Dissertation on

COMPARATIVE STUDY BETWEEN BILEAFLET AND TILTING DISC MECHANICAL VALVE PROSTHESIS - A RETROSPECTIVE ANALYSIS

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CERTIFICATE

This is to certify that the dissertation entitled **"COMPARATIVE STUDY BETWEEN BILEAFLET AND TILTING DISC MECHANICAL VALVE PROSTHESIS - A RETROSPECTIVE ANALYSIS"** presented here is the original work done by **Dr.ARUNKUMAR.K** in the department of Cardio Thoracic Surgery, Rajiv Gandhi 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 solemnly declare that this dissertation titled **"COMPARATIVE STUDY BETWEEN BILEAFLET AND TILTING DISC MECHANICAL VALVE PROTHESIS – A RETROSPECTIVE ANALYSIS "** is done by me in the Department of Cardiovascular and Thoracic Surgery, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai under the guidance and supervision of **Prof.S.Manoharan, MS., Mch**., Professor & Head of the Department, Department of Cardio Vascular and Thoracic Surgery, Madras Medical College & Rajiv Gandhi Government General Hospital, Chennai. This dissertation is submitted to the Tamil Nadu Dr.MGR Medical University, Chennai in partial fulfillment of the university requirements for the award of the degree of **Mch Cardiovascular and Thoracic Surgery**.

Place : Chennai **K. ArunKumar**

Date :

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INDEX

The innovation of mechanical heart valve prosthesis five decades ago by retired engineer M.Lowel Edwards from orange country (left) and a young cardiac surgeon Albert Starr (right) from oregan was one of the most significant breakthroughs in history of cardiothoracic surgery

INTRODUCTION

Introduction

The ideal valvular prosthesis, as described by **Harken**[1], the prosthesis should have a hemodynamic performance similar to a healthy native valve, durable with a longevity approaching that of a native valve, Thrombogenicity would be non-existent, no valve related long-term morbidity and mortality, should be easy to implant, should last forever and should have a good availability in all sizes, finally, growth commensurate with that of the recipient would be possible. None of the valve prostheses, that are available today, fulfill this entire criterion. It remains the **Holy Grail of cardiac surgery.** When a patient needs a valve replacement today, there are several options for the valve substitute. The most often used mechanical valve prosthesis is **"bileaflet"** or "**tilting disc**''. In order to determine which of these the best valve prosthesis is for a particular patient, we cannot rely on large prospective randomized studies proving that at any given age of a patient one kind of valve prosthesis is superior to all others. The reason for this is that such studies are not available. Therefore, we have to look at the results of different kind of valve substitutes in large mainly retrospective series. It is important to realize that it is very difficult to compare the reported results. Moreover, most reports are coming from different countries, are done by different investigators whereas patient population are often not comparable. Nearly, 175 isolated valve replacements including aortic and mitral position are being done every year at Government General Hospital, Chennai. Hence, it is paramount importance to find ideal mechanical valve prosthesis and eventually cost effective. This study designed retrospectively to analysis short term outcomes between "**bileaflet"** and "**tilting disc**'' mechanical valve prosthesis.

AIM OF THE STUDY

Aim of the study

In our department 60% of all open heart procedures per annum are valve replacements. Among these 70% are isolated mitral valve replacements, 20% isolated aortic valve replacement, 10% double valve replacements. Valve replacements done by using mechanical valve prosthesis either **“bileaflet”** or “**tilting disc**’’ from different marketing companies. Considering high volume valve replacements being done in our center, it is imperative to conduct a study to find an ideal mechanical valve prosthesis between **“bileaflet”** and “**tilting disc**’’.

With above concepts in mind, aims of this trial are,

- To compare the ease of procedure on valve orientation and placement
- To compare the immediate post-operative hemodynamics
- To compare the gradient across of valve on post op echocardiography
- To compare the post op left ventricular function
- To compare the incidence of valve thrombosis
- Embolic and hemorrhagic complications
- To compare the valve related mortality
- Freedom from complications for 6 months after discharge

REVIEW OF THE LITERATURE

Review of the Literature

History

The first human heart valve operation was a digital valvotomy of a stenotic aortic valve performed by **Tuffier** in 1914. Cutler, Sutter[2], Brock, Swan, and Harken refined valvotomies and commissurotomies over the ensuing decades. The need for a replacement valve arose out of the quest for an effective treatment of valvular insufficiency. In 1950 **Hufnagel[3]** developed a ball valve, designed to be placed in the descending thoracic aorta. He was the first to implant a prosthetic valve in a human when he implanted his valve in the descending thoracic aorta of a patient with severe aortic insufficiency.

With the introduction of cardiopulmonary bypass, open valve replacement became a possibility. The first successful prosthetic mitral valve was a device implanted by **Nina Braunwald** at the National Institutes of Health in 1959. This was a homemade device with artificial chordae made of polyurethane. In 1960 **Harken** successfully performed aortic valve replacements with valves made of polyurethane.

In 1961 the first reliable device for replacement of the mitral valve was produced on a commercial basis. This was **the Starr-Edwards** ball-and cage mitral valve that resulted from the collaboration of Albert Starr, a cardiac surgeon in Portland, and Lowell Edwards, a mechanical engineer in southern California. This prosthesis was a great success and became the **"gold standard"** for many years, until the late 1960s, when second and third-generation prosthetic valves began to appear. Although reliable hemodynamically, it was soon found that the Starr-Edwards valve

had significant thromboembolic potential, particularly in the small ventricle, and aggressive anticoagulation was required to control thromboembolic events. The Silastic ball in the original prosthesis also had to be replaced because of inadequate durability.

To overcome these limitations, several investigators designed disk valves, which functioned by having a disk pivot into an open or closed position as dictated by flow across the valve. The first of these tilting disk valves was the Wada hinge less valve introduced by the Japanese surgeon **Jura Wada**, in 1966. The Lillehei–Kaster valve was a hinge less valve, with a freely rotating pivoting disk retained by struts, which was introduced in 1967 by C. Walton Lillehei and Robert L. Kaster. Viking Bjork, working with Shiley Laboratories, developed a similar version of a hinge less pivoting disk valve. Although the hemodynamic profile was improved when compared to the caged ball valves, these early pivoting disk valves were subject to occasional thrombosis. The 60° Convexo-Concave Bjork–Shiley disk valve was prone to catastrophic structural failure secondary to fracture of its welded struts; the resultant strut fracture led to escape of the occluder disk, which led to its eventual withdrawal from the market[9]. Seeking to improve on the problems of durability and Thrombogenicity seen with these initial pivoting disk valves, Karl-Victor Hall, along with Woien and Kaster and the Medtronic Corporation, introduced the **Medtronic–Hall valve** in 1977.

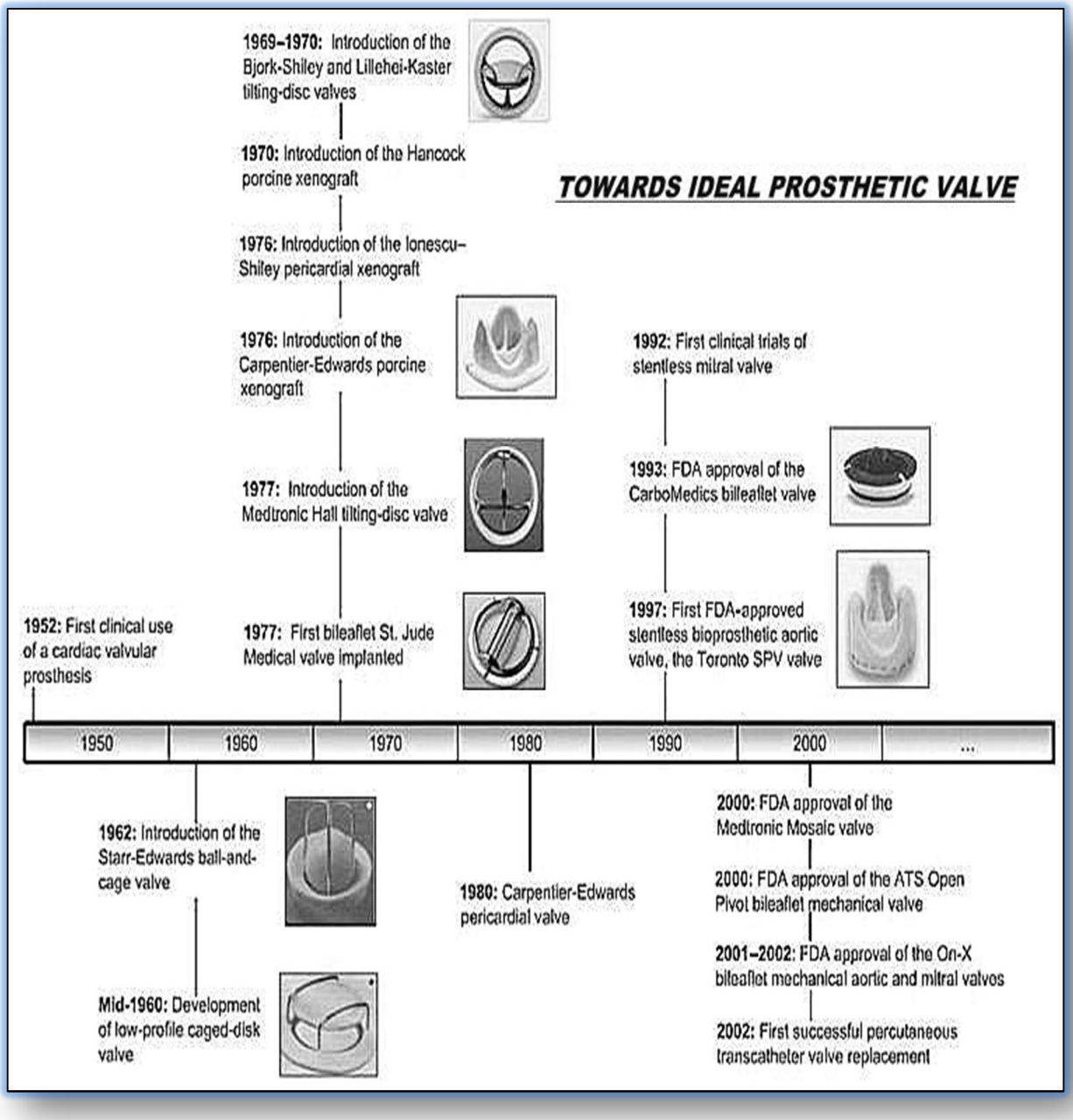
A third-generation prosthetic valve was developed in 1977 that became the valve of the 1980s: the bileaflet **St. Jude Medical valve**, which had improved hemodynamics compared with older valves with less stagnation of blood, more complete opening of the leaflets, and reduced incidence of thromboembolism.

