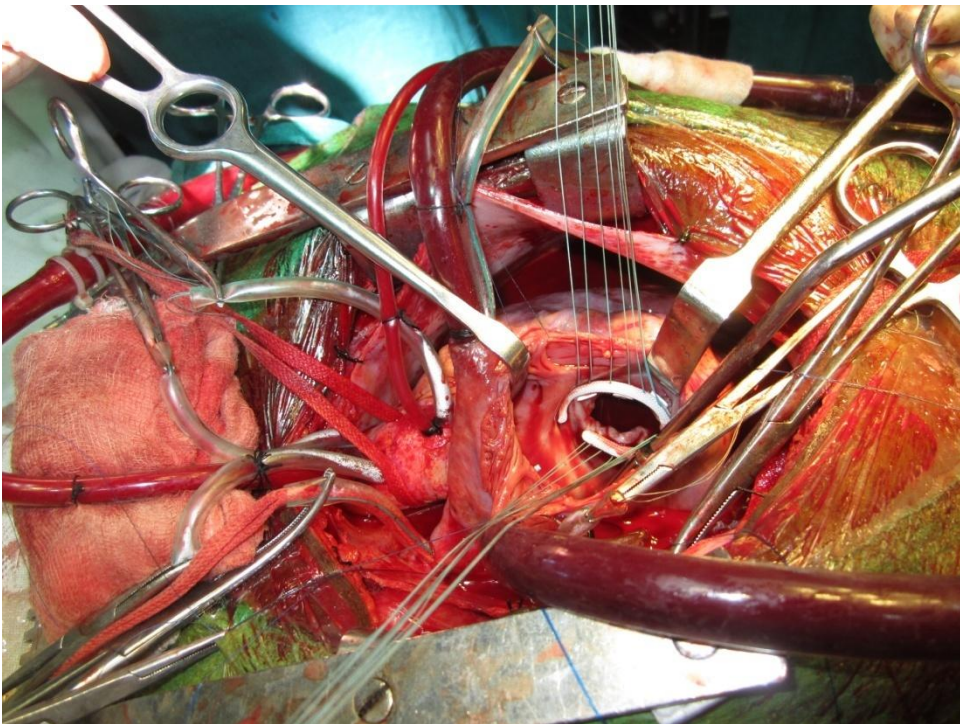
In isolated tricuspid regurgitation and for more severe forms of regurgitation with annular dilation in the presence of structurally normal leaflets, tricuspid ring annuloplasty is performed. Carpentier-Edwards tricuspid annuloplasty ring is used, which is an incomplete ring leaving a gap in the area of septal annulus adjacent to the conduction system. Sizing of the annuloplasty ring is done by measuring the intercommissural distance (anterior leaflet length). This can be done most accurately by distracting the chordae of the anterior leaflet adjacent to the commissures while using the ring sizers. Typically a No. 33 ring will be used for male patients and a No. 31 ring will be used for female patients.

Horizontal mattress sutures consisting of 2-0 ethibond with pledgets are used. No preset number of sutures is used for every case; rather a number suited to each particular patient is used. Typically there will be 3 mm to 4 mm between each suture in the annulus and 1 mm to 2 mm of space between each suture as it is placed through the annuloplasty ring. This will ensure even distribution of the annular plication around the circumference of

the annuloplasty band. Each stitch enters the atrial tissue just outside the annulus and exits within the annulus . The suture is then placed through the inside of the ring to get the ring to sit in a directly annular position. The ring is lowered down to its annular position, and the sutures are tied and cut .

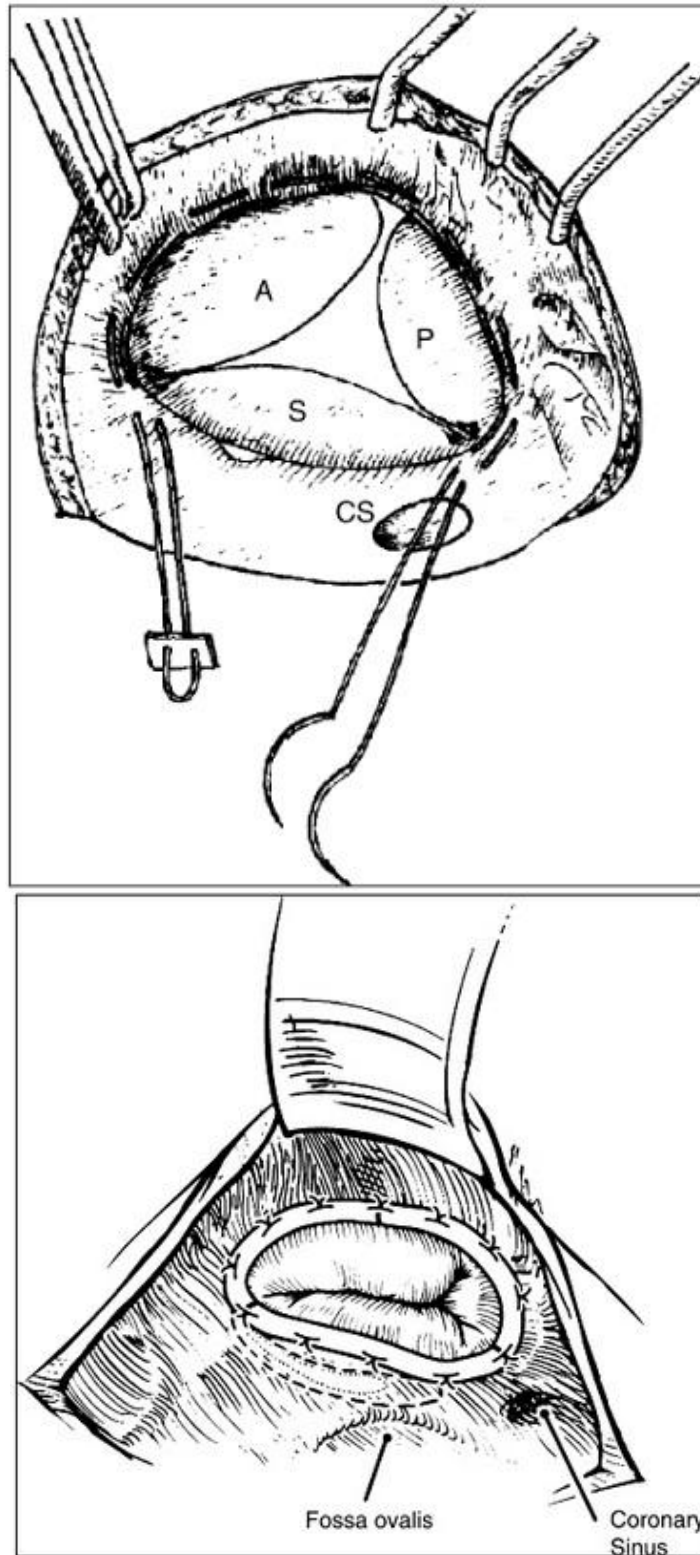


Carpentier ringannuloplasty





***Carpenter rigid prosthetic ring open at anteroseptal commissure to avoid the conducting system.<sup>13</sup>***



Kaplan et al advocated bileaflet prosthesis.<sup>52</sup> Matsuyama et al reported significant TR on echo postoperatively in patients who underwent MVR with

grade 2+TR. Tricuspid annuloplasty with a ring should be performed at the time of initial mitral valve surgery. Tricuspid annulus diameter is the best criteria for performing annuloplasty.

<sup>31</sup>Antunes and Barlow suggested that rheumatic disease directly involves the tricuspid annulus and weakens the annulus and causes it to dilate.

Sugimoto et al showed a good correlation between tricuspid diameter and tricuspid regurgitant volume.

Patients who have concomitant successful maze procedure during their MVR were reported to have less TR, which has been proved by Kim HK, Kim YJ in impact of maze operation with Left valve surgery.

<sup>25</sup>Tricuspid valve repair with annuloplasty ring resulted in long term survival free of recurrent TR in a study by Tang et al.

<sup>28</sup>Chopra et al found that diameter was best to differentiate severe from non severe TR.

Preoperative and intraoperative echocardiograms are valuable assessment tools to help the surgeon understand the structure and function of the valve.

The old technique of keeping a finger into the right atrium by taking a purse string in the right atrium to palpate the tricuspid valve and keeping the

fingertip 2 to 3 cm from the valve orifice to access the force of the regurgitant jet is not important now.

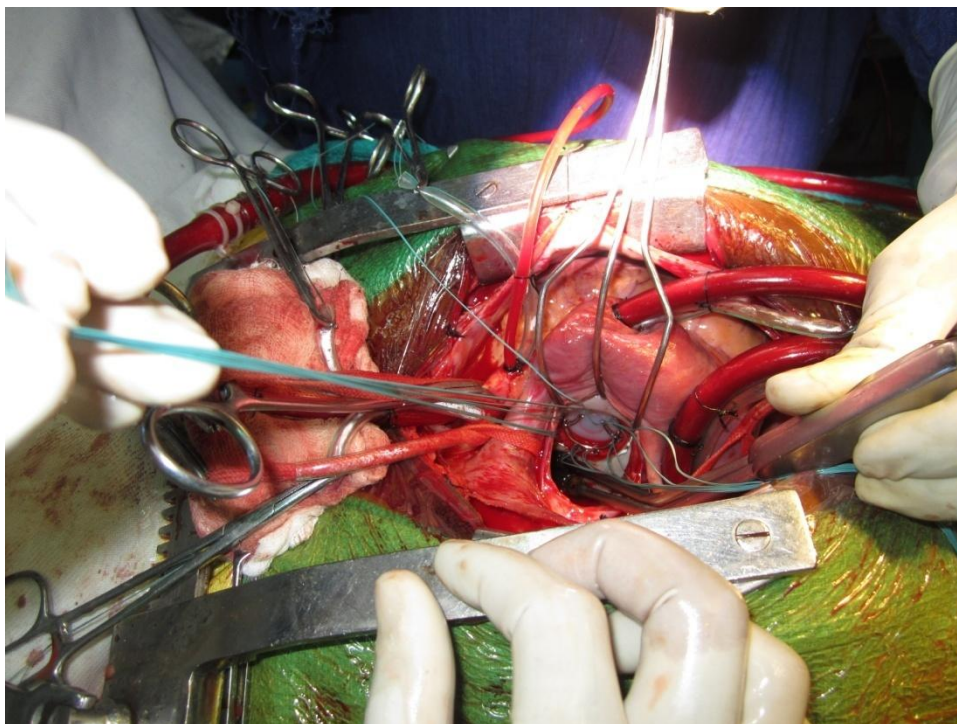
The tricuspid annulus is a component of both the tricuspid valve and the right ventricle. the tricuspid valve leaks if the tricuspid annulus and the right ventricle are dilated. There is a very low probability for TR If the tricuspid annulus and the right ventricle are not dilated, tricuspid annulus dilates in the anterior and posterior directions and corresponds to the free wall of the right ventricle.

The grade of pulmonary hypertension, right ventricular dilatation, and systolic function, coupled with the size of the right atrium, must be taken into account for decision making. The intra operative transesophageal echocardiogram (TEE) shows the surgeon the tricuspid regurgitation and reversal of flow in the inferior cava. Good TEE assessment after the repair is necessary in completing a good and satisfactory repair.

It is important to understand these important fundamental facts for current practice regarding the management of functional TR, which focuses on assessment of the severity of TR and advocates treatment of tricuspid regurgitation along with the primary one (i.e., mitral valve replacement). Treatment of the mitral valve lesion alone only decreases the afterload. It neither brings down the preload nor correct tricuspid dilatation, nor does it improve right ventricular function. Once the tricuspid annulus is dilated, it does not return to normal spontaneously, and it may in fact, continue to

progress further. This explains why some patients come for a second operation for TR years after the initial mitral valve surgery.

The degree of TR is also directly related to three important factors. In addition to the preload, the afterload, tricuspid dilatation, and right ventricular function. TR is difficult to assess accurately as these three factors can interfere with the severity of TR under different conditions and are variable. Significant TR may not be detected echocardiographically despite considerable annular dilatation in the tricuspid valve in these situations.



MITRAL VALVE REPLACEMENT

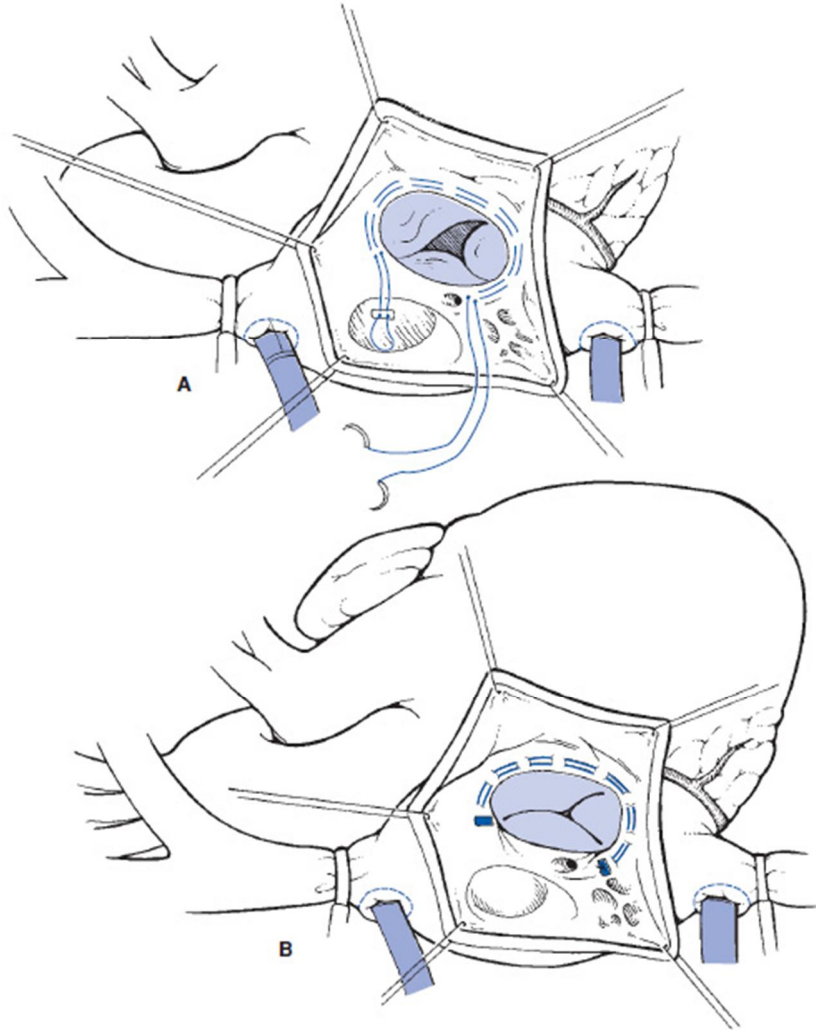
## **DEVEGA TECHNIQUE**

A 3-0 prolene/2-0 prolene suture is started at the junction of the annulus and right ventricular wall and is continued from the anteroseptal commissure to the posteroseptal commissure. The other arm of the suture is placed through a pledget and is run parallel and close to the first suture line in the same clockwise direction, placing it through a second pledget at the posteroseptal commissure.

A purse-string effect is produced on tightening the suture and reduces the length of the anterior and posterior annulus to provide adequate leaflet coaptation and orifice flow . The DeVega technique is also employed for mild to moderate annular dilatation.

The annuloplasty provides a competent tricuspid valve during the early post operative course, while the remodeling of the heart after surgical treatment of the left-sided valvular lesions takes some time

## DEVEGA REPAIR

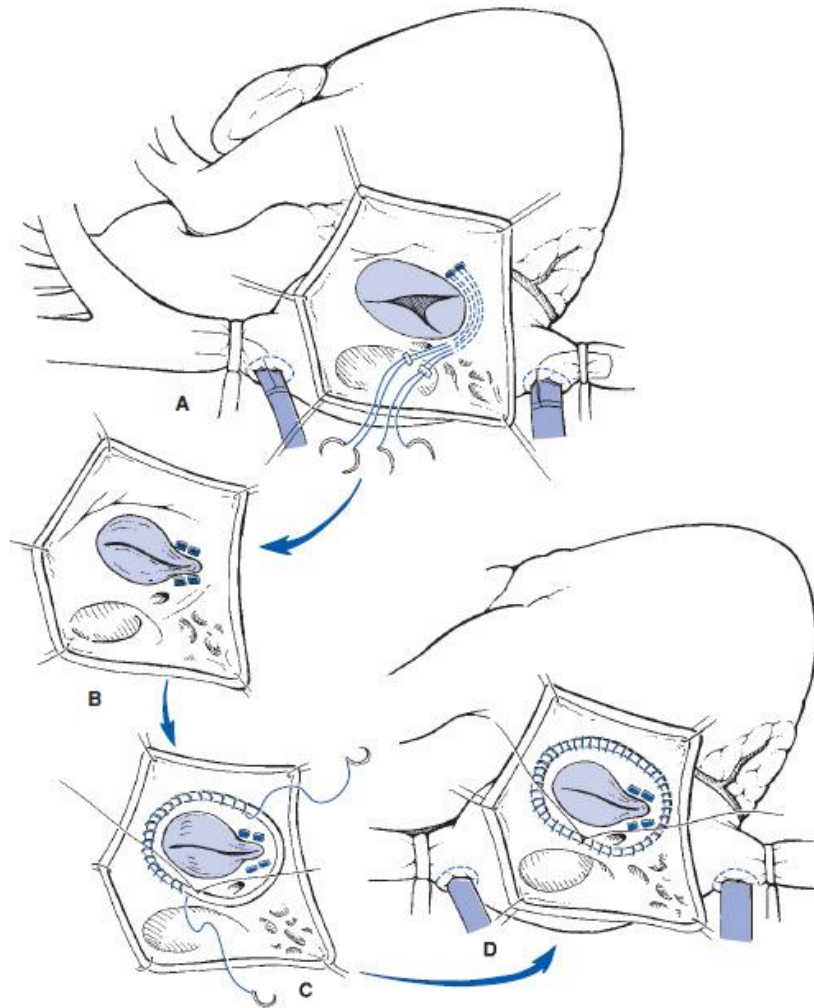


## **BICUSPIDIZATION**

The SVC and IVC are snared the right atrium is opened by an oblique incision. Good exposure of the tricuspid valve is a basic requirement for tricuspid repair.

The pledgeted mattress sutures are taken from the center of the posterior leaflet to the commissure between the septal and posterior leaflets. A second suture should be done to further reduce the annulus, ensuring good leaflet coaptation while providing adequate orifice for flow. An annuloplasty ring need to be inserted after the repair to further support the annular reduction if needed.

## BICUSPIDIZATION



## RINGS AND BANDS

There are various types of rings ,rigid rings and flexible rings

Carpentier- Edwards and MC3

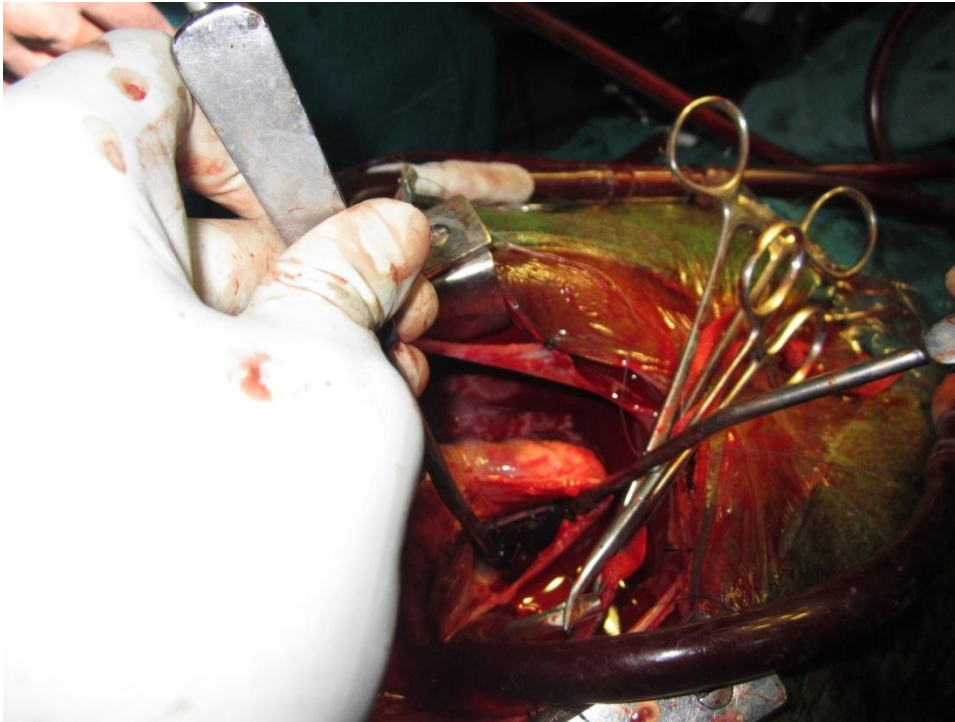
flexible rings (e.g., Duran)

flexiblebands (e.g., Cosgrove annuloplasty system).

The intertrigonal distance or the length of the base of the septal leaflet is taken to determine the size of the ring or band. These devices avoid suture placement in the region of the atrioventricular (AV) node (apex of the triangle



of Koch) to avoid injury to the bundle. The mattress sutures are placed in a circular fashion, taking widely on the annulus and small corresponding bites through the skirt of the ring or band, which produces annular coaptation along the length of the posterior leaflet. This allows the tricuspid valve orifice to be occluded by the leaflet tissue of the anterior and septal leaflets.

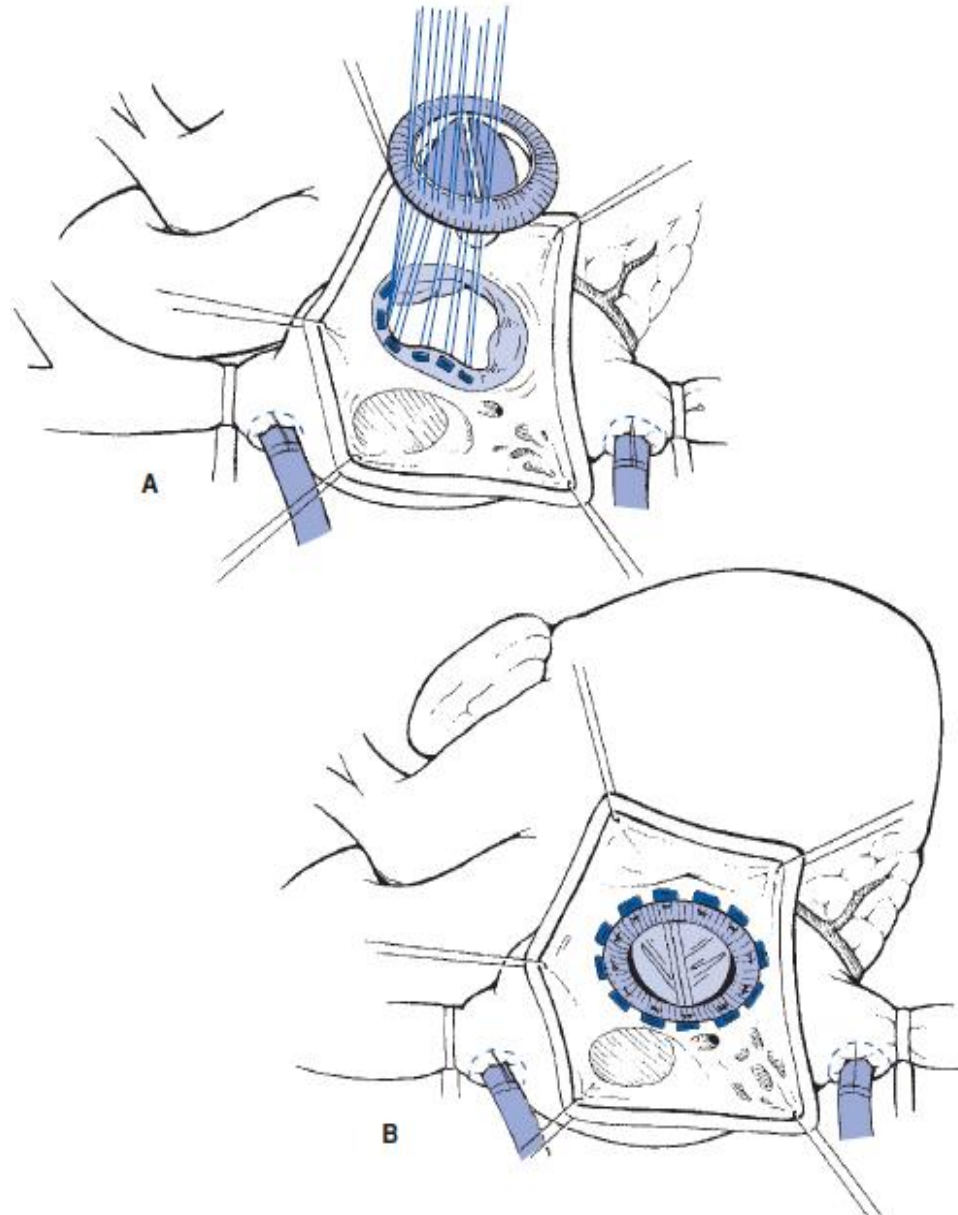


CARPENTIER RING ANNULOPLASTY

## CARPENTIER RING ANNULOPLASTY



## TRICUSPID VALVE REPLACEMENT



The prosthetic tricuspid valve is fixed with pledgetted mattress sutures using an horizontal everting sutures either a supra-annular or an intra-annular technique for prosthetic valves. The tricuspid valve leaflets are left undisturbed, preserving the subvalvular structures and avoiding injury to the bundle. If there is concern that the anterior leaflet could fold and thereby

obstructing the right ventricular outflow tract, only the central portion of the leaflet can be excised preserving the subvalvular apparatus.



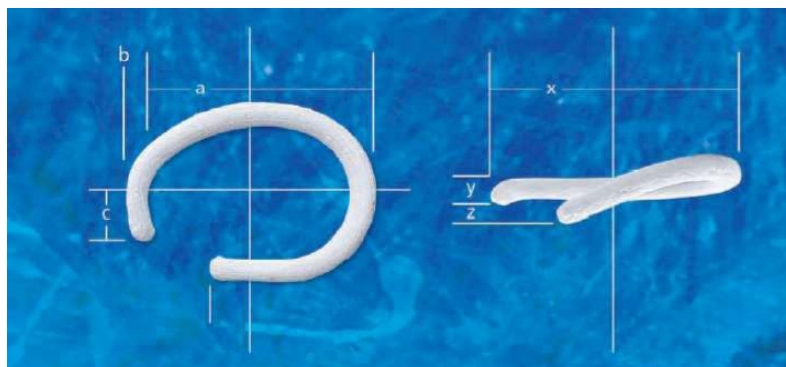
A mitral homograft can be used to replace tricuspid valve. The homograft tissue is usually a mitral valve. The intratrigoal distance is measured. The papillary muscles are fixed through the wall of the right ventricle. The chordal length needs to be adjusted. The annulus is sutured with a 3-0 prolene. A ring annuloplasty is done to prevent dilatation and to ensure adequate leaflet coaptation. Care is taken to avoid the bundle.