It has gone through several refinements and is currently the most commonly used mechanical valve prosthesis. Structural failure is no longer a source of significant morbidity with mechanical prostheses, but thromboembolism and anticoagulant associated hemorrhage remain significant sources of morbidity.

Since the introduction of SJM bileaflet valve, numerous other attempts have been made to improve upon that bileaflet valve design. For example, the **CarboMedics** (Sorin Group, Austin, TX, USA) bileaflet prosthesis, which gained US Food and Drug Administration (FDA) approval in 1993, differs from the SJM bileaflet heart valve by the opening angle of its leaflet and the shape of the hinge region (which has sharper features than the hinge region of the SJM valve). **The ATS Open Pivot valve** (Minneapolis, MN, USA), introduced in 2000, also features a change in the pivot design. This design inverts the traditional pivot mechanism by exposing the pivot to the bulk forward flow and using a protruding rather than a recessed hinge design. The On-X valve, marketed by the Medical Carbon Research Institute (Austin, TX, USA), is the most recent mechanical valve design introduced in the US. Some of the innovative features of this valve are a length-to-diameter ratio close to that of native heart valves, a smoothed pivot recess that allows the leaflets to open at an angle of 90° relative to the valve housing and a two-point landing mechanism during valve closure. The bileaflet mechanical heart valve is, at present, the most popular mechanical design and accounts for approximately 80% of implanted mechanical valves

Independently, in 1969 Carpentier and Hancock developed the first porcine xenografts. Lonescu developed the first glutaraldehyde-preserved bovine pericardial

valve in 1971. Limited long-term durability secondary to leaflet calcification and subsequent perforation plagued these early bioprostheses. Significant progress has been made with the latest generation bioprostheses using state-of-the-art fixation and preservation methods to achieve extended durability.



Types of mechanical valve prosthesis

Caged Ball Prostheses

Starr–Edwards Silastic Ball Valve Prosthesis

The Starr–Edwards ball valve prosthesis (Edwards Life sciences, Inc., Irvine, CA) were introduced in 1966. The model currently available is constructed of a cage made from a single piece of titanium that covers a Silastic ball. Although the valve is very durable and has a notable history, indications for its use today are limited because it's hemodynamic and thromboembolic profiles do not match more modern designs.

Tilting Disk Prostheses

Medtronic–Hall Mechanical Heart Valve

The Medtronic–Hall tilting disk valve (Medtronic, Inc., Minneapolis, MN) came on the market in 1977. The valve housing is constructed from one piece of titanium alloy with no introduced welds or bends. The round central disk is made from tungsten-impregnated graphite with a pyrolytic carbon coating and has a central hole that allows the disk to be retained by a curved central guide strut that is part of the housing. It was hoped that its design would be an improvement on previous tilting disk valves in terms of durability, hemodynamic performance, and reduced Thrombogenicity. Its design incorporated several new features designed to decrease Thrombogenicity. Areas of low flow across the valve are reduced by a relatively larger minor orifice and a disk that lifts out of the housing and rotates with opening, which improves the ability of the valve to wash itself. Loss of structural integrity has not been reported. The valve can be rotated after implantation and has a low inherent transvalvular gradient. It has a moderately high profile in the open

position. Occluder impingement is possible because its position at the equator of the valve housing makes it susceptible to obstruction from retained valve elements or sutures cut too long.

Aortic prostheses are available in sizes from 20–31 mm. The optimal orientation is with the larger orifice of the aortic prosthesis facing the greater curvature of the aorta. Mitral prostheses are available in sizes from 23–33 mm. Low incidences of valve-related morbidity and mortality has been demonstrated by several studies. Most recently Butchart et al[30], from the University Hospital of Wales, reported their 20-year experience with 1766 Medtronic–Hall valve replacements. Akins[7] at the Massachusetts General Hospital, also recently reported his extensive experience with the Medtronic–Hall valve, with favourable results.

TTK chitra valve

Unique in design, construction and fabrication, the TTK Chitra Heart Valve Prosthesis is one of the extensively researched, tested and clinically evaluated device in India. Initially conceived in 1978, the heart valve being a critical implant went through the most painstaking development for 12 years at the prestigious Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Trivandrum, India - an autonomous Institute under the Department of Science and Technology, Government of India. The development also followed international protocols applicable to heart valve prosthesis.

The shock absorbing characteristics of the disc prevents structural failure by gently transferring stresses while greatly abating valve noise. The low physical profile, the streamlined flow contours and the mirror finish all combine to give excellent hemodynamic performance for the TTK Chitra Heart Valve. The pressure

gradients across the valve, the effective orifice area, the regurgitant volume per cycle, energy loss and performance index are all comparable to or better than other mechanical valves[17, 18].

The TTK Chitra Valvular Prosthesis has three components:

- A frame carved out of a single block of Chrome Cobalt Alloy, long proven in cardiac valvular implants.

- An occluder made from the superbly biocompatible Ultra High Molecular Weight Polyethylene (UHMW-PE).

- A sewing ring made from implant tested 100% Polyester fabric.TK Chitra Heart Valve

Bileaflet Prostheses

St. Jude Medical Mechanical Heart Valve

The St. Jude Medical (SJM) valve prosthesis (St. Jude Medical, Inc., Minneapolis, MN) is the most commonly used bileaflet mechanical valve today. The FDA approved it in 1977, and over 1 million valves have been implanted. It is constructed of pyrolytic carbon and has proven to be extremely durable, with only 20 instances of structural integrity loss being reported. The standard SJM valve is available in sizes from 19–31 mm for aortic valves and sizes from 19–33 mm for mitral valves. The SJM Masters series valves employ the same basic design as the standard series, but are designed to allow rotation after implantation[10].

On-X Prosthetic Heart Valve

The On-X prosthetic valve (Medical Carbon Research Institute, Austin, TX) is a bileaflet valve constructed completely of pyrolytic carbon. The valve's manufacturer claims that the lack of silicon doping in the valve's carbon construction decreases its Thrombogenicity. The manufacturer also points to a tall flared inlet that increases orifice area and decreases the ability of retained valve tissue to interfere with valve opening and closing. The design of the valve's pivots also allows the valve to wash itself. Aortic valves are available in sizes from 19–29 mm, and mitral valves are available in sizes from 23–33 mm. A Conform X model is available with a more flexible sewing ring. The valve was introduced in 1996 and received FDA approval in May 2001. It is not yet known if this valve will be less Thrombogenicity than other mechanical valves[11].

ATS Medical Open Pivot Mechanical Heart Valve

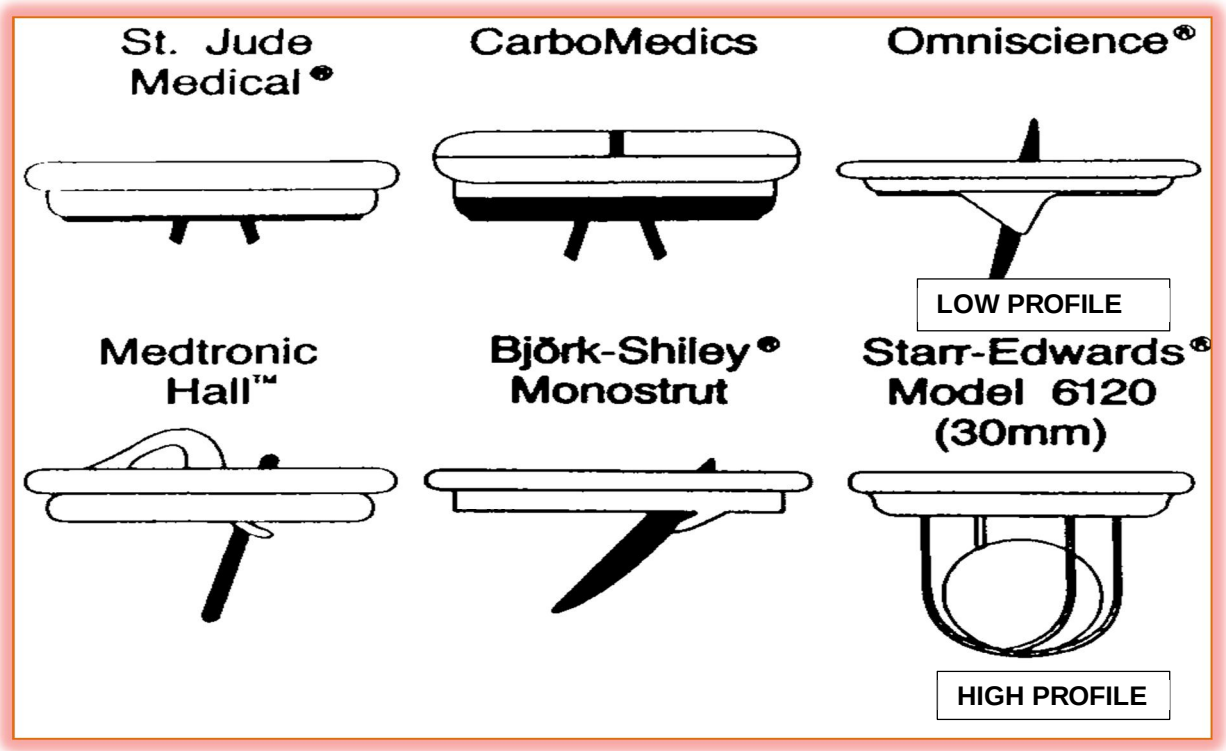
The ATS Medical Open Pivot mechanical heart valve (ATS Medical, Inc., MN) is a bileaflet valve. It is available in sizes from 19–31 mm for the aortic position and from 19–33 mm for the mitral position[13].