### **MC3 TRICUSPID VALVE ANNULOPLASTY**

A new tricuspid valve (TV) annuloplasty system, the MC3 ring, is a three-dimensional structure designed to remodel the TV annulus and preserve physiologic annular function.



The MC3 TV annuloplasty ring is the first TV annuloplasty ring anatomically designed to conform to the three-dimensional shape of the normal TV and minimize stress on sutures. Progressive flexibility is created from the unique processing of the titanium band. The Edwards MC3 annuloplasty ring is covered with material that favours host tissue ingrowth



In endocarditis a stentless porcine valve or equine valve is used in which the commissural posts were anchored to the right ventricular septal, anterior, and posterior walls. Orientation is important so that the right ventricular outflow tract is straddled by two of the commissural posts and does not obstruct it.

Carpentier techniques for MVR can be applied to the organic tricuspid valve. Leaflet tears due to trauma, healed granulomas and perforations due

to endocarditis, or the rare myxomatous valve can be repaired. Pericardial patch closure of perforations, limited resections including triangular and quadrangular resections of the anterior (limited) or posterior (extensive) leaflets, and ring annuloplasty are routinely done techniques to produce competent valves and avoid replacement.

TV annulus should be assessed in all mitral valve surgeries and annuloplasty should be considered. Aggressive repair of accompanying TR should be taken at the time of MVR with large atrium or AF even if pre operative TR is 2+.

McCarthy et al has studied the durability of tricuspid valve repair. Study by Dreyfus et al gives the best evidence for the utility of TV ring annuloplasty during MV surgery and the importance of TA diameter as a criterion for TV repair.

On the basis of the available information, Prophylactic TV repair should be performed in patients undergoing MVR regardless of the grade of TR if the TV annulus is >3.5 cm, especially in rheumatic patients.

TV assessment, including measurement of the TA diameter, is mandatory in patients with MV disease. It is better to do Mitral valve surgery or balloon valvotomy before RV dysfunction and severe TR sets in.

A TV ring annuloplasty is the best procedure to correct or prevent TR in most cases. It improves the outcome, prevents late TR and heart failure, and therefore should be performed at the time of the initial mitral valve

surgery. The TA diameter is the best guide to select patients for TV repair, and the echocardiographic limit should be 3.5 cm regardless of TR severity and can be lower for rheumatic patients. old Patients with significant TR who have longstanding MV disease, and those who are in AF, long standing nonsevere pulmonary hypertension, large left atrium and organic TV disease will benefit more from MV surgery with TV repair/replacement.

# **PATIENTS AND METHODS**



## **PATIENTS AND METHODS**

This prospective study was undertaken as an observational evaluation of Management of tricuspid regurgitation in patients undergoing mitral valve replacement for rheumatic mitral valve diseases among the newly registered patients undergoing mitral valve replacement in Department of Cardio Thoracic Surgery at Government General Hospital, Chennai, using a descriptive method of analysis over a period of 30 months from August 2009 to February 2012.

### **INCLUSION CRITERIA**

Patients undergoing mitral valve replacement for rheumatic mitral valve diseases

Age group 20-40years

### **EXCLUSION CRITERIA**

- Patients with mitral restenosis
- Age >40
- Patients with combined other valvular heart diseases
- Congenital tricuspid regurgitation
- Tricuspid regurgitation due to other causes

## **METHODOLOGY**

Information regarding each patient is entered in a proforma specially designed to include all relevant information.

Detailed history is recorded using pre framed questionnaires.

A thorough physical examination consisting of general examination, cardiovascular, respiratory and other physical findings are done and recorded.

Trans-thoracic ECHO cardio graphic evaluation is done pre operatively and post operatively

TEE is done for special cases.

## **PREOPERATIVE EVALUATION**

All patients were examined by both the cardiologist and the cardiac surgeon before they were enrolled in the study. The patients underwent full clinical evaluation, including routine laboratory tests (erythrocyte sedimentation rate, antistreptolysin-0 titer, and C-reactive protein, liver function test), and radiologic and electrocardiographic examination.

Preoperative and postoperative echo was done and tricuspid regurgitation graded according to

- 1) Proximal Isovelocity Surface Area(PISA).
- 2) Echo doppler

- 3) Vena contracta
- 4) Colour Doppler

### **PRE-OP PROCEDURE**

Patients were given pre-op antibiotics and anaesthesia induced in supine position. Pre-op CVP noted before inducing anaesthesia.

### **OPERATIVE PROCEDURE**

Patient in supine position, median sternotomy, systemic heparinization, aorta cannulated, bicaval venous cannulation done, cardio pulmonary bypass established core cooled to 28<sup>0</sup>celcius, aorta cross clamped,root cold cardioplegia given heart arrested in diastole, left atrium opened diseased mitral valve excised prosthetic mitral valve replaced with everting mattress 2-0 ethibond sutures ,left atrium closed with 4-0 prolene, core rewarmed, cross clamp released, heart picked up in sinus rhythm, SVC and IVC were snugged right atrium opened parallel to sondegrads groove tricuspid valve assessed and the necessary procedure devega/annuloplasty done.

### **DEVEGA**

Horizontal cotinuous sutures are taken parallel to anterior and posterior leaflets only avoiding the septal leaflet so as to not to injure the bundle and tied.

## **ANNULOPLASTY**

Classic carpentier ring was introduced by horizontal mattress interrupted sutures

Right atrium closed with 4-0 prolene

Gradually weaned off cardiopulmonary bypass ,decannulation done heparin neutralised with protamine ,complete hemostasis secured ,right pleuro pericardial drain kept stenotomy closed with wires, wound closed in layers.

## **POST OP PERIOD**

The patient was extubated in the POST OP ICU after 6 hours of elective ventilation and Twenty-four hours later, the intercostal tube was removed and the patient was discharged from intermediate care.the patients are followed up with tablet acitrome(acecoumarin) with an INR of 2.5-3.0.

After recovery follow-up echocardiography was performed with particular attention to checking for tricuspid regurgitation

## **ETHICS**

Ethical committee clearance was obtained and all the procedures followed in accordance with the ethical standards. Photographs were taken with patient and their relative's full consent.

## **GLOSSARY**

TV-tricuspid valve

TA-tricuspid annulus

MVR-mitral valve replacement

TR-tricuspid regurgitation

RHF-right heart failure

JVP – Jugular Venous pressure

PE - Pedal Edema

LFT- liver function test

CAMS- calcific mitral stenosis

MS/MR-mitral stenosis/mitral regurgitation

# **OBSERVATION**

# OBSERVATION

Total Number of cases: 250

## PARAMETERS STUDIED

- ❖ Personal details
- ❖ Symptoms
- ❖ Signs
- ❖ Echo
- ❖ Surgery
- ❖ Complications
- ❖ Management of TRICUSPID regurgitation

All the above details were analyzed and tabulated in the masterwork sheet and statistic significance arrived.

In my study of 250 patients, patients with moderate/severe tricuspid regurgitation underwent tricuspid repair (annuloplasty/ devega) concomitantly during mitral valve replacement which significantly decreased post op tricuspid regurgitation, which left alone would have made the prognosis bad.

All post op patients had no symptoms of right heart failure.

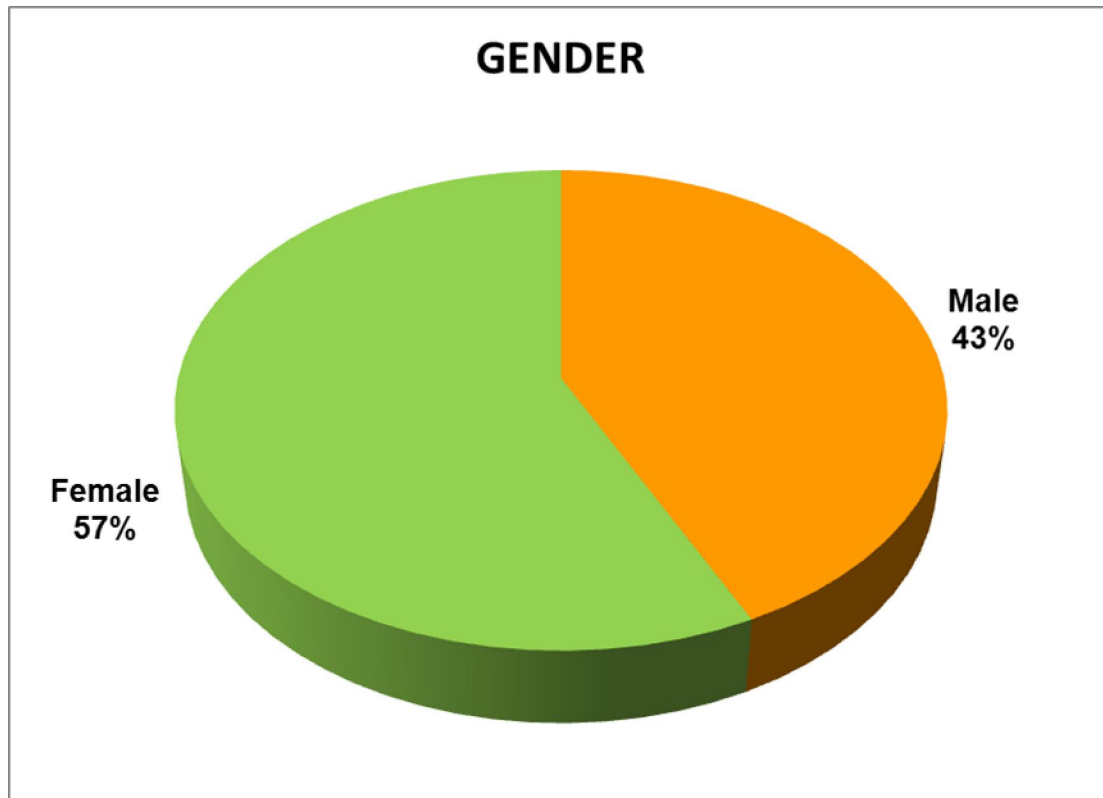
They were followed for a period of 6 months to 1 year with a minimum of 3 visits.

In my study I observed a significant change in patients who underwent tricuspid repair for moderate and severe regurgitation concomitantly with mitral valve replacement.

## AGE AND SEX DISTRIBUTION

Table -1

<b>GENDER</b>	Frequency	Percent
Male	107	42.8
Female	143	57.2
Total	250	100.0

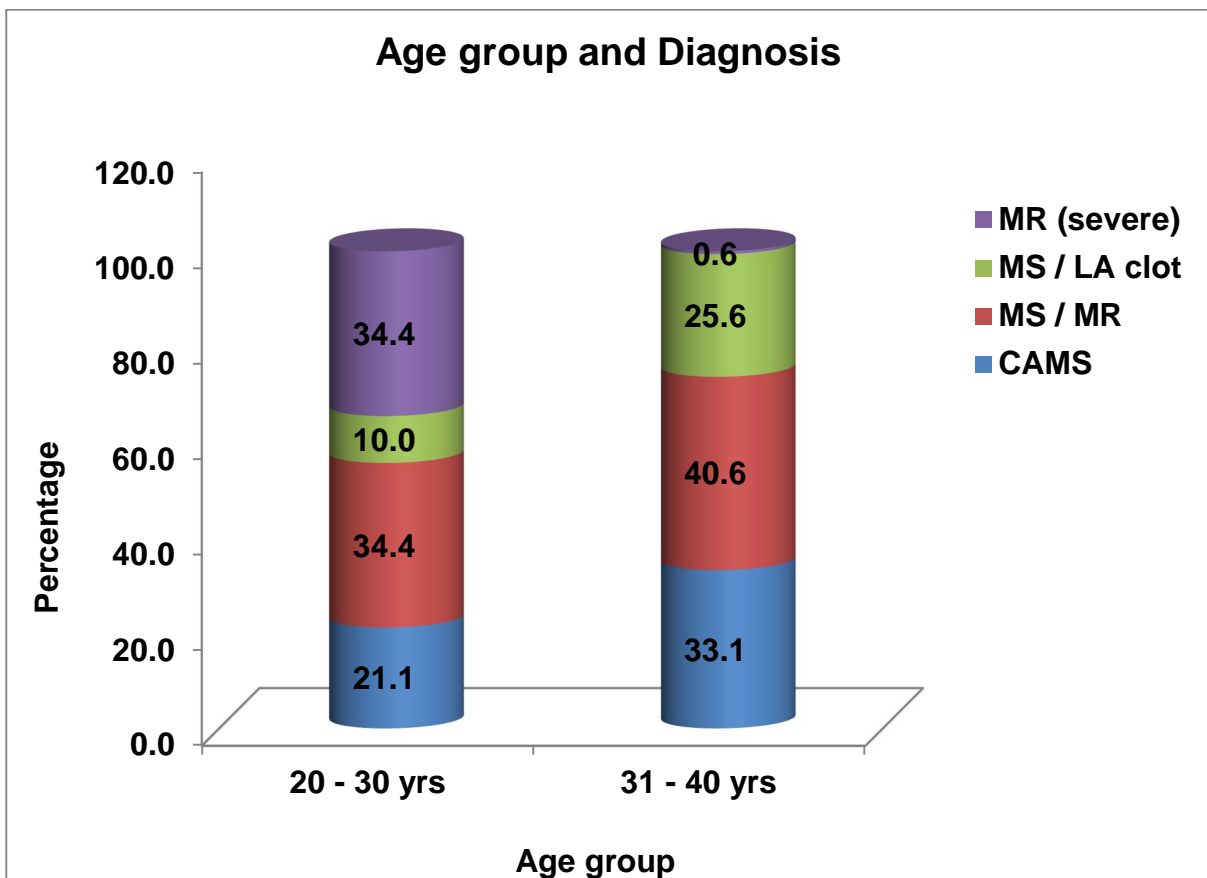
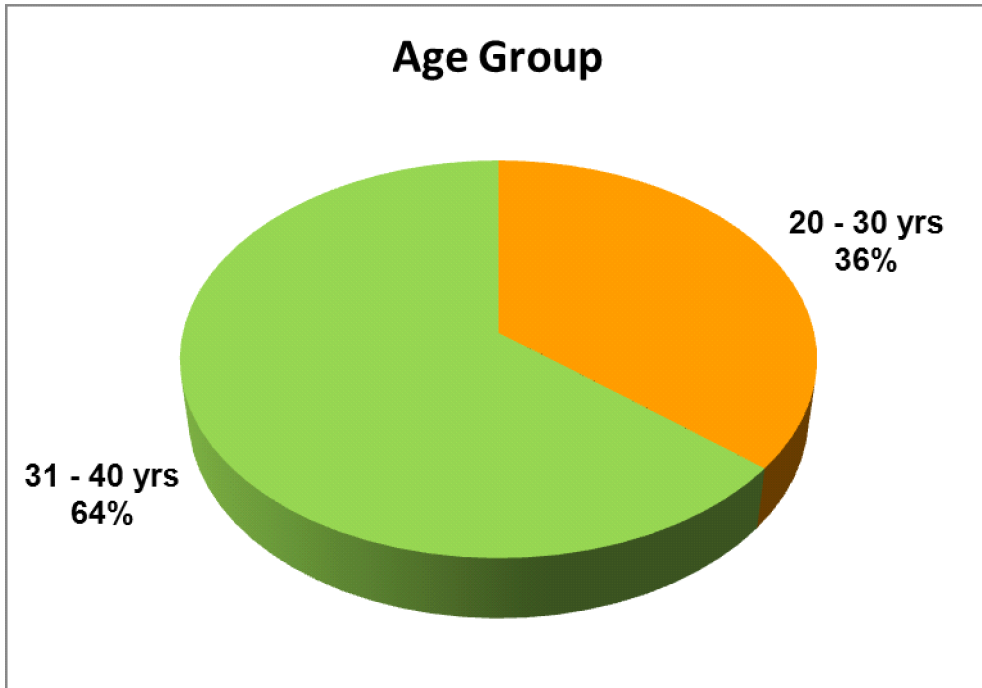




90 patients were in the age group of 20-30 and 160 of them were in the age group of 30-40. males comprised 42.8%, females comprised 57.2%. This showed a definite female predilection as rheumatic mitral valve disease is more common in females. This clearly shows tricuspid regurgitation is more seen in patients with long standing left side valve lesions associated with pulmonary hypertension.

**Table -2**

<b>Age Group</b>	<b>Frequency</b>	<b>Percent</b>
20 - 30 yrs	90	36.0
31 - 40 yrs	160	64.0
Total	250	100.0



### **Distribution of tricuspid regurgitation in mitral valve diseases**

Calcific mitral stenosis patients had 28.8% TR

Mitral stenosis/ mitralregurgitation patients had 38.4% TR

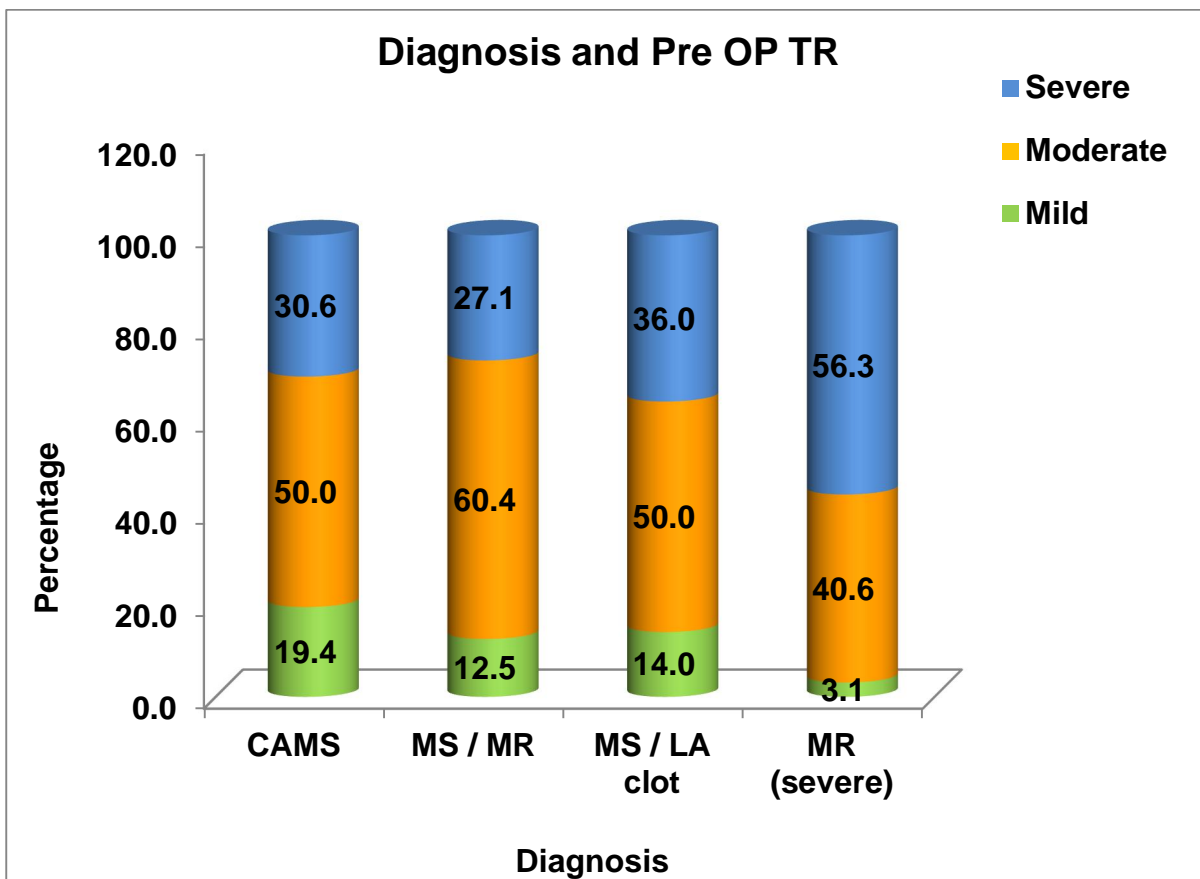
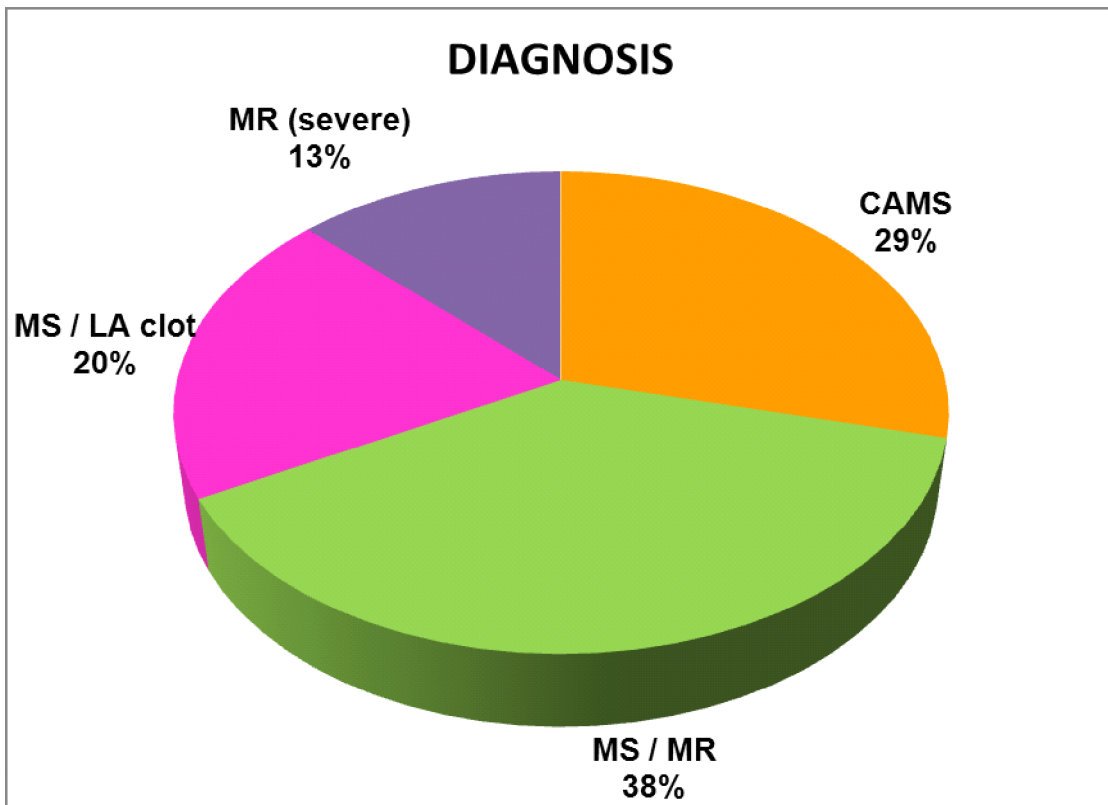
Mitral stenosis /left atrial clot patients had 20% TR

Mitral regurgitation (severe) patients had 12.8% TR

Tricuspid regurgitation is more common in mitralstenosis/mitral regurgitation associated with long standing pulmonary hypertension.

**Table -3**

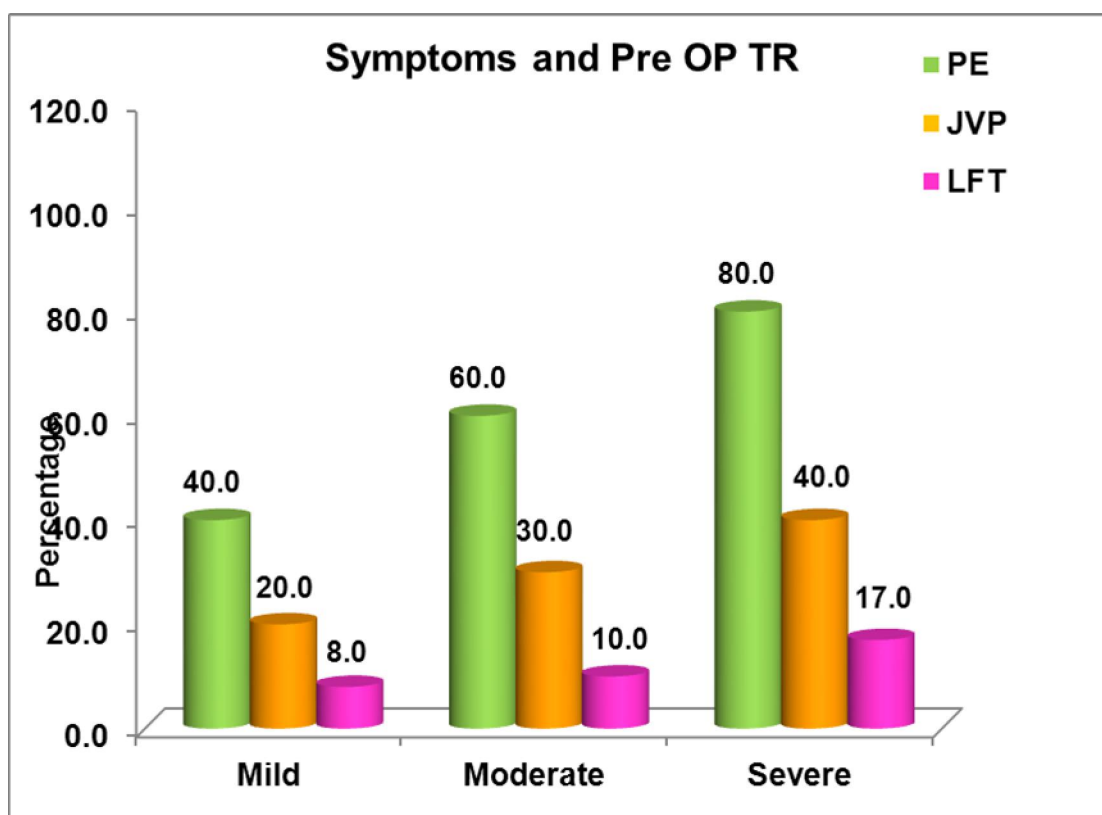
<b>Diagnosis</b>	<b>Frequency</b>	<b>Percent</b>
CAMS	72	28.8
MS / MR	96	38.4
MS / LA clot	50	20.0
MR (severe)	32	12.8
Total	250	100.0



## SYMPTOMS AND SIGNS

The symptoms and signs including pedal edema ,raised jugular venous pressure, raised liver fuction test were more in severe TR and less in moderate TR followed by mild TR.