CarboMedics Prosthetic Heart Valve

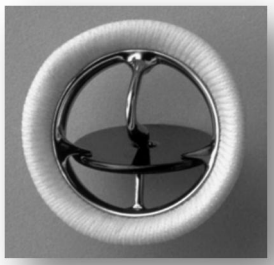
The CarboMedics prosthetic heart valve (Sulzer CarboMedics, Inc., Austin, TX), introduced in 1986, and was the first rotatable bileaflet mechanical valve. Standard aortic and mitral prostheses are available in sizes from 19–31 mm and from 23–33 mm, respectively. Paediatric/small adult valves are available in smaller sizes: aortic: 16–18 mm; mitral: 16–21 mm. The Top Hat Supra-Annular aortic valve is designed to maximize effective orifice area by having the sewing cuff of the valve sit above the annulus. A potential advantage over the SJM HP valve comes from the

fact that the pivot guards of the Top Hat are completely supraannular. Top Hat valves are available in sizes from 19–27 mm. Concerns over valve thrombosis, particularly in the mitral position, have been raised by observational studies comparing the CarboMedics prosthetic heart valve with the SJM prosthesis[26]. Other studies, including a randomized prospective trial from the Bristol Heart Institute in England, have not substantiated this concern and describe a similar pattern of morbidity and mortality for the two bileaflet mechanical valves The Optiform mitral prosthesis is designed for supraannular, intraannular, or subannular placement and is available in sizes from 23–33 mm.

Current FDA-Approved Prosthetic Heart Valves(2006)
Mechanical
Alliance Medical Technologies Monostrut Cardiac Valve Prosthesis
ATS Medical Open Pivot Bileaflet Heart Valve
Edwards Lifesciences Starr–Edwards Silastic Ball Heart Valve Prosthesis
Medical Carbon Research Institute On-X Prosthetic Heart Valve
Medical CV Omniscience Cardiac Valve Prosthesis
Medical CV Omni carbon Cardiac Valve Prosthesis
Medtronic–Hall Prosthetic Heart Valve
St. Jude Medical Mechanical Heart Valve
Sulzer CarboMedics Prosthetic Heart Valve(SORIN)



Starr–Edwards



Medtronic hall

TTK - chitra

St Jude

CarboMedics

ATS

FLUID DYNAMICS ON MECHANICAL PROSTHETIC VALVES

Ball-and-cage valve

During the forward flow phase, the flow emerging from the valve forms a circumferential jet that separates from the ball, hits the wall of the flow chamber and then flows along the wall. At peak forward flow, a maximum velocity as high as 2.20 m/s was reported near the annulus in this forward flow jet under aortic conditions. This velocity decreases to 1.80 m/s 30 mm downstream of the valve. Immediately downstream of the apex of the cage, a wake develops and a region of low-velocity recirculating flow is present throughout the forward flow phase. A region of high-velocity gradient, and thus of high shear, exists at the edge of the forward flow jet and the recirculation region. A maximum turbulent shear stress up to 1850 dyn/cm2 was measured in this region. Turbulent shear stresses reach as high as 3500 dyn/cm2 in the annular region between the flow channel wall and the ball. Such high shear levels are clearly above the established thresholds to activate platelets ,and thus where thrombus formation may occur. This is confirmed by clinical results that revealed the presence of thrombi at the apex of the cage

During the leakage flow phase, the ball moves back on the valve seat, but a small gap may form, thus permitting a mild regurgitation. However, regions of elevated shear may exist at the edges of the leakage jets, thus promoting platelet activation.

Tilting-disc valve

In the open position, the disc tilts to form a major orifice and a minor orifice for the blood to flow. A large forward flow jet emanates from the major orifice,

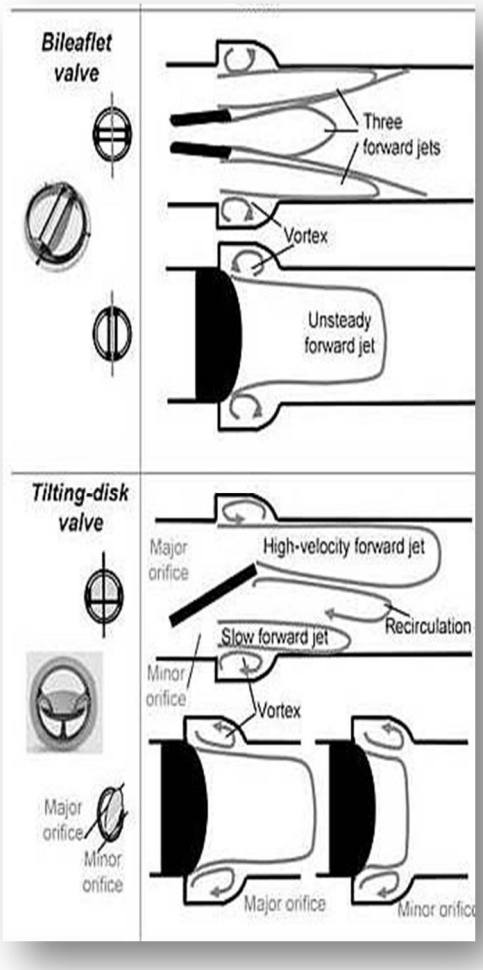
whereas a smaller jet of lesser velocity magnitude emanates from the minor orifices. These two jets of different velocity magnitudes induce a recirculation in the wake of the disc. A recirculating flow pattern forms in the sinus region. Studies report that in the major orifice region, high turbulent shear stresses are confined to narrow regions at the edges of the major orifice jet.9,23 Maximum turbulent shear stresses measured at peak systole are in the order of 1500 dyn/cm2 High turbulent shear stresses are more dispersed in the minor orifice than those in the major orifice region.

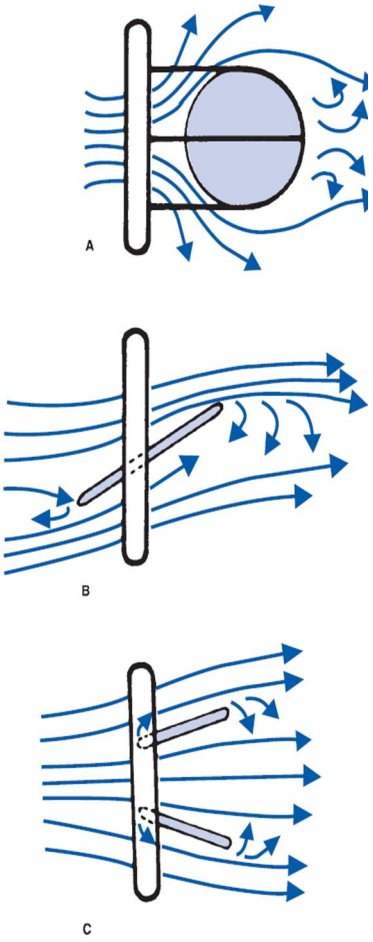
During the closed phase, the tilting disc moves back and seats on the valve housing to occlude the valve orifice; however, a small gap may be present at the periphery of the disc, thus permitting a small amount of flow regurgitation. Moreover, tilting-disc valve designs include a retaining mechanism for the disc.

Bileaflet valve

As mentioned earlier, the open leaflets divide the area available for the flow into three regions: two lateral orifices and a central orifice. The major part of the forward flow emerges from the two lateral orifices. Measurements along the Centre plane of the valve 8 mm distal to the valve annulus indicate that the velocity in the lateral orifices (2.2 m/s) is higher than in the central orifice (2 m/s). Two recirculation regions are seen in the sinus region of the aortic root. High turbulent shear stresses are present at locations of high-velocity gradients and at locations immediately distal to the valve leaflets. The flow becomes more disturbed as it travels further downstream of the valve. A close look at the vorticity contours (curl of the velocity field) indicates the formation of alternately rotating counter vortices in the wake of the leaflets at peak forward flow[26,27]. This structure disappears during the

deceleration phase and is replaced by a highly chaotic flow field. The peak turbulent shear stresses measured along the centreline plane at peak systole are in the order of 1500 dyn/cm2 downstream of the valve. During the leakage flow phase, the leaflets rotate to occlude the valve orifice. All the hinge flow fields are characterized by the presence of recirculation regions during the forward flow phase. Such recirculating flow regions are the primary locations where clots begin to form by increasing cell-to-cell contact time. Therefore, it is important to note that the hinge design plays an essential role in thrombus formation.