Symptoms	Pre OP TR		
	Mild	Moderate	Severe
PE	40	60	80.0
JVP	20	30	40.0
LFT	8	10	17.0

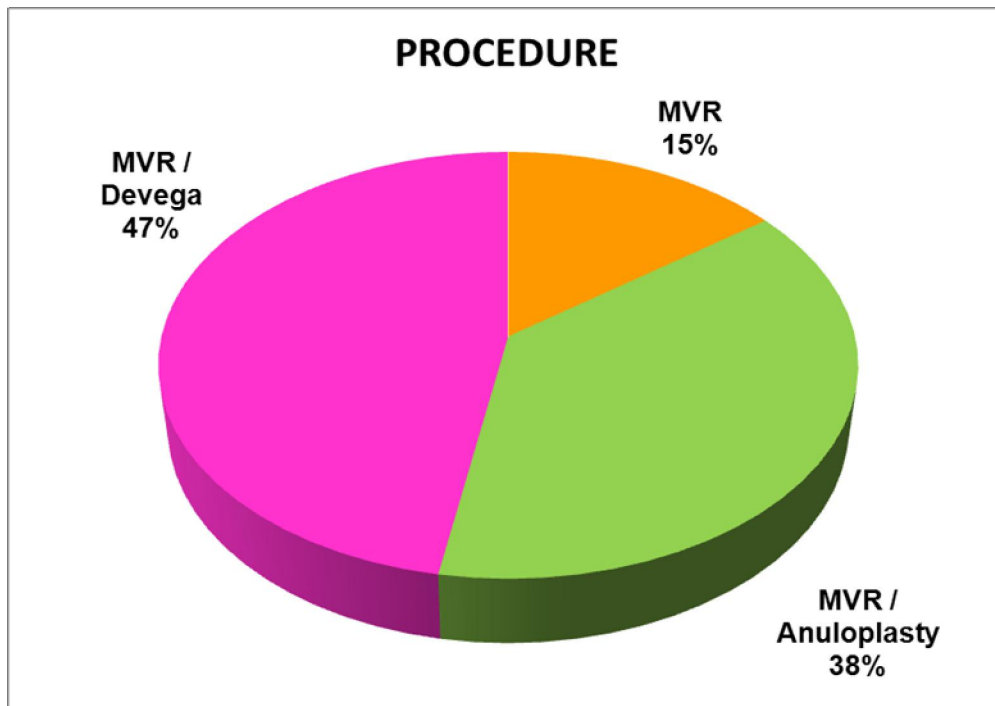


## TRICUSPID REGURGITATION AND ITS TREATMENT

37 patients with mild regurgitation were managed conservatively with diuretics .Annuloplasty was done for 95 patients with moderate and severe regurgitation ,devega was done in 118 patients with moderate and severe regurgitation. Tricuspid valve replacement was not done .

Hence tricuspid repair in mvr patients showed a significant decrease in tricuspid regurgitation.

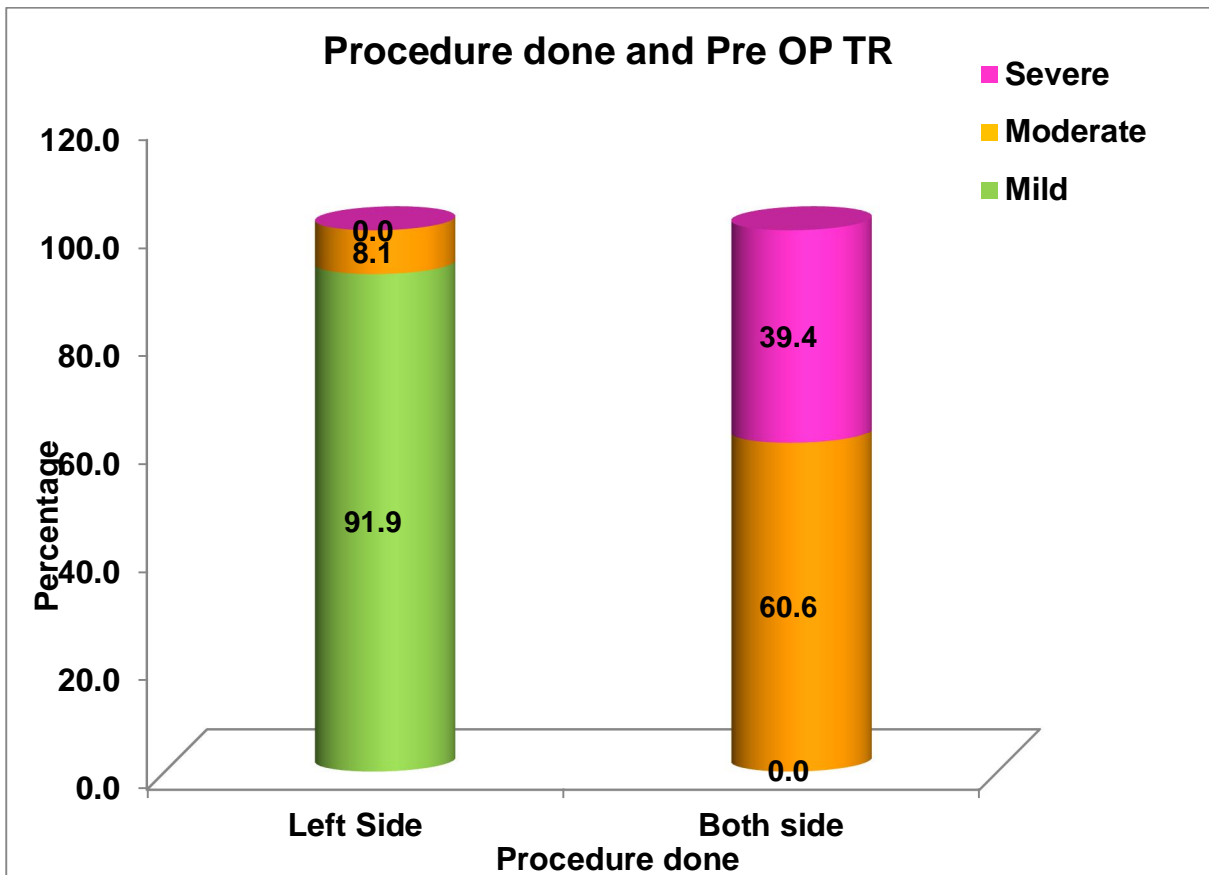
PROCEDURE	Frequency	Percent
MVR	37	14.8
MVR / Ring Annuloplasty	95	38.0
MVR / DevegaRepair	118	47.2
Total	250	100.0



## PREOP TRICUSPID REGURGITATION

Mild tricuspid regurgitation was present in 13.6% of patients .moderate tricuspid regurgitation was present in 52.8% of patients. Severe tricuspid regurgitation was present in 33.6% of patients. this study shows majority of patients with moderate tricuspid regurgitation,since ours being a tertiary centre tricuspid regurgitation is diagnosed even at the early stage.

PRE OP TR	Frequency	Percent
Mild	34	13.6
Moderate	132	52.8
Severe	84	33.6
Total	250	100.0

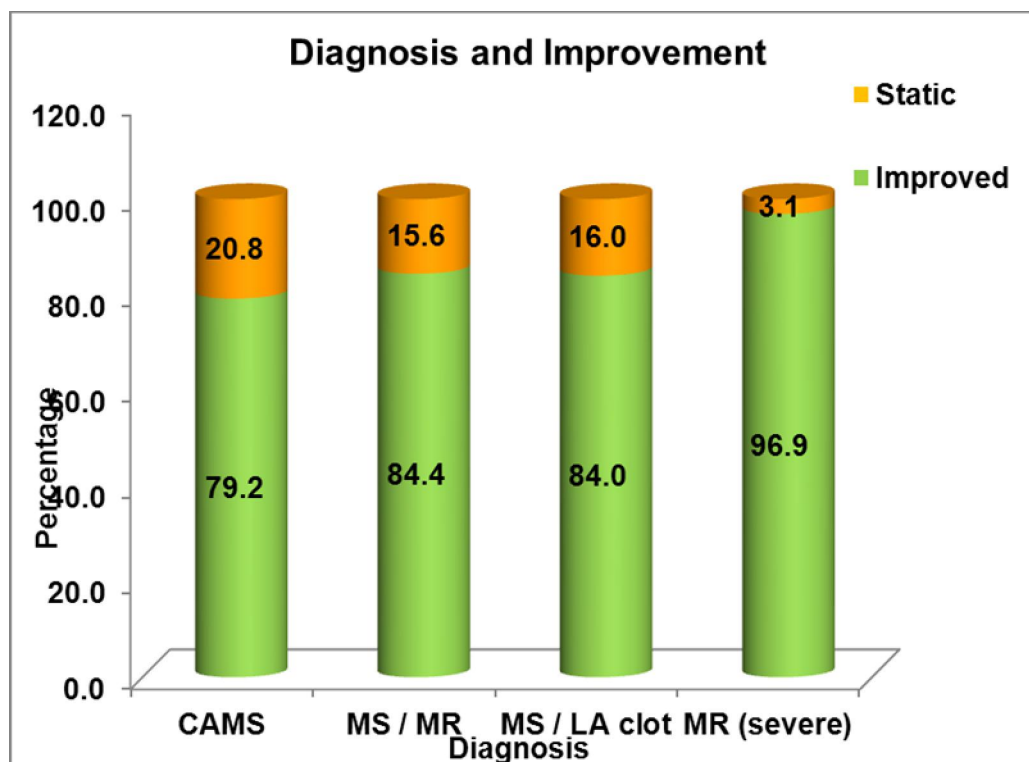


## POST OP TRICUSPID REGURGITATION

Post operatively 97.2% of patients had mild tricuspid regurgitation. Moderate tricuspid regurgitation persisted in 7 patients 2.8%. Tricuspid repair was not done in 3 cases with moderate TR and in 4 cases the tricuspid repair done failed to bring down moderate TR. This was managed conservatively without redo surgeries.

**Table -6**

POST OP TR	Frequency	Percent
Mild	243	97.2
Moderate	7	2.8
Total	250	100.0





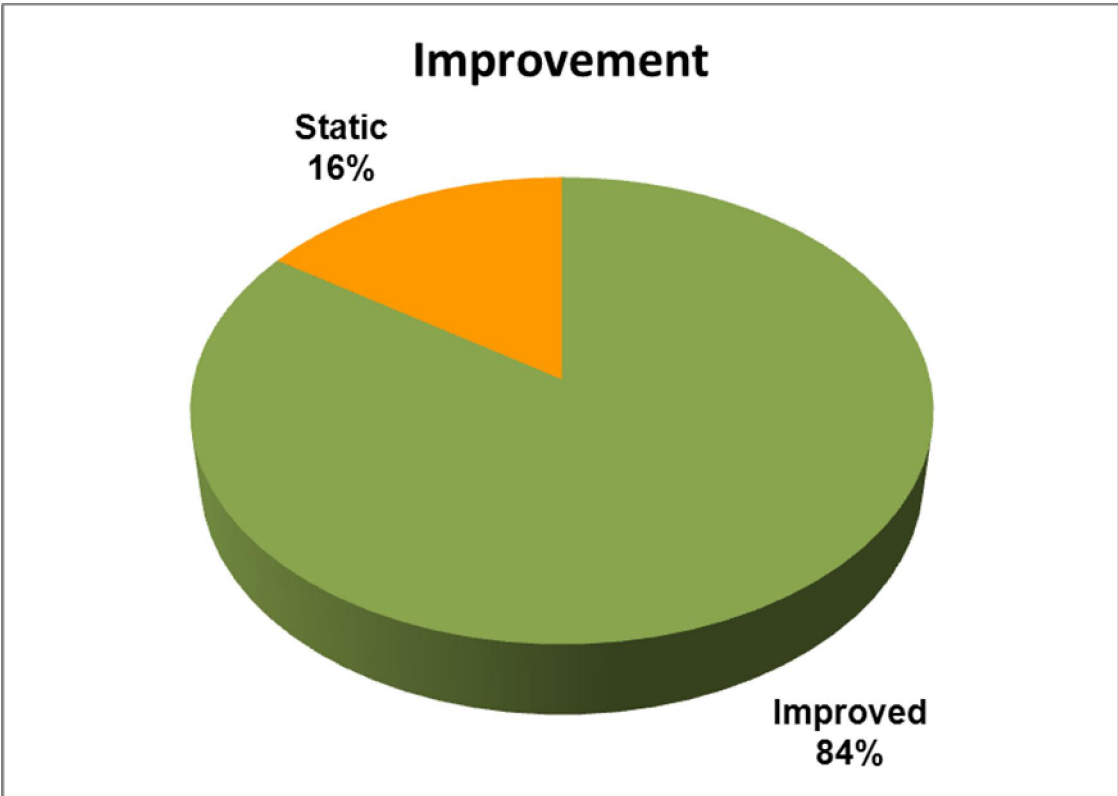
## **OUTCOME**

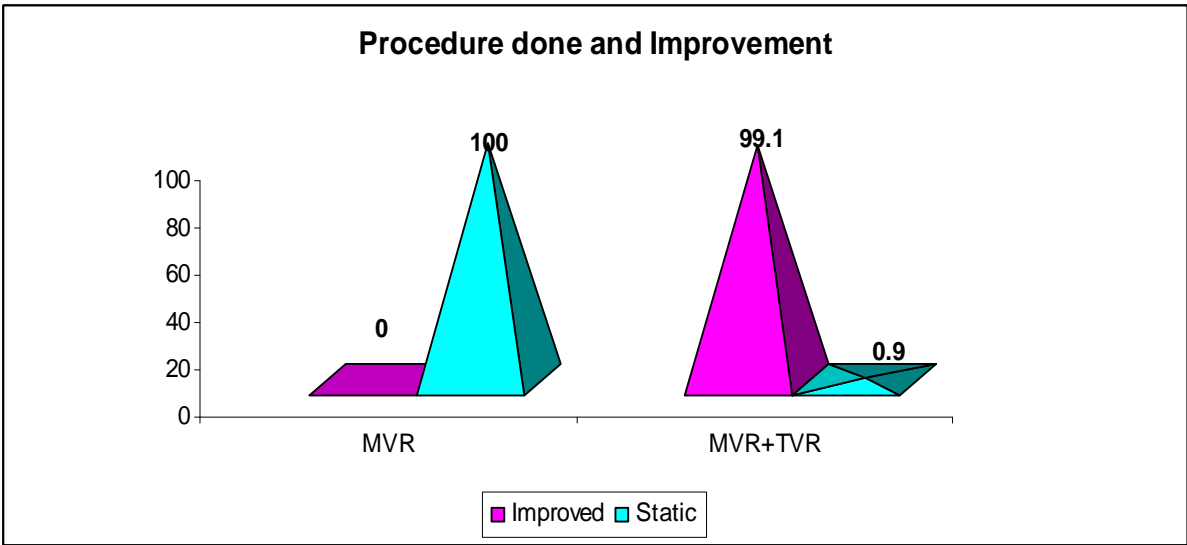
As majority of my patient were in the group of moderate tricuspid regurgitation 52.4% followed by sever tricuspid regurgitation 33.6%and mild regurgitation 14%.the mild group was managed with MVR alone and diuretics. The moderate and severe group showed an improvement in post operative TR by 84.4%.