HEMODYNAMIC ASSESSMENT OF CARDIAC VALVES

The normal valve area is 3.0–4.0 cm^2 for the aortic valve and 4.0–5.0 cm^2 for the mitral valve. Stented bioprostheses and mechanical prostheses have inherent gradients because the actual valve is supported by a stent and housing material. The effective orifice area (EOA) refers to the true cross-sectional area of the prosthetic valve orifice through which blood must flow. The gold standard for measuring valve area is the Gorlin formula, which uses data derived from catheterization and applies hydraulic formulas for fixed orifice systems to heart valves. The formula is as follows:

$$\text{Valve area} = \frac{\text{cardiac output (liters/min)}}{\sqrt{\text{pressure gradient}}}$$

The continuity equation uses echo Doppler-acquired data to calculate EOA. Both a standard and a simplified equation exist. The standard equation is as follows:

$$\mathbf{EOA = SV/VTI\ (\ \Sigma\ t\ dt/\ \Sigma\ v\ t\ dt\ )}$$

Where *SV* is the stroke volume (derived from flow measurement) and *VTI* is the velocity time integral across the prosthesis (also measured by Doppler).

The simplified equation is

$$\mathbf{EOA = Qp/Vp}$$

where *Qp* is peak flow (ml/sec) and *Vp* (ml/sec × cm^2) is the peak flow velocity across the valve.The continuity equation has been shown to be accurate for bioprostheses. When applied to bileaflet valves such as the St. Jude Medical

prosthesis, it has been shown to underestimate valve area because of localized high-velocity jets.

Although valve manufacturers have often used the geometrical cross-sectional area of prostheses to describe their size, the parameter that is clinically important is the functional orifice of the valve: the EOA. In general, EOA is proportional to valve size for a given type of prosthesis, and the EOA is generally always less than the cross-sectional area of a patient's valve annulus. Accordingly, some degree of obstruction is always imparted by prostheses, and this is particularly important in the case of the aortic valve.. Although the concept of patient–prosthesis mismatch makes intuitive sense, its impact on patient morbidity and mortality in the short or long term remains unclear and is the subject of numerous studies. Some authors have suggested that patient–prosthesis mismatch can be avoided when the ratio of EOA to patient body surface area exceeds 0.85 cm^2/m^2

Hemodynamics of Mitral Valve Prostheses

		EOA (cm^2)					Mean diastolic gradient (mm Hg)				
Valve	Reference (year)	25 mm	27 mm	29 mm	31 mm	33 mm	25 mm	27 mm	29 mm	31 mm	33 mm
Starr-Edwards	Pyle[133] (1978)		1.4	1.4	1.9			8.0	10.0	5.0	
	Sala[135] (1982)							7.9	6.7	5.0	
	Horskotte[123] (1987)			1.8				6.3			
Omniscience/ Omnicarbon	Mikhail[131] (1989)							6.1		5.4	
	Messner-Pellenc[130] (1993)		1.9	2.2	2.0	2.0	4.3	3.6	3.5	2.0	
	Fehske[119] (1994)						6	6	5	6	4
	di Summa[117] (2002)	1.7	1.9	1.6	1.9		9	4.1	5.1	5.6	
Medtronic Hall	Hall[121] (1985)							3.0	2.7	2.0	
	Fiore[15] (1998)						4.0	4.3	3.1	2.9	2.7
St. Jude	Chaux[12] (1981)			2.1	2.8	3.1			1.9	1.8	1.6
	Horskotte[123] (1987)			3.1					2.3		
	Fiore[15] (1998)						3.0	3.3	3.8	1.5	2.5
	Hasegawa[122] (2000)	2.6	2.5	2.4							
Carbomedics	Johnston[126] (1992)			3.3					3.8		
	Chambers[114] (1993)		2.1	2.1	1.8			3.9	3.3	3.3	
	Carbomedics[110] (1993)		2.9	3.0	3.0			3.9	4.6	4.6	
	Carrier[112] (2006)						5.3	4.9	4.6	4.4	4.9
ATS	Westaby[141] (1996)		3	2	2	2					
	Shiono[136] (1996)						5	6	4.5		
	Hasegawa[122] (2000)	2.3	2.6	2.7							
	Emery[188] (2001)						7.8	5	6	4	3

Indications for Mechanical Valve Replacement

- High probability for anticoagulant use
- Need for chronic anticoagulation (any age)
- Preferences of patient
- Surgical risk for reoperation
- Age below 55 years
- Age 55–70 years with patient discussion

Indications of Mitral Valve Replacement

Mitral Stenosis

Any patient with symptomatic mitral stenosis (with or without pulmonary hypertension, right heart failure, or haemoptysis) is considered an operative candidate unless he or she is a suitable candidate for percutaneous balloon valvotomy. It is generally agreed that operation is indicated for individuals in New York Heart Association (NYHA) functional class III or IV and those with critical mitral stenosis by echocardiographic criteria (mitral valve orifice <1.0 cm^2) and severe pulmonary hypertension (>60 mm Hg), regardless of symptoms. Although the onset of atrial fibrillation usually exacerbates symptoms, it is only a relative indication for operation; conversely, the development of systemic embolization should prompt early surgical consideration. Prophylactic operation may also be necessary for women with asymptomatic, severe mitral stenosis who plan to become pregnant, due to the increased hemodynamic burden during the third trimester.

Mitral Regurgitation

Acute mitral insufficiency accompanied by hemodynamic compromise that cannot be easily managed medically mandates urgent mitral valve repair or replacement. On the other hand, most patients stabilize with medical therapy. Patients with advanced class III or IV congestive heart failure symptoms as a result of chronic mitral regurgitation generally have depressed left ventricular systolic function; operation is indicated, and probably should have been offered much earlier. In contrast, the optimal timing for surgical treatment of patients with asymptomatic or minimally symptomatic chronic mitral regurgitation is debatable. Determination of left ventricular dimensions and measurement of right ventricular systolic pressure during exercise are the most useful objective approaches in terms of prognosis and determining therapy. For those with no or minimal symptoms, early operation is warranted if there is severe mitral regurgitation, the valve looks repairable, or there is evidence of progressive left ventricular dilation or any degree of systolic left ventricular dysfunction. Echocardiographic indicators include ejection fraction <60%, end-systolic diameter >40 mm. The evidence also favours operation for new onset of atrial fibrillation or pulmonary hypertension (>50 mm Hg at rest or >60 mm Hg with exercise). If the echocardiographic findings indicate that a high likelihood of valve repair does not exist and MVR is probably necessary, asymptomatic or minimally symptomatic patients should be treated medically and followed with serial echocardiograms.

Indications of Aortic Valve Replacement

Aortic stenosis

The normal area of the aortic valve is 2-3 cm2. An area less than 0.8 cm2 can be considered severe stenosis, as is a gradient across the aortic valve of greater than 50 mm mean gradient.

The indications for surgery for aortic stenosis include the classic symptoms of Syncope, angina or heart failure. Of these, angina is the most common symptom occurring in half of patients requiring aortic valve replacement for aortic stenosis. These symptoms usually exist when the aortic valve gradient is greater than 50 mmHg or the area of the valve is less than 1 cm2.

ACC/AHA Guidelines for Aortic Valve Replacement in Patients with Aortic Stenosis (AS)

Indication	Class
1. Symptomatic patients with severe AS	I
2. Patients with severe AS undergoing coronary bypass surgery	I
3. Patients with severe AS undergoing surgery on the aorta or other heart valves	I
4. Patients with severe AS and left ventricular systolic dysfunction (ejection fraction <50%)	I
5. Patients with moderate AS undergoing coronary artery bypass or other aortic or valvular surgery	IIA
6. Asymptomatic patients with severe AS and:	
a. Abnormal response to exercise (hypotension)	IIB
b. Likelihood of rapid progression (age, calcification, or coronary artery disease)	IIB
c. Ventricular tachycardia	IIB
d. Valve area <0.6 cm^2, mean gradient >60 mm Hg, jet velocity >5.0 m/s	IIB
7. Patients with mild AS and moderate to severe valve calcification undergoing coronary bypass surgery	IIB
8. Prevention of sudden death in an asymptomatic patient with none of the findings in 5–7.	III

Aortic Regurgitation

Aortic insufficiency has a more varied aetiology. Rheumatic disease is the most common cause of aortic insufficiency. Unlike rheumatic aortic stenosis, commissural fusion is not present in rheumatic insufficiency and the leaflets are only

minimally thickened .The basic pathology of aortic insufficiency related to rheumatic disease is related to shortening of the cusps.

Other causes of aortic insufficiency include bicuspid or unicuspid aortic valves, endocarditis, and annular ectasia from a chronic aortic aneurysm or from acute dissection.

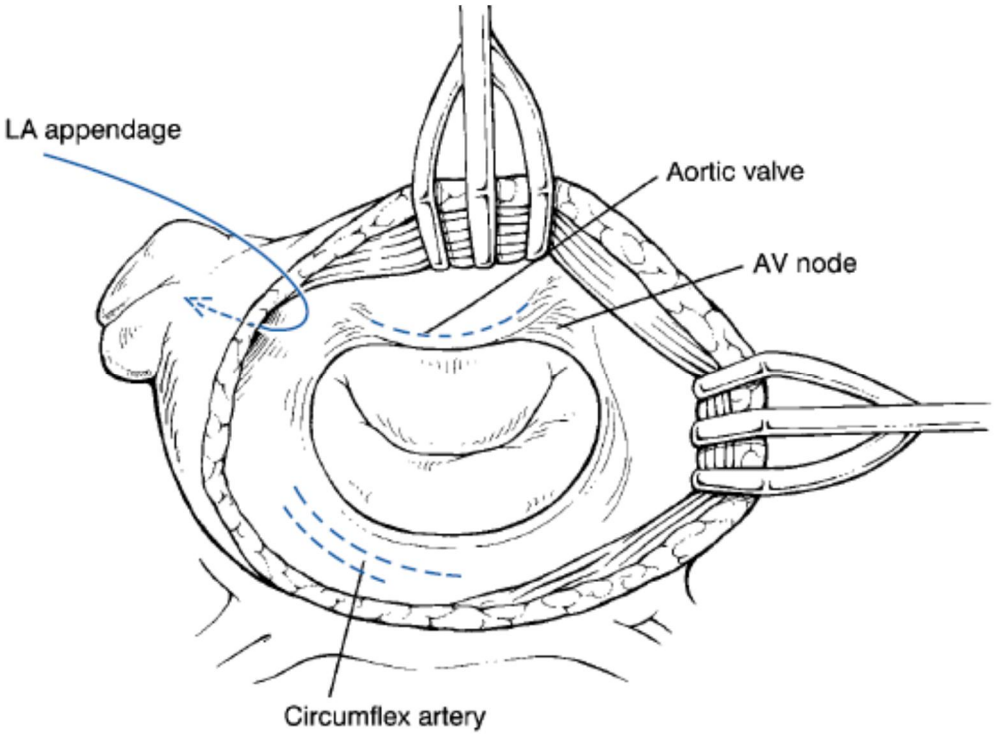
Indications for operating on patients with aortic insufficiency are much more complex and less clear-cut than for stenosis. Generally, Class III or Class IV heart failure status is an indication for surgery. For Class I or Class II New York Heart Association classification, surgery is only performed if there are signs of left ventricular dysfunction.