All the patients are followed for a period of 6 months, patients with mild TR had a definite decrease in the right heart failure symptoms and they are followed up with diuretics.

Two patients who underwent mitral valve replacement alone with moderate tricuspid regurgitation died two years after surgery due to low cardiac output failure.Two patients who underwent MVR+TVR died two years after surgery due to struck valve and bleeding complications rrespectively.

<b>Improvement</b>	<b>Frequency</b>	<b>Percent</b>
Improved	211	84.4
Static	39	15.6
Total	250	100.0





Improvement	Procedure done on				Total		P-Value
	MVR		MVR+TVR				
	N	%	N	%	N	%	
Improved	0	0.0	211	99.1	211	84.4	<0.001
Static	37	100.0	2	0.9	39	15.6	
Total	37	100.0	213	100.0	250	100.0	

# **DISCUSSION**

## DISCUSSION

In the current study we have selected only a small group of patients and have excluded all the complicated cases. This study shows a definite predilection of moderate and severe TR in patients presenting in their third decade of life and more in female population which can be associated with long standing pulmonary hypertension. Patients with mitral stenosis/mitral regurgitation in atrial fibrillation and huge left atrium tend to develop early pulmonary hypertension and subsequent TR when compared to other groups of patients undergoing mitral valve replacement.

A study by katushiko Matsuyama<sup>56</sup> et al concluded that Aggressive repair of accompanying TR should be undertaken at the time of initial surgery in patients with huge left atrium or atrial fibrillation, even if preoperative TR is 2+.

In a study by alex sagie<sup>53</sup> et al study of patients undergoing bollon mitral valvotomy for mitralvalvestenosis,he observed severe TR to be present in all cases of severe and long standing mitral stenosis and these patients have advanced mitral valve and pulmonary vascular diseases followed by poor outcome.

Postoperative TR has consistently come down in all patients undergoing tricuspid valve repair irrespsctive of the preoperative diagnosis

for which MVR was planned concomitantly with mitral valve replacement as has been demonstrated by other studies also.

In a study by Kenjikuwaki et al<sup>54</sup> to prevent late tricuspid reoperation after mitral valve surgery it is best to not to leave residual TR of grade more than 2+. It would be better if tricuspid valve surgery is done concomitantly with mitral valve surgery.

The present study shows a definite reduction in tricuspid regurgitation if tricuspid repair has been done along with MVR. Statistical significance of my study is  $<0.001$  which is comparable with other studies.

In a study by Gilles Dreyfus<sup>55</sup> tricuspid annulus remodelling improves the functional state. Tricuspid dilatation is an ongoing process that will with time may progress if not treated.

Tricuspid regurgitation has significantly improved in patients who underwent TVR with MVR as shown by their immediate post operative echocardiogram and the mild TR patients in whom MVR alone was done also showed an improvement in their symptoms in their subsequent follow ups.

Of the 250 patients who underwent mitral valve replacement, tricuspid repair was not done in three cases with moderate TR. Their post operative echo showed moderate TR, which was conservatively managed and followed up. Four patients who underwent tricuspid repair still persisted with moderate TR and they are managed conservatively.

# **SUMMARY**

## SUMMARY

This prospective observational study reflects the epidemiological pattern of tricuspid regurgitation in patients presenting in GOVT GEN HOSPITAL CHENNAI during the period of AUG2009-FEB2012 for mitral valve replacement, and the management of tricuspid regurgitation in patients undergoing MVR for rheumatic mitral valve diseases and its outcome.

- Tricuspid regurgitation has a definite predilection towards female sex and third decade of life.
- Tricuspid regurgitation is more seen in patients with severe MS/MR with huge left atrium and in patients in atrial fibrillation with long standing pulmonary hypertension.
- Patients who present for mitral valve replacement mostly have moderate TR followed by severe TR and only few 13.6% presented with mild TR.
- Symptoms and signs of TR were obviously more in the severe TR group followed by the moderate TR and mild TR.
- De Vega repair was done in 47.2% of patients, Ringannuloplasty was done in 38% of patients, and MVR alone was done in 14.8% of patients with moderate and severe TR.
- The postoperative TR was decreased in 97.2% of patients, who underwent TVR with MVR.
- In this study 84.4% of patients showed an improvement in symptoms of signs of TR post operatively.



# **CONCLUSION**

## **CONCLUSION**

This study shows that long standing mitral valve lesions demanding mitral valve replacement are associated with pulmonary hypertension and tricuspid annular dilatation leading onto varying grades of functional tricuspid regurgitation.

This study also emphasises on the point of not overlooking or neglecting tricuspid valve in cases of rheumatic mitral valve diseases with tricuspid regurgitation. Mild tricuspid regurgitation can be managed with MVR alone and conservatively but Moderate and Severe tricuspid regurgitation definitely needs addressing of the tricuspid valve by repair to improve the outcome and prevent both morbidity and mortality.

This study shows that moderate and severe functional tricuspid regurgitation addressed either by de Vega or ring annuloplasty concomitantly during mitral valve replacement has significantly brought down the post operative tricuspid regurgitation and hence improves the outcome.

# **BIBLIOGRAPHY**

## BIBLIOGRAPHY

- 1) Tsakins A G Mair D D, Setkis et al motion of the tricuspid valve annulus in anaesthetised intact dogs. Circulation res 36; 43-48,1975
- 2) Hong J, Krelling T, Semigran MJ et al, usefulness of echocardiographic determined tricuspid regurgitation in predicting event free survival in severe heart failure Am J Cardiol 82;1301-1303
- 3) Goldman ME, Guarino T, Fuster V et al; The necessity for tricuspid valve repair can be determined intraoperatively by 2D echo. J.thoracic cardiovascular surgery 94;542-550 1987
- 4) Groves PH, Ikrans S, Ingold U et al, TR following MVR an echo study J. Heart Valve Dis 2;273-278 1993
- 5) Guiraudon GM, Kush R; Extended vertical transatralseptal approach to mitral valve An Thoracic Surgery 53;1058-62 1991
- 6) Bailey CP Tricuspid Stenosis; surgery of heart,Philadelphia;lea and feibeger1995 846-861
- 7) Wooler GH Nixon PGF, Grimshaw VA et al experience with repair for mitral valve 17;49-57 1962
- 8) Carpentier A; la valvuloplasty reconstitute une nouvelle technique de valvuloplastymitrale 7;251-253
- 9) Kaplan M Kut MS Demitas MM et al prosthetic replacement of tricuspid valve ann thoracic surgery 73;467-473

- 10) Kratz JM, Crawford et al, Trends and results in tricuspid surgery chest88;837-840
- 11) Bogari A, Glece, V, Topaloglu S, Outcome of significant functional TR late after MVR angioplasty, 2007: .
- 12) Izumi C, Iga K, Konishi T. Progression of Isolated TR late after MVR functional Rheumatic mitral valve disease. J Heart Valve Dis 2002; 11: 353-6.
- 13) Forter A, Shapira Y, Courzal M et al TR after MVR clinical and echo evaluation J Heart Valve Dis, 1999; 8: 57-62.
- 14) Reul M, Reubeas FD, Mastern Rh, Late Incidence and prediction of permanent or recent heart failure in patient with mitral valve prosthesis. J Thoracic Cardiovascular Surgery 2004; 128: 278-83.
- 15) Rogues F, Nashef SA, Michel P, Lesson from Euroscore pilot programme J Heart Valve Dis 2001; 10: 572-7.
- 16) Turina J, Stark T, Safort B, Turina M, Prediction of the long term outcome after combined Aortic and mitral valve surgery J Thoracic Cardiovascular Surgery 1999; 110: 48-53.
- 17) Kind RM, Schaff HV, Danielson GK, Gersh BJ, Osszulak TA, Surgery for the late after MVR circulation, 1984; 70: 193.
- 18) Kay JH, Mendenhall AM, Zubieta P, A further look at Tricuspid Annuloplasty, Ann Thoracic Surgery, 1976; 22: 498.

- 19) Barrett Boyes BG; Rutherford IN, Whitlock RM, Pemberton FR, A review of Surgery of Acquired Tricuspid Valve Surgeries, Aust NZ J Surgery 1988; 58: 23.
- 20) Nakano S, Kawashima Y, Hane H, Malsuda H, Shimazaki Y, Evaluation of Long term results of bicuspidalizationannuloplasty for functional TR, J. Thoracic Carduranular, 1988; 95: 340.
- 21) Cabrol C, Annuloplastie valvulaire Nourpresse Med I; 1366.
- 22) Devega NG La Annuloplasty selective regulable permanent cardiol 25; 555-560.
- 23) Management of TR Heart 2007. 93: 271-8.
- 24) Journal Thoracic CUS 1999; 117: 463-71.
- 25) Circulation 2006; 114: 1577-81.
- 26) J Ann Cardiol 1989; 14: 1266.
- 27) Dreyfas GD, Corbi PJ, Chan KM, Secondary TR which should be the criteria for surgical repair, Ann Thoracic Surgery 2005; 79: 127-32.
- 28) Bonow RO, Carabello BA, Chatterjee K, et al. ACC/AHA 2006 guidelines for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Cardiovascular Angiography and Interventions and the Society of Thoracic Surgeons. J Am CollCardiol 2006;48:e1–148.
- 29) Vahanian A, Baumgartner H, Bax J, et al. Guidelines on the management of valvular heart disease: the Task Force on the

Management of Valvular Heart Disease of the European Society of Cardiology. *Eur Heart J* 2007;28:230–68.

- 30) Matsuyama K, Matsumoto M, Sugita T, Nishizawa J, Tokuda Y, Matsuo T. Predictors of residual tricuspid regurgitation after mitral valve surgery. *Ann Thorac Surg* 2003;75:1826–8.
- 31) Antunes MJ, Barlow JB. Management of tricuspid valve regurgitation. *Heart* 2007;93:271– 6.
- 32) Roques F, Nashef SA, Michel P. Risk factors for early mortality after valve surgery in Europe in the 1990s: lessons from the Euro SCORE pilot program. *J Heart Valve Dis* 2001;10:572–7, discussion 7–8.
- 33) Turina J, Stark T, Seifert B, Turina M. Predictors of the long-term outcome after combined aortic and mitral valve surgery. *Circulation* 1999;100:1148 –53.
- 34) Sagie A, Schwammenthal E, Newell JB, et al. Significant tricuspid regurgitation is a marker for adverse outcome in patients undergoing percutaneous balloon mitral valvuloplasty. *J Am CollCardiol* 1994; 24:696 –702.
- 35) Groves PH, Lewis NP, Ikram S, Maire R, Hall RJ. Reduced exercise capacity in patients with tricuspid regurgitation after successful mitral valve replacement for rheumatic mitral valve disease. *Br Heart J* 1991;66: 295–301.

- 36) Mangoni AA, DiSalvo TG, Vlahakes GJ, Polanczyk CA, Fifer MA. Outcome following isolated tricuspid valve replacement. *Eur J CardiothoracSurg* 2001;19: 68 –73.
- 37) King RM, Schaff HV, Danielson GK, et al. Surgery for tricuspid regurgitation late after mitral valve replacement. *Circulation* 1984;70: 1193–7.
- 38) Hornick P, Harris PA, Taylor KM. Tricuspid valve replacement subsequent to previous open heart surgery. *J Heart Valve Dis* 1996; 5: 20–5.
- 39) Ubago JL, Figueroa A, Ochoteco A, Colman T, Duran RM, Duran CG. Analysis of the amount of tricuspid valve anular dilation required to produce functional tricuspid regurgitation. *Am J Cardiol* 1983;52: 155–8.
- 40) Sugimoto T, Okada M, Ozaki N, Hatakeyama T, Kawahira T. Long-term evaluation of treatment for functional tricuspid regurgitation with regurgitant volume: characteristic differences based on primary cardiac lesion. *J ThoracCardiovascSurg* 1999;117:463–71.
- 41) Sagie A, Schwammenthal E, Padial LR, Vazquez de Prada JA, Weyman AE, Levine RA. Determinants of functional tricuspid regurgitation in incomplete tricuspid valve closure: Doppler color flow study of 109 patients. *J Am CollCardiol* 1994;24:446 –53.