ACC/AHA Recommendations for Aortic Valve Replacement (AVR) in Chronic Severe Aortic Regurgitation (AR)

Indication	Class
1. AVR is indicated for symptomatic patients with severe AR irrespective of left ventricular systolic function	I
2. AVR is indicated for asymptomatic patients with chronic severe AR and left ventricular systolic dysfunction (ejection fraction ≤0.50) at rest	I
3. AVR is indicated for patients with chronic severe AR while undergoing coronary artery bypass graft or surgery on the aorta or other heart valves	I
4. AVR is reasonable for asymptomatic patients with severe AR with normal left ventricular systolic function (ejection fraction >0.50) but with severe left ventricular dilatation (end-diastolic dimension >75 mm or end-systolic dimension >55 mm)*	IIA
5. AVR may be considered in patients with moderate AR while undergoing surgery on the ascending aorta	IIB
6. AVR may be considered in patients with moderate AR while undergoing coronary artery bypass graft surgery	IIB
7. AVR may be considered for asymptomatic patients with severe AR and normal left ventricular systolic function at rest (ejection fraction >0.50) when the degree of left ventricular dilatation exceeds an end-diastolic dimension of 70 mm or end-systolic dimension of 50 mm, when there is evidence of progressive left ventricular dilatation, declining exercise tolerance, or abnormal hemodynamic responses to exercise.*	IIB
8. AVR is not indicated for asymptomatic patients with mild, moderate, or severe AR and normal left ventricular systolic function at rest (ejection fraction >0.50) when the degree of dilatation is not moderate or severe (end-diastolic dimension <70 mm, and those with end-diastolic dimension >70 mm should have aortic valve replacement if there is evidence of serial deterioration of ventricular function or exercise intolerance.).*	III

Mitral valve replacement

Anatomy



The mitral valvular apparatus is an assembly of complex independent elements that constitute a functional entity. The mitral valve is composed of leaflets (valve tissue), mitral annulus, chordae tendineae, papillary muscles, and the left ventricle. The chordae tendineae and papillary muscles form the subvalvular apparatus.

Operative techniques

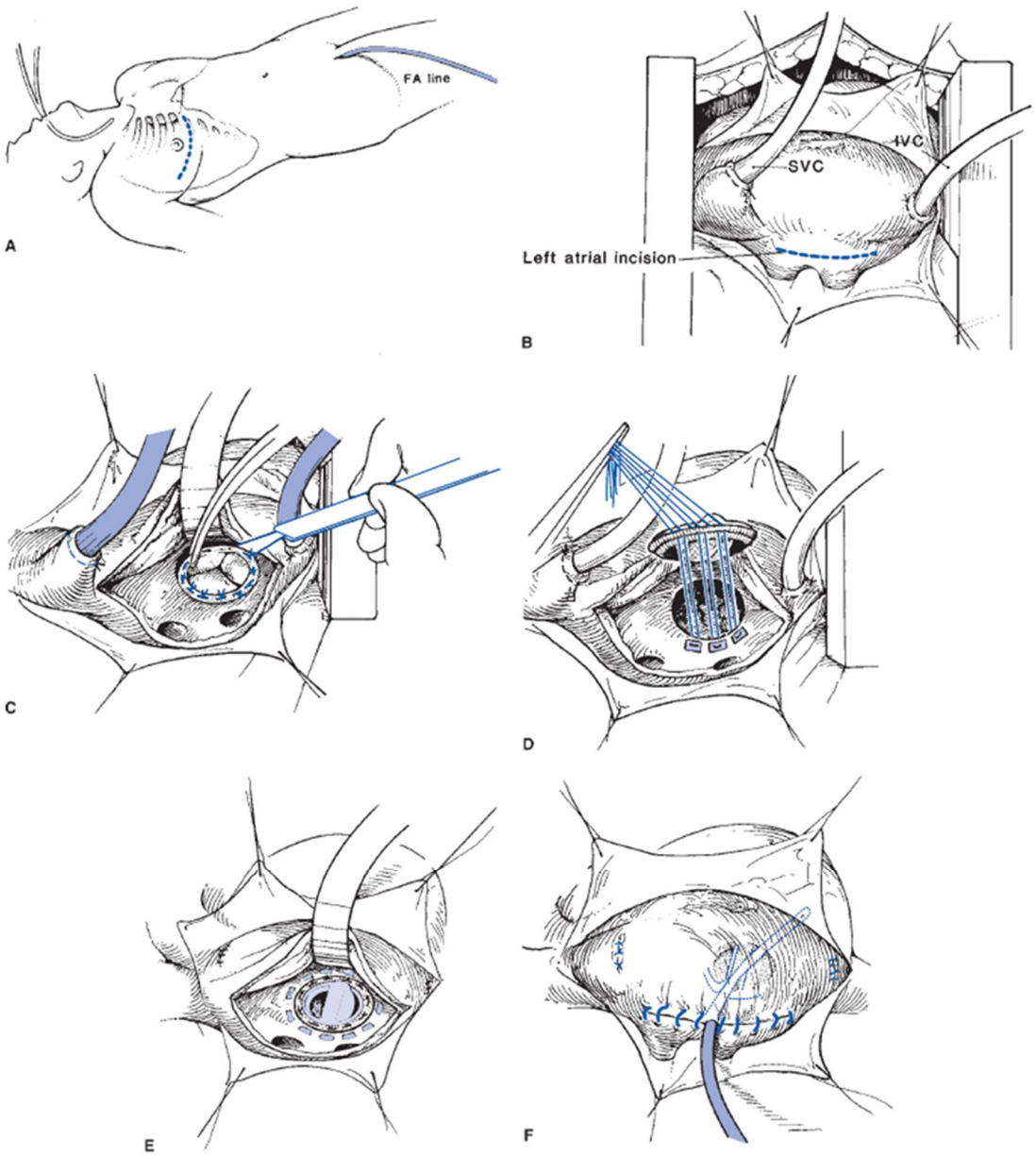
The heart is generally approached via a median sternotomy or lower ministernotomy. The heart is cannulated for cardiopulmonary bypass (CPB). Usually, bicaval cannulation and caval tourniquets are used (total CPB) to eliminate systemic venous return, which rewarms the heart during aortic cross-clamping. Systemic cooling to 28Â°C to 30Â°C is initiated on CPB. The aorta is then cross-

clamped and the heart arrested with cold blood cardioplegia delivered antegrade via the aortic root. Myocardial protection is provided by intermittent antegrade cold blood cardioplegic solution and topical cooling. For patients with severe pulmonary hypertension, antegrade-grade cold blood cardioplegia can enhance right ventricular myocardial protection. The initial dose of cold cardioplegic solution required to lower the myocardial temperature to 10°C is usually about 1,000 mL. Supplemental doses of antegrade cold blood cardioplegic solution are given intermittently every 20 to 30 minutes, even though the myocardial temperature usually remains <10°C .

Surgical exposure of the mitral valve is achieved by one of three incisions The most commonly used is a vertical left atriotomy incision in Sonderguards groove anterior to the right pulmonary veins .The incision can easily be extended cephalad and caudad beneath the superior and inferior venae cavae, respectively. With cephalad extension, care is taken not to injure the sinus node artery, which courses across the top of the interatrial septum. Inferiorly, the incision is extended underneath the inferior vena cava aiming toward the left inferior pulmonary vein. After the atriotomy is made, a sump vent is usually inserted into the left atrium and positioned dependently near the left superior pulmonary vein. Once it is determined that mitral valve reconstruction is not possible or is judged not to be the most prudent course of action, MVR is performed using one the following techniques.

Conventional Mitral Valve Replacement

Conventional MVR is preceded by complete removal of the mitral leaflets and the subvalvular apparatus this is reserved only for patients with advanced rheumatic disease with excessive scarring and calcification. The leaflets are excised, leaving 1 mm to 2 mm of leaflet tissue along the annular circumference.



The chordae tendineae are divided near the tips of the papillary muscles. Irrespective of the type of procedure, the size of the mitral annulus is measured as the valve size that fits easily into the left ventricle; care not to oversize the valve is very important. The annulus is then ringed with a series of 2-0 ethibond polyester horizontal mattress sutures with a width of approximately 8 mm to10 mm. Pledgets reinforcement of the sutures is not routine, but is used when friable or destroyed annular tissue is encountered in association with severe endocarditis, with re-do MVR, and in patients with the Marfan syndrome. It is important that the sutures not

be placed too deeply into the annulus to avoid injury to the circumflex coronary artery, the aortic valve leaflets, or the conduction system. The sutures are placed in an everting fashion (atrium to ventricle) for mechanical valve prostheses. Next, the sutures are passed through the sewing ring of the prosthesis, which is then lowered into place. Bileaflet mechanical valve prostheses are inserted in the antianatomic position with the pivot guards located towards the 12:00 and 6:00 positions. Tilting disc valves greater orifice facing the PML side kept for better hemodynamics.