- 42) Song H, Kang DH, Kim JH, et al. Percutaneous mitral valvuloplasty versus surgical treatment in mitral stenosis with severe tricuspid regurgitation. *Circulation* 2007;116:1246–50.
- 43) Fukuda S, Saracino G, Matsumura Y, et al. Three-dimensional geometry of the tricuspid annulus in healthy subjects and in patients with functional tricuspid regurgitation: a real-time, 3-dimensional echocardiographic study. *Circulation* 2006;114:1492–8.
- 44) Ton-Nu TT, Levine RA, Handschumacher MD, et al. Geometric determinants of functional tricuspid regurgitation: insights from 3-dimensional echocardiography. *Circulation* 2006;117:143–9.
- 45) Simon R, Oelert H, Borst HG, Lichtlen PR. Influence of mitral valve surgery on tricuspid incompetence concomitant with mitral valve disease. *Circulation* 1980;62:1152–7.
- 46) Sadeghi HM, Kimura BJ, Raisinghani A, et al. Does lowering pulmonary arterial pressure eliminate severe functional tricuspid regurgitation? Insights from pulmonary thromboendarterectomy. *J Am Coll Cardiol* 2004;44: 126–32.
- 47) Tang GH, David TE, Singh SK, Maganti MD, Armstrong S, Borger MA. Tricuspid valve repair with an annuloplasty ring results in improved long-term outcomes. *Circulation* 2006;114:1577–81.
- 48) McCarthy PM, Bhudia SK, Rajeswaran J, et al. Tricuspid valve repair: durability and risk factors for failure. *J Thorac Cardiovasc Surg* 2004;127: 674–85.

- 49) Jonjev ZS, Mijatov M, Fabri M, Popovic S, Radovanovic ND. Systematic reductive annuloplasty of the mitral and tricuspid valves in patients with end-stage ischemic dilated cardiomyopathy. *J Card Surg* 2007;22:1 11– 6.
- 50) 57 Radovanovic N, Mihajlovic B, Selestiansky J, et al. Reductive annuloplasty of double orifices in patients with primary dilated cardiomyopathy. *Ann ThoracSurg* 2002;73: 751–5.
- 51) Haddad F, Hunt SA, Rosenthal DN, Murphy DJ. Right ventricular function in cardiovascular disease, part I: Anatomy, physiology, aging, and functional assessment of the right ventricle. *Circulation* 2008; 117: 1436–48.
- 52) Tang GH, David TE, Singh SK, Maganti MD, Armstrong S, Borger MA. Tricuspid valve repair with an annuloplasty ring results in improved long-term outcomes. *Circulation* 2006;114:I577– 81.
- 53) NS Braunwald, J Ross, AG Morrow Conservative management of tricuspid regurgitation in patients undergoing mitral valve replacement *Circulation*, 35 (Suppl I) (1967), pp. I-63–I-69.
- 54) *European Journal of Cardio-Thoracic Surgery* Volume 20, Issue 3, September 2001, Pages 577–582
- 55) *The Annals of Thoracic Surgery* Volume 79, Issue 1, January 2005, Pages 127–132
- 56) *The Annals of Thoracic Surgery* Volume 75, Issue 6, June 2003, Pages 1826–1828

# **ANNEXURES**

**THESIS PROFORMA FOR M.Ch CARDIO VASCULAR AND  
THORACIC SURGERY**

**DISSERTATION ON**  
**A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS**  
**UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL**  
**VALVE DISEASES**

**Patient Profile**

SL NO:

**Name** :

**DOA:**

**DOD:**

**DOS:**

**Age** :

**Sex** :

**IP No** :

**ADDRESS** :

**SOCIOECONOMICAL STATUS :**

- Working / Dependent :
- Monthly Earning :
- Religion :
- Educational Status :

**FINAL DIAGNOSIS**

A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS  
UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL  
VALVE DISEASES

## History

*Presenting Complaints* : PEDAL EDEMA  
ANGINA:  
BREATHLESSNESS:  
PALPITATION:  
HEMOPTYSIS:  
OTHERS:

*Past History* :  
  
RHEUMATIC FEVER:  
  
H/O SURGERY:  
  
OTHERS:

*Personal History* :

*Family History* :

A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS  
UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL  
VALVE DISEASES

## Examination

*General Examination:*

*Systemic Examination:*

*Cardiovascular:*

*Respiratory:*

*Abdomen:*

*Central Nervous:*

*Skull & Spine:*

A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS  
UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL  
VALVE DISEASES

*Investigations*

*Heamatogram:*

*Biochemical Profile:*

*Radiogram:*

*Chest X-ray:*

*Echo Cardiogram:*

*Others:*

*Mitral Valve Status:*

A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS  
UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL  
VALVE DISEASES

*Operative History*

*Preoperative Status:*

*Operation Notes:*

*Per operative Findings:*

*PICTURES ATTACHED: YES / NO*

*NUMBERS:*

*Postoperative Period:*



*A STUDY ON MANAGEMENT OF TRICUSPID REGURGITATION IN PATIENTS  
UNDERGOING MITRAL VALVE REPLACEMENT FOR RHEUMATIC MITRAL  
VALVE DISEASES*

*Post OP Complications & Management*

*Follow up:*

NAME	AGE	SEX	IP NUMBER	DIAGNOSIS	PROCEDURE	PREOP TR	POST OP TR
1 SANGEETHA	24	FEMALE	42805	CA/ MS	MVR/DEVEGA	MILD	MILD
2 MAHESWARI	32	FEMALE	40416	MS/MR	MVR/DEVEGA	MOD	MILD
3 NARAYANAN	30	MALE	42481	MS/MR	MVR/DEVEGA	MOD	MILD
4 DIWAKAR	20	MALE	39745	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
5 PUSHPARANI	33	FEMALE	51623	MS/LA CLOT	MVR/DEVEGA	MOD	MILD
6 MALATHY	28	FEMALE	51592	CA/ MS	MVR/DEVEGA	MILD	MILD
7 EGAVALLI	30	FEMALE	48807	CA/ MS	MVR/DEVEGA	MOD	MOD
8 ADAIKALAM	38	MALE	42918	CA/ MS	MVR/ANNULOPLASTY	MOD	MILD
9 KANNIAMMAL	40	FEMALE	51459	CA/MS	MVR/DEVEGA	MOD	MILD
10 MEENAKSHI	40	FEMALE	40509	MS/LACLOT	MVR	MILD	MILD
11 SHANMUGHAM	35	MALE	37667	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
12 ARUMUGAM	25	MALE	39746	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
13 MANTHIRAKUMAR	40	MALE	53394	CAMS	MVR/DEVEGA	MOD	MILD
14 VIGNESH	24	MALE	56563	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
15 SANGEETHA	22	FEMALE	56575	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
16 LAXMI	30	FEMALE	52439	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
17 CHANDRAN	35	MALE	49737	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
18 AMUDHA	21	FEMALE	52427	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
19 FAQRUDEEN	38	MALE	54287	CAMS	MVR	MILD	MILD
20 SALIM	21	MALE	26600	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
21 SHANKAR	40	MALE	45590	CAMS	MVR/DEVEGA	MOD	MILD
22 VINNARASI	20	FEMALE	52482	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
23 SIVAKUMAR	30	MALE	39753	MS/MR	MVR/DEVEGA	MOD	MILD
24 MARIMUTHU	40	MALE	53716	CAMS	MVR/DEVEGA	MOD	MILD
25 SEKHAR	38	MALE	60583	MS/MR	MVR/DEVEGA	MOD	MILD
26 SATISH	40	MALE	60903	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
27 TAMILARASI	40	FEMALE	58015	CAMS	MVR	MILD	MILD
28 VIJAYALAXMI	30	FEMALE	39753	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
29 MURUGAN	22	MALE	30484	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
30 VIJAYA	28	FEMALE	57824	MS/MR	MVR	MILD	MILD
31 REVATHI	26	FEMALE	64925	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
32 JAYANTHI	32	FEMALE	51812	CAMS	MVR/DEVEGA	MOD	MILD
33 ARUMUGAM	30	MALE	58961	MS/LACLOT	MVR/DEVEGA	MOD	MILD
34 JAYAMANI	28	FEMALE	52483	MS/MR	MVR/DEVEGA	MOD	MILD
35 BAKKIYAM	40	FEMALE	56420	MS/LACLOT	MVR	MILD	MILD
36 MUTHUSELVI	40	FEMALE	60024	MS/LACLOT	MVR/DEVEGA	MOD	MILD

37 SAGAYAMARY	28	FEMALE	26592	MS/MR	MVR/DEVEGA	MOD	MILD
38 MURUGAN	31	MALE	59916	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
39 MANIKAM	40	MALE	52435	CAMS	MVR	MILD	MILD
40 SIVARAMAN	38	MALE	56226	CAMS	MVR/DEVEGA	MOD	MILD
41 SELVARAJ	40	MALE	66417	MS/LACLOT	MVR	MILD	MILD
42 VIJAYA	29	FEMALE	76689	MS/MR	MVR/DEVEGA	MOD	MILD
43 AHAMED	25	FEMALE	66435	MS/MR	MVR/DEVEGA	MOD	MILD
44 AMALRAJ	32	MALE	41315	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
45 BABU	38	MALE	58935	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
46 RAMYA	25	FEMALE	61951	MS/MR	MVR	MILD	MILD
47 SAMUEL	32	MALE	62225	CAMS	MVR/ANNULOPLASTY	MOD	MILD
48 MARIMUTHU	40	MALE	62805	CAMS	MVR/DEVEGA	MOD	MILD
49 MATHU	40	MALE	62810	MS/MR	MVR	MILD	MILD
50 VENUGOPAL	40	MALE	68448	MS/LACLOT	MVR/DEVEGA	SEVERE	MILD
51 KANCHANA	25	FEMALE	30454	CAMS	MVR/DEVEGA	MOD	MILD
52 ANITHA	30	FEMALE	71178	MS/MR	MVR/DEVEGA	MOD	MILD
53 LAVANYA	30	FEMALE	68401	CAMS	MVR	MILD	MILD
54 SELVI	37	FEMALE	63886	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
55 SUMATHY	32	FEMALE	62751	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
56 ARJUNAN	38	MALE	52508	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
57 JAYAPERUMAL	29	MALE	65882	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
58 VADIVEL	38	MALE	63070	CAMS	MVR/DEVEGA	MOD	MILD
59 PUSHPARANI	40	FEMALE	53743	CAMS	MVR	MILD	MILD
60 MANIKAM	38	MALE	70751	MS/MR	MVR/DEVEGA	MOD	MILD
61 BANU	30	FEMALE	74711	MS/MR	MVR/DEVEGA	MOD	MILD
62 CHANDRAN	35	MALE	55149	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
63 RAVI	40	MALE	64289	CAMS	MVR	MILD	MILD
64 MARUTHAMAL	39	FEMALE	73259	MS/LACLOT	MVR/ANNULOPLASTY	MOD	MILD
65 BABU	20	MALE	84840	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
66 RADHA	30	FEMALE	76626	MS/MR	MVR/DEVEGA	MOD	MILD
67 ALAMELU	39	FEMALE	61968	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
68 VALLI	34	FEMALE	74451	MS/LACLOT	MVR/DEVEGA	MOD	MILD
69 MAHESWARI	32	FEMALE	73268	CAMS	MVR	MILD	MILD
70 KUMUDHA	39	FEMALE	67407	MS/MR	MVR/DEVEGA	MOD	MOD
71 RAMU	35	MALE	77264	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
72 mangai	37	FEMALE	76309	CAMS	MVR/DEVEGA	MOD	MILD
73 BARATHI	35	FEMALE	62787	MS/MR	MVR/ANNULOPLASTY	MOD	MILD

74 PERIYASAMY	40	MALE	52131	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
75 NAGAMUTHU	40	FEMALE	85475	MS/LACLOT	MVR	MILD	MILD
76 VIJAY	32	MALE	85258	MS/LACLOT	MVR/DEVEGA	MOD	MILD
77 LALITHA	38	FEMALE	46308	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
78 KAVITHA	31	FEMALE	87438	MS/MR	MVR/DEVEGA	MOD	MILD
79 ARUMUGHAM	38	MALE	88384	CAMS	MVR/DEVEGA	MOD	MILD
80 LAXMI	34	FEMALE	80328	CAMS	MVR	MILD	MILD
81 ESWARAN	33	MALE	88786	MS/MR	MVR/DEVEGA	MOD	MILD
82 KOWSALYA	35	FEMALE	90641	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
83 VENKATESAN	38	MALE	83784	MS/MR	MVR/DEVEGA	MOD	MILD
84 UMA	38	FEMALE	88929	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
85 NIRMALA	40	FEMALE	84023	MS/LACLOT	MVR/DEVEGA	MOD	MILD
86 ANITHA	40	FEMALE	95238	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
87 MANJULA	35	FEMALE	91159	CAMS	MVR	MILD	MILD
88 SHANMUGAM	40	MALE	91449	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
89 KAMARAJ	39	MALE	86156	CAMS	MVR	MILD	MILD
90 SELVARANI	38	FEMALE	96726	CAMS	MVR/DEVEGA	MOD	MILD
91 ELANGO	39	MALE	90868	MS/MR	MVR/DEVEGA	MOD	MILD
92 JANAKI	40	FEMALE	84035	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
93 DAMODARAN	39	FEMALE	102219	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
94 SUNDARAM	40	FEMALE	101318	CAMS	MVR/ANNULOPLASTY	MOD	MILD
95 KALPANA	29	FEMALE	94276	MS/MR	MVR	MILD	MILD
96 NIRMALA	40	FEMALE	82702	MS/MR	MVR/DEVEGA	MOD	MILD
97 RAMESH	34	MALE	99976	CAMS	MVR/ANNULOPLASTY	MOD	MILD
98 ISMAIL	40	MALE	10061	MS/LACLOT	MVR/DEVEGA	MOD	MILD
99 SUDHA	40	FEMALE	88726	MS/MR	MVR	MILD	MILD
100 RAMU	40	MALE	18081	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
101 RANGASAMY	34	MALE	91476	CAMS	MVR/ANNULOPLASTY	MOD	MILD
102 SURUMBAYEE	40	FEMALE	10315	MS/LACLOT	MVR/ANNULOPLASTY	MOD	MILD
103 SEENIVASAN	39	MALE	35770	CAMS	MVR/DEVEGA	MOD	MILD
104 ELUMALAI	40	MALE	97374	CAMS	MVR/DEVEGA	MOD	MILD
105 DHANDAPANI	40	MALE	88091	MS/MR	MVR/DEVEGA	SEVERE	MILD
106 SEKHAR	21	MALE	4713	MR(SEVERE)	MVR	MILD	MILD
107 JOTHI	37	MALE	87719	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
108 SUGUNA	34	FEMALE	5647	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
109 GANDHI	33	MALE	5475	CAMS	MVR/ANNULOPLASTY	MOD	MILD
110 MARY	30	FEMALE	8784	MS/LACLOT	MVR/DEVEGA	MOD	MILD