Postoperative care

Postoperative care is directed toward the resumption of normal cardiac output, respiratory function, temperature control, electrolyte management, adequate renal flow, and prophylaxis against bleeding.

Patients with low cardiac output are managed with a variety of pharmacologic agents after providing adequate volume loading. Left atrial and especially pulmonary arterial catheters are particularly helpful in determining optimal balancing of volume loading and myocardial function in the first hours following operation. Reduction of pulmonary interstitial fluid is pursued aggressively by diuresis in the intensive-care unit in patients with severe pulmonary hypertension. Most patients with severe pulmonary hypertension can be extubated within 48 hours of surgery.

Nutritional, respiratory, and general metabolic support is provided. Many patients with severe, long-standing mitral valve disease are cachectic and, despite preoperative nutritional support, are severely catabolic at the time of operation. These patients generally require longer periods of ventilatory support owing to lack of respiratory muscle strength. They need aggressive nutritional support with nasogastric hyperalimentation to increase respiratory muscle strength. In patients with severe pulmonary hypertension and cardiac cachexia who require prolonged

intubation, tracheostomy may be necessary to reduce ventilatory dead space and facilitate faster weaning and better pulmonary toilet. Tracheostomy usually is performed by the end of the first postoperative week.

Anticoagulation is prescribed for all patients undergoing mitral valve replacement with either a mechanical or a bio prosthetic valve. In the first 6 weeks following operation, the incidence of atrial and other arrhythmias is high; thus these fluctuating rhythms mandate anticoagulation even if the basic rhythm is sinus. In addition to rhythm concerns, the left atrial incisions and the possibility of stasis in the left atrial appendage justify full anticoagulation with warfarin for all patients. Some surgeons advocate immediate intravenous heparin until therapeutic warfarin doses can be reached. Low-molecular-weight heparin (LMWH) also can be used. The therapeutic international normalized ratio (INR) after mitral valve replacement is 2.5 to 3.5 depending on the type of valve, cardiac rhythm, and presence or absence of the aforementioned intraoperative risk factors for thromboembolism. Anticoagulation levels are in the low range for patients in sinus rhythm who received tissue valves. Patients who have mechanical valves need lifelong anticoagulation Warfarin usually is started on the second postoperative day. Addition of aspirin, 80 to 150 mg daily, to the warfarin may reduce the risk of thromboembolism and may have a role in patients with prosthetic valves.[19]

RESULTS

Early Results

The hospital mortality for mitral valve replacement with and without coronary bypass grafting has decreased significantly since inception of mitral valve surgery.

The current risk (1996) of elective primary mitral valve replacement with and without coronary bypass grafting is 5 to 9 % Operative (30-day) mortality is related to myocardial failure, multisystem organ failure, bleeding, respiratory failure in the chronically ill, debilitated individual, infection, stroke, and very rarely, technical problems. Mortality is correlated with preoperative functional class, age, and preexisting coronary artery disease.

LATE RESULTS

FUNCTIONAL IMPROVEMENT

In over 90% of patients following mitral valve replacement, functional class improves to at least class II. A small group of patients remain in class III or IV depending on left ventricular function prior to surgery or other coexisting morbidity[18].

SURVIVAL

The causes of late death in patients following mitral valve replacement are primarily chronic myocardial dysfunction, thromboemboli and stroke, endocarditis, anticoagulant-related hemorrhage, and coronary artery disease. The extent of left ventricular dysfunction and patient age, particularly if myocardial and coronary diseases are combined, also correlates with late mortality. The probability of survival after mitral valve replacement at 10 years is 50 to 60% either with a tissue or a mechanical heart valve .The fact that more than 50% of patients following mitral valve replacement are in chronic atrial fibrillation increases the propensity for thromboembolic stroke despite anticoagulation and for mechanical valve thrombosis if the anticoagulation protocol is altered.

LATE MORBIDITY

The major morbidity in patients following mitral valve replacement is structural valve deterioration of a bioprosthetic valve and thromboembolism and anticoagulant

hemorrhage with a mechanical prosthesis. Both valve types develop perivalvular leak and infection.

THROMBOEMBOLISM

Thromboembolism is perhaps the most common complication of either biologic or mechanical mitral prostheses but is more frequent in patients with mechanical valves. Chronic atrial fibrillation and local atrial factors, already discussed, increase the risk of thromboembolism in patients with mitral prostheses. A number of recent studies have summarized the thromboembolic potential of various valves, and it appears that the better the valve hemodynamics, the lower is the probability of thromboemboli. The incidence of thromboemboli in currently available bileaflet valves and tilting-disk valves is similar to that of bioprosthetic valves about 1.5 to 2.0% per patient-year. Thromboembolism in patients with mitral valve replacement is lower in those with a small left atrium, sinus rhythm, and normal cardiac output. Thrombosis of a mechanical valve, once a feared complication of tilting-disk valves, is now relatively rare unless anticoagulation is stopped for any period of time. Valve thrombosis can be treated with thrombolytic agents if the patient is not in cardiogenic shock but requires surgery if the circulation is inadequate.

ANTICOAGULANT HEMORRHAGE

The incidence of anticoagulant-related hemorrhage has decreased markedly with hemodynamic improvements in mitral valve prostheses. New valves do not require the intensity of anticoagulation of older prostheses. For example, the distinctive Starr-Edwards ball-and-cage valve requires an INR of 3.5 to 4.5.Patients with streamlined bileaflet or tilting-disk valves require an INR of between 2.5 and

3.5; thus the incidence of anticoagulant hemorrhage is significantly reduced in the newer, hemodynamically improved prostheses.

PERIVALVULAR LEAK

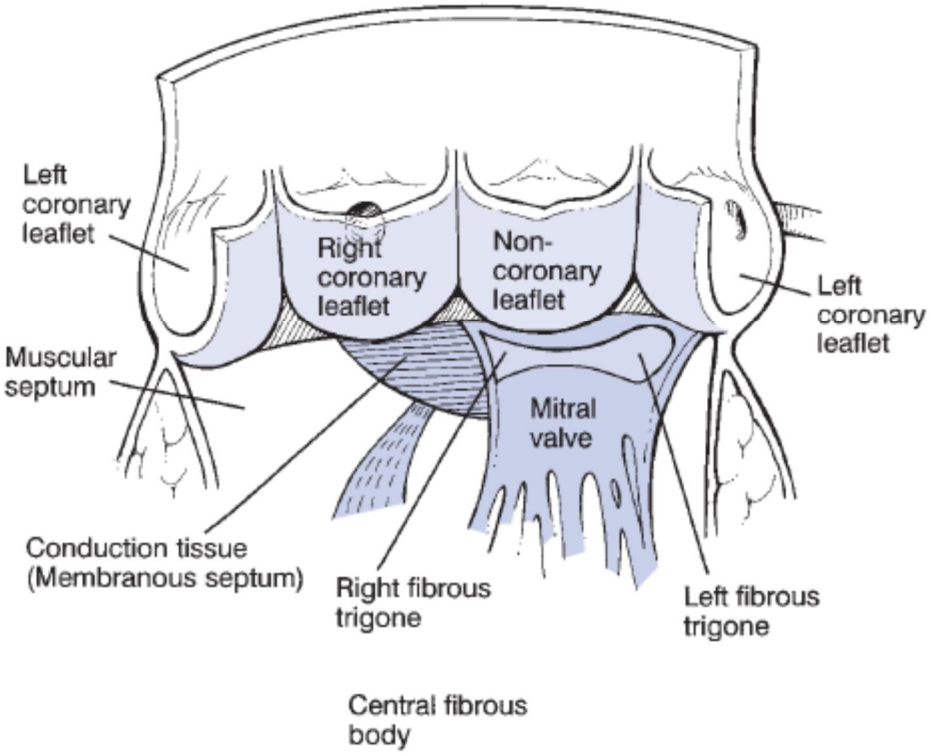
Perivalvular leak is an uncommon complication because of improved surgical techniques and the use of Teflon pledgets. The incidence of perivalvular leak for both mechanical and biologic valves is about 0 to 1.5 percent per patient-year. Perivalvular leak is slightly more common with the bileaflet valve than with the porcine valve because of the need for the everting suture technique and less bulky sewing ring.

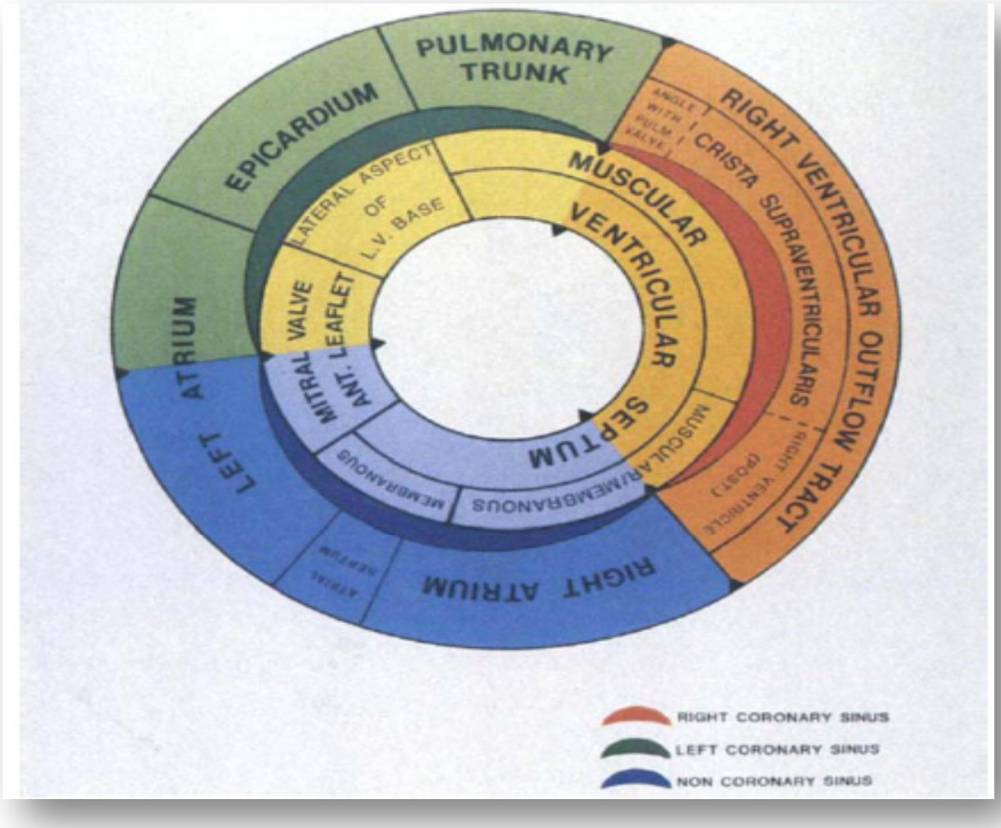
ENDOCARDITIS

Endocarditis is a feared complication after valve replacement, and prosthetic mitral valve endocarditis often presents difficult management problems related to timing of operation, type of operation, ability to securely fix the prosthesis, and operative and late survival. Mitral valve endocarditis is considerably less common than aortic prosthetic valve endocarditis. Antibiotic therapy depends on the sensitivity of the organisms, but immediate high-dose intravenous therapy must begin as soon as possible. The surgical indications for mitral valve prosthetic endocarditis are persistent sepsis, congestive failure, perivalvular leak, large vegetations, or systemic infected emboli. Postoperative care should include at least 6 weeks of appropriate intravenous antibiotics. Recurrence of infection depends on the type of organism and the surgeon's ability to completely remove all areas of infection. Recurrence of infection is the single most important long-term complication.

Aortic valve replacement

Anatomy





The normal aortic valve is composed of three thin, pliable leaflets or cusps attached to the heart at the junction of the aorta and the left ventricle. The leaflets are attached within the three sinuses of Valsalva to the proximal aorta and joined together in three commissures that create the shape of a coronet. Because the coronary arteries arise from two of the three sinuses of Valsalva, the aortic leaflets are named after their respective sinuses as the left coronary leaflet, the right coronary leaflet, and the noncoronary leaflet. However, because of the oblique position of the aortic root, the sinuses themselves are rarely in a strict left or right position. The attachment of the leaflets to the left ventricular outflow tract is termed an annulus; however, in the strictest terminology this is not a true annulus because it is not truly circular: The points of attachment of the leaflets do not all lie in the same plane. There are two important surgical landmarks. First, the commissure between the left and noncoronary leaflets is positioned along the area of aortic-mitral valve continuity. Beneath this commissure is the fibrous sub aortic curtain. The commissure between the noncoronary and the right coronary leaflets is positioned over the left bundle of His. Injury to this conduction bundle during aortic valve surgery may create heart block.

Operative techniques

The standard surgical approach for AVR is via a median sternotomy Cardiopulmonary bypass is established by aortic and right atrial cannulation. After initiation of cardiopulmonary bypass, the aortic root is vented and a left ventricular vent is inserted via the right superior pulmonary vein. If the aortic valve is competent, cardiac arrest may be achieved by antegrade cardioplegia with

subsequent administration of cardioplegia in retrograde fashion. Otherwise, all cardioplegia may be administered retrograde. The myocardial temperature is monitored in the interventricular septum and kept below 10° by administration of cold blood cardioplegia every 20 minutes throughout the period of aortic occlusion. I routinely cool the patient to a bladder temperature of 28°C.

There are several important technical caveats. First, it is important to prevent the introduction of air into the left atrium with the insertion of a left ventricular vent via the right superior pulmonary vein. This can be done by temporarily pinching the venous line, thereby filling the left atrium with blood. I typically vent the aortic root before placing the left ventricular vent to evacuate any air that might be introduced. Second, the ascending aorta in patients undergoing aortic valve replacement may be very thin because of poststenotic dilation, advanced age, annuloaortic ectasia, and so on. Hence, aortic cannulation stitches must be placed very carefully to avoid tearing the aorta. I often use felt pledgets to reinforce each bite of the aortic cannulation stitches to minimize this problem. Third, in operations for aortic regurgitation, the heart is prone to ventricular fibrillation once cardiopulmonary bypass has been initiated. If the heart fibrillates, the left ventricle will immediately distend, which may sometimes be lethal. The heart typically fibrillates soon after the initiation of systemic cooling, at which point I immediately cross-clamp the aorta and administer retrograde cardioplegia.

After cardiopulmonary bypass has been initiated, the plane between the aorta and pulmonary artery is dissected. This is important to optimize visualization of the aortic valve and to facilitate aortic closure. One of the most important technical nuances of this operation is to identify the surface anatomy of the right coronary artery as it originates from the right sinus of Valsalva. This may be done by gentle dissection of

the fat pad overlying the right sinus of Valsalva. If the aortotomy is too close to the right coronary ostium, the os may be damaged or distorted with aortic closure or by the valve itself. As the patient is systemically cooled, the heart will fibrillate. The aortic cross-clamp is then applied, and cardioplegia is administered. A small, transverse aortotomy is made approximately 3 cm to 4 cm distal to the origin of the right coronary artery. Through this initial aortotomy, one can visualize the aortic valve. The aortotomy is then extended transversely across the anterior surface of the aorta. It is important to stay approximately 1 cm distal to the zenith of the commissures of the aortic valve leaflets. Having extended the aortotomy to the patient's right, once the incision is exactly over the halfway point of the noncoronary leaflet, one directs the aortotomy incision in the axis of the aorta down toward the aortic annulus. This portion of the aortotomy incision should stop at least 1 cm distal to the aortic annulus.[19]

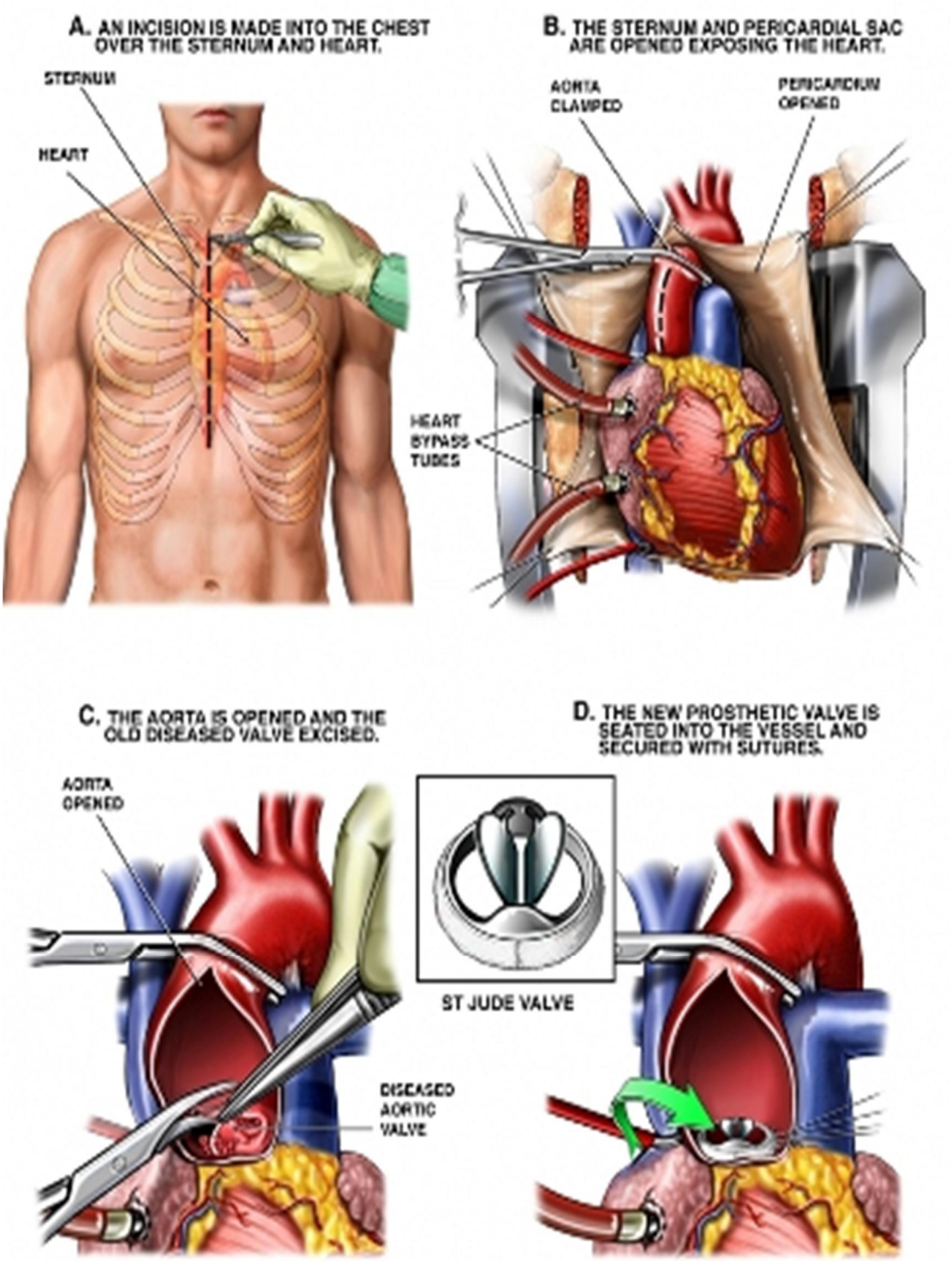
The aortic valve is best visualized with the operating table in a bit of reverse Trendelenburg position and rotated a bit to the patient's left. Traction sutures are then placed through the top of each commissure and snapped to the surgical drapes. This brings the aortic valve up toward the surgeon. The aortic valve leaflets are then excised with scissors. After the leaflets have been removed, a moist gauze sponge is placed in the lumen of the left ventricle to help catch any small pieces of calcium. A Rongeur instrument is then used to gently debride the annulus of calcium. During this process, it is helpful for the assistant to follow along with an open-tipped suction catheter to help sweep up any small pieces of calcium. After the annulus has been sufficiently debrided of calcium, the sponge is removed from

within the ventricle, and the lumen of the left ventricle is liberally irrigated with cold saline to flush out any calcium debris. The annulus is then sized.