111 PERUMAL	30	MALE	10188	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
112 MOORTHY	27	MALE	8828	MS/MR	MVR	MOD	MOD
113 MANONMANI	36	FEMALE	3576	MS/MR	MVR/DEVEGA	MOD	MILD
114 PARAMESWARAN	38	MALE	29752	CAMS	MVR/DEVEGA	SEVERE	MILD
115 SELVI	20	FEMALE	98702	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
116 RAVICHANDRAN	38	MALE	7957	MS/MR	MVR/DEVEGA	MOD	MILD
117 THANGARAJ	22	MALE	8846	MS/LACLOT	MVR/DEVEGA	SEVERE	MILD
118 KAMALA	40	FEMALE	10794	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
119 USHA	20	FEMALE	13648	CAMS	MVR	MILD	MILD
120 MALATHY	32	FEMALE	94127	MS/MR	MVR/DEVEGA	MOD	MILD
121 SHANTHI	37	FEMALE	7368	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
122 KASIAMMAL	38	FEMALE	100219	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
123 DARUNISHA	38	FEMALE	100219	MS/MR	MVR/DEVEGA	MOD	MILD
124 VAITHYANATHAN	40	MALE	9415	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
125 KAMATCHI	34	FEMALE	97191	CAMS	MVR/ANNULOPLASTY	MOD	MILD
126 GIRIJA	32	FEMALE	9431	MS/MR	MVR/DEVEGA	MOD	MILD
127 INDHRA	25	FEMALE	14408	MR(SEVERE)	MVR/ANNULOPLASTY	MOD	MILD
128 ILAYAPRIYA	26	FEMALE	9697	MS/MR	MVR/DEVEGA	MOD	MILD
129 LAXMI	30	FEMALE	13969	CAMS	MVR/DEVEGA	MOD	MILD
130 RAMACHANDRAN	20	MALE	13376	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
131 KARTHICK	23	MALE	7074	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MOD
132 MARIAPPAN	40	MALE	11491	MS/MR	MVR/DEVEGA	MOD	MILD
133 NAGAMANI	22	FEMALE	9975	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
134 ANBUMANI	40	MALE	19831	CAMS	MVR/DEVEGA	SEVERE	MILD
135 VAJRAVEL	40	MALE	5052	MS/LACLOT	MVR/DEVEGA	MOD	MILD
136 CHINNATHAMBI	40	MALE	22859	MS/LACLOT	MVR	MILD	MILD
137 MANIKANDAM	23	MALE	17214	MR(SEVERE)	MVR/ANNULOPLASTY	MOD	MILD
138 LAXMI	29	FEMALE	10915	MS/MR	MVR/DEVEGA	MOD	MILD
139 NALLATHANGAL	38	FEMALE	23135	MS/MR	MVR	MILD	MILD
140 ARULRAJ	24	MALE	20211	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
141 DEVI	30	FEMALE	22867	CAMS	MVR/DEVEGA	MOD	MILD
142 LALITHA	27	FEMALE	21740	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
143 PATCHAIAMMAL	40	FEMALE	26714	MS/MR	MVR/ANNULOPLASTY	SEVERE	MOD
144 SIVAKUMAR	30	MALE	228149	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
145 JAYANTHI	25	FEMALE	28949	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
146 BAKYALAXMI	24	FEMALE	24238	MS/MR	MVR/DEVEGA	MOD	MILD
147 KALAIARASI	27	FEMALE	25325	CAMS	MVR/DEVEGA	MOD	MILD

148	MANJULA	38	FEMALE	10399	MS/LACLOT	MVR/DEVEGA	MOD	MILD
149	SAKTHIVEL	25	MALE	28953	CAMS	MVR/DEVEGA	SEVERE	MILD
150	VADIVEL	25	MALE	28081	MS/MR	MVR	MILD	MILD
151	DURAISAMY	29	MALE	31984	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
152	PERUMAL	22	MALE	32363	MS/MR	MVR/DEVEGA	MOD	MILD
153	BAKIYANATHAN	35	MALE	29532	MS/LACLOT	MVR/DEVEGA	SEVERE	MILD
154	RANI	30	FEMALE	27989	CAMS	MVR/DEVEGA	MOD	MILD
155	PONMANI	40	FEMALE	12389	MS/LACLOT	MVR/DEVEGA	MOD	MILD
156	MANDAPATHAL	28	FEMALE	30329	MS/MR	MVR/DEVEGA	MOD	MILD
157	SELVARAJ	29	FEMALE	20222	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
158	NAGARAJ	29	MALE	32097	MS/MR	MVR/DEVEGA	MOD	MILD
159	HARI	40	MALE	38344	CAMS	MVR/DEVEGA	MOD	MILD
160	RATHI	39	FEMALE	33932	MS/LACLOT	MVR/ANNULOPLASTY	MOD	MILD
161	TANTHONY	28	FEMALE	28434	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
162	KUPPU	38	FEMALE	42840	MS/MR	MVR/DEVEGA	SEVERE	MILD
163	PAPPAMAL	40	FEMALE	38937	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
164	MALATHY	34	FEMALE	30022	MS/LACLOT	MVR	MOD	MOD
165	KARTHIKEYAN	36	MALE	35216	MS/MR	MVR/DEVEGA	MOD	MILD
166	BASKHAR	40	MALE	45512	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
167	GEETHA	32	FEMALE	42115	CAMS	MVR/DEVEGA	MOD	MILD
168	KARPAGAM	35	FEMALE	34954	MS/LACLOT	MVR/DEVEGA	MOD	MILD
169	VIJAYAKUMAR	29	MALE	24462	CAMS	MVR/DEVEGA	MOD	MILD
170	KALIAMMAL	40	FEMALE	44129	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
171	JAYA	37	FEMALE	42462	MS/MR	MVR/DEVEGA	MOD	MILD
172	KASINATHAN	35	MALE	51243	CAMS	MVR/DEVEGA	MOD	MILD
173	JAYANTHI	36	FEMALE	51238	MS/LACLOT	MVR/DEVEGA	MOD	MILD
174	PRABHAKARAN	22	MALE	52246	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
175	MONA	40	FEMALE	49468	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
176	AMBIKA	39	FEMALE	45151	MS/LACLOT	MVR/DEVEGA	MOD	MILD
177	LAXMI	32	FEMALE	46167	CAMS	MVR/DEVEGA	SEVERE	MILD
178	JOTHI	38	FEMALE	59071	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
179	ANJALI	30	FEMALE	50571	MS/MR	MVR/DEVEGA	MOD	MILD
180	SARALA	25	FEMALE	56491	MS/LACLOT	MVR	MILD	MILD
181	UMAPATHY	34	MALE	58370	MS/LACLOT	MVR/ANNULOPLASTY	MOD	MILD
182	SOUNDARAJAN	33	MALE	55629	MS/MR	MVR	MILD	MILD
183	SHANKAR	38	MALE	54088	MR(SEVERE)	MVR/DEVEGA	SEVERE	MILD
184	RAJA	35	MALE	62585	MS/MR	MVR/DEVEGA	MOD	MILD

185 VALLI	33	FEMALE	70389	MS/MR	MVR/DEVEGA	SEVERE	MILD
186 UMA	28	FEMALE	70397	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
187 KAVITHA	24	FEMALE	72222	MS/LACLOT	MVR/DEVEGA	MOD	MILD
188 MURUGAN	28	MALE	35540	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
189 VADIVEL	36	MALE	67894	MS/MR	MVR/DEVEGA	MOD	MILD
190 JAYANYHI	27	FEMALE	67385	MR(SEVERE)	MVR/DEVEGA	SEVERE	MILD
191 LATHA	30	FEMALE	54867	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
192 PADMANABAN	34	MALE	78114	MS/LACLOT	MVR/ANNULOPLASTY	MOD	MILD
193 MAHALAXMI	38	FEMALE	69311	MS/MR	MVR/DEVEGA	MOD	MILD
194 ANGAMAL	39	FEMALE	68868	MS/MR	MVR/DEVEGA	MOD	MILD
195 SUMATHY	38	FEMALE	61314	MS/MR	MVR/DEVEGA	MOD	MILD
196 VETRI	26	MALE	72238	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
197 PARAVATHY	40	FEMALE	77954	CAMS	MVR/DEVEGA	MOD	MILD
198 VANDI	26	MALE	74394	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
199 PARIMALA	40	FEMALE	79750	MS/MR	MVR/DEVEGA	SEVERE	MILD
200 RATHNAM	34	FEMALE	75841	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
201 SARATHA	40	FEMALE	74070	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
202 YESUPADHAM	35	MALE	67749	CAMS	MVR/DEVEGA	MOD	MILD
203 SRIDEVI	20	FEMALE	76336	MR(SEVERE)	MVR/ANNULOPLASTY	MOD	MILD
204 MANI	40	MALE	79808	CAMS	MVR/DEVEGA	MOD	MILD
205 RADHA	37	FEMALE	79347	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
206 RATHNAM	40	FEMALE	61289	MS/MR	MVR/DEVEGA	MOD	MILD
207 MALAR	38	FEMALE	71136	MS/LACLOT	MVR/DEVEGA	MOD	MILD
208 RADHA	37	FEMALE	79347	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
209 JOTHI	38	FEMALE	72922	MS/MR	MVR	MILD	MILD
210 RAJKUMAR	27	MALE	67590	MS/MR	MVR/DEVEGA	MOD	MILD
211 HARIDOSS	36	MALE	71601	MS/MR	MVR/DEVEGA	SEVERE	MILD
212 VADIVEL	30	MALE	76350	CAMS	MVR/DEVEGA	SEVERE	MILD
213 KRISHNAN	38	MALE	62732	MS/MR	MVR	MILD	MILD
214 LALITHA	33	FEMALE	80719	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
215 SATISH	23	MALE	74345	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
216 VALI	33	FEMALE	81986	CAMS	MVR	MILD	MILD
217 CHITRA	30	FEMALE	74686	MS/LACLOT	MVR/ANNULOPLASTY	SEVERE	MILD
218 ELLAMAL	40	FEMALE	60527	CAMS	MVR/DEVEGA	MOD	MILD
219 SAKTHIVEL	17	MALE	88445	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
220 ARUNA	40	FEMALE	65344	MS/MR	MVR/ANNULOPLASTY	MOD	MILD
221 DHANALAXMI	40	FEMALE	80760	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD

222 SELVI	37	FEMALE	78880	MS/MR	MVR/DEVEGA	MOD	MILD
223 SUMATHY	29	FEMALE	86514	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
224 SATHYA	24	FEMALE	98912	MS/MR	MVR	MILD	MILD
225 VIMALATHA	23	FEMALE	79781	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
226 BASKAR	40	MALE	78787	MS/MR	MVR/DEVEGA	MOD	MILD
227 KULLAMAL	32	FEMALE	48639	CAMS	MVR/DEVEGA	MOD	MILD
228 MADHURAM	40	FEMALE	51916	MS/MR	MVR/DEVEGA	SEVERE	MILD
229 SARALA	38	FEMALE	34667	MS/LACLOT	MVR/DEVEGA	SEVERE	MILD
230 CHANDRAN	40	MALE	56102	MS/LACLOT	MVR	MILD	MILD
231 SARAVANAN	35	MALE	55127	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
232 VELAYUTHAM	40	MALE	53128	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
233 MARY	36	FEMALE	48565	MS/LACLOT	MVR/DEVEGA	MOD	MILD
234 SEENIVASAN	39	MALE	52341	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD
235 RANI	40	FEMALE	45181	MS/LACLOT	MVR/DEVEGA	MOD	MILD
236 ELLAMAL	40	FEMALE	47284	MS/MR	MVR	MILD	MILD
237 SARADHA	38	FEMALE	44893	CAMS	MVR/DEVEGA	SEVERE	MILD
238 SUBRAMANI	40	FEMALE	47505	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
239 VIJAYAN	39	MALE	51628	MS/MR	MVR/DEVEGA	MOD	MILD
240 SARALA	30	FEMALE	47340	MS/LACLOT	MVR/ANNULOPLASTY	MOD	MILD
241 DRAUPATHY	29	FEMALE	63771	MR(SEVERE)	MVR/DEVEGA	MOD	MILD
242 KUPPAMAL	30	FEMALE	53373	MR(SEVERE)	MVR/ANNULOPLASTY	MOD	MILD
243 NITHYA	20	FEMALE	60550	CAMS	MVR/ANNULOPLASTY	SEVERE	MILD
244 RAJATHI	40	FEMALE	49592	CAMS	MVR/DEVEGA	MOD	MILD
245 MALIK	40	MALE	59394	MS/MR	MVR	MOD	MOD
246 SELVI	20	FEMALE	62623	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
247 RAJESWARI	35	FEMALE	62679	MS/MR	MVR/DEVEGA	SEVERE	MILD
248 SARAVANAN	20	MALE	54426	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
249 ANBARASAN	20	MALE	81265	MR(SEVERE)	MVR/ANNULOPLASTY	SEVERE	MILD
250 RAVI	23	MALE	81287	MS/MR	MVR/ANNULOPLASTY	SEVERE	MILD