The appropriate valve size is chosen by measuring the annulus with valve sizers. It is very important not to attempt to place an oversized valve. Regardless of the choice of prosthesis, I routinely implant a valve one size smaller than what the patient's annulus might accept as judged by valve sizers. Horizontal pledgetted mattress sutures are placed in the aortic annulus with the pledgets in the subannular position. After all the sutures have been placed, the aortic valve prosthesis is brought to the field and the sutures passed through valve sewing ring. To facilitate symmetric suture placement, it is helpful to mark the sewing ring in thirds.

After the sutures are passed through the sewing ring, the valve is seated into the aortic annulus, and the sutures are tied. After the valve is sewn in place, the aortotomy is closed with 5-0 polypropylene sutures in two layers. The first layer is a running horizontal mattress stitch, and the second is an over-and-over running stitch. The purpose of this is to flush air out of the coronary arteries and to begin increasing the myocardial metabolic rate before reanimating the heart. During this infusion, it is helpful to begin de-airing the left ventricle by partial occlusion of the venous line and the resumption of ventilation while the left ventricular and aortic vents are on suction. After the retrograde administration of 500 cc of warm blood, the aortic cross-clamp is removed. With the heart reanimated, one should assess the adequacy of the de-airing maneuvers by TEE. The usual maneuvers include filling the heart while on cardiopulmonary bypass, rotating the operating table from right-to-left and using Valsalva maneuvers to express air out of the pulmonary veins.

When the surgeon is satisfied that the left heart is completely de-aired, the left ventricular vent is removed and the patient is weaned from cardiopulmonary bypass.



Results

Outcomes from aortic valve replacement with mechanical valve prostheses vary among reports depending on the patient population. Patients with higher risk factors for TE and those with risk factors for anticoagulation will have a higher incidence of valve-related events, making meta-analyses less meaningful. Older patients are at higher risk for valve-related events, particularly thromboembolic episodes, because of the greater number of risk factors that accumulate with aging. The incidence of valve-related events is also determined by the intensity with which the investigators follow their patients. A higher incidence of early haemorrhagic events may also be diluted over the longer periods of follow-up. The majority of valve-related morbidity is related to TE and anticoagulation-related haemorrhage.

Anticoagulant-Related Hemorrhage

Anticoagulation -related haemorrhage (ARH) is the most common valve-related event. ARH also accounts for the highest incidence of patient mortality for valve-related events. Acceptable ARH rates range from 1.0 to 2.5% per patient-year in long-term reports. These long-term reports dilute the short-term impact, as ARH risks are higher early after valve replacement. Freedom from anticoagulation at 10 and 20 years are 75 to 80% and 65 to 70%, respectively. Importantly, one long-term study noted that nearly 40% of all ARH that occurred over a 25-year follow-up period occurred during the first 6 months of anticoagulation, indicating that a slow increase to therapeutic levels, coupled with close follow-up during this early period is warrented.

Thromboembolism

Thromboembolic episodes are the second most common valve-related event and are the reason that chronic anticoagulation is warranted. Acceptable thromboembolic rates range between 0.8 and 2.3% per patient-year. Approximately one-half of these events are neurologic events, 40% are transient, and 10% peripheral. Freedom from thromboembolic events at 10 and 20 years is approximately 80 to 85% and Thromboembolism is a continuous risk factor that is present throughout the life of the mechanical valve prosthesis. Changes in the target INR may be necessary as individual risks increase.

Valve Thrombosis

Valve thrombosis in the aortic position is an unusual event that occurs late after valve replacement and is most commonly due to inadequate anticoagulation or noncompliance. IN bileaflet valves, thrombus formation impinging valve function occurs at the pivot guards and in the crevices of the valve. Only one bileaflet design does not have convexities into which the leaflets fit. In tilting disc valves, thrombus is most common at the minor flow orifice. The incidence of thrombosis is approximately <.3% per patient-year and freedom from valve thrombosis at 20 years is >97%.

Prosthetic Valve Endocarditis

Prosthetic valve endocarditis is also a rare event in the modern era with prophylactic antibiotics. Approximately 60% of events occur early and are associated with staphylococci. The mortality for this event is high. The remainder appear late (>60 days). Prosthetic valve endocarditis is also a continuous variable, and patients must

be cautioned to take prophylactic antibiotics for any invasive procedure. Freedom from endocarditis with mechanical valve prostheses is 97 to 98% at 20 to 25 years.

Paravalvular Leak

Paravalvular leak is an operative complication and is related to operative technique and to endocarditis. With annular decalcification and closely placed sutures, these events can be minimized. There may be an anatomic predisposition to paravalvular leak in the area of the annulus extending from the right and noncoronary commissure, one-third the distance along the right coronary cusp, and two-thirds the distance to the noncoronary cusp, due to intrinsic weakness in this area of the annulus. The acceptable range of paravalvular leak is approximately <.1% per patient-year, with early postoperative occurrence predominating.

Freedom from Reoperation

The long-term durability of modern mechanical valve prostheses is excellent, and a valve replacement rate of less than 2% over 25 years can be expected, and re-reoperation after AVR replacement is even rarer. Subvalvular pannus formation is rare with bileaflet valves. The most common reasons for prosthetic valve reimplantation are pre- and postoperative endocarditis, paravalvular leak, and valve thrombosis.

ACC/AHA Guidelines for anti-thrombotic therapy in mechanical heart valves 2006

.	INR	DURATION	ALTER NATIVE	ADD
GENERAL APPROACH *				
Mechanical prostheses(1)	2.0-3.0	Indefinite		May add ASA 50-100
Mechanical prostheses, others	2.5-3.5	Indefinite		May add ASA 50-100
Mechanical prostheses(3)	2.5-3.5	Indefinite		Add ASA 50-100
Mechanical prostheses, with RF(2)	2.5-3.5	Indefinite		Add ASA 50-100
AORTIC VALVE *				
AV prostheses, bileaflet (1), no RF(2)	2.0-3.0	Indefinite		May add ASA 50-100
AV prostheses, bileaflet (1), with RF(2)	2.5-3-5	Indefinite		Add ASA 50-100
AV prostheses, others, no RF(2)	2.5-3.5	Indefinite		May add ASA 50-100
AV prostheses, others, with RF(2)	2.5-3.5	Indefinite		Add ASA 50-100
MITRAL VALVE *				
MV prostheses, mechanical	2.5-3.5	Indefinite		May add ASA 50-100

- * Warfarin can be started the day after valve replacement. UFH or LMWH should be started about 2 days post-surgery (when surgical bleeding completely controlled) and continue until INR reaches therapeutic level for 2 consecutive days.
- (1) In aortic Position. St. Jude Medical bileaflet, CarboMedics bileaflet, Medtronic-Hall tilting disc, Omni carbon mono tilting disc, and sorin bileaflet.
- (2) Risk factors: History of TIAs, CVA, systemic emboli, severe LV systolic dysfunction, recurrent CHF.
- (3) Caged ball or caged disk valve

Materials

This retrospective analysis was under taken as an observational evaluation on "**bileaflet"** and "**tilting disc**'' mechanical valve performance and outcome for isolated mitral and aortic valve replacement in Department of Cardio Thoracic Surgery at Government General Hospital, Chennai, using a descriptive method of analysis over a period of 24 months from September 2009 to September 2011.

INCLUSION CRITERIA

- Isolated mitral or aortic valve disease
- Age between 15 - 60
- Both stenotic and regurgitation lesion

EXCLUSION CRITERIA

- Multi Valvular lesions
- Severe LV dysfunction (EF <30 %)
- Associated coronary artery disease
- Previous Thromboembolic & Hemorrhagic history
- Concomitant cardiac/ non cardiac major surgeries
- Age above 60

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

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 and radiologic and electrocardiographic examination with elective pre-operative anesthetic assessment. Transthoracic ECHO cardiographic evaluation is done pre operatively, trans esophageal ECHO for selected cases.

Pre-operative Procedure

Patients were given preoperative sedatives and prophylactic antibiotics 1 hour before the procedure. Anesthesia was induced and endotracheal intubation was performed. The patient was placed in supine position sand bag under shoulder.

Operative Procedure

Mitral valve replacement

Through midline sternotomy, aortic bicaval cannulation. under conventional cardiopulmonary bypass, core cooled upto 28’C. Aortic cross clamp at 32’C. Antegrade cold (4’C) cardioplegia given through aortic root. Diastolic cardiac arrest established. Through left atrial approach beyond sonderguards grove, mitral valve anatomy, presence of LA clot assessed.

In case of LA clot, after declotting left atrium exclusion will be done. Most of the cases PML have been preserved except small ventricular cavity, severe calcification. Mitral valve sizing done for all available valves. Using 2 0 pledgetted interrupted everting placed for intra annular valve positioning. For bileaflet anti anatomic position and for tilting disc greater orifice facing PML was positioned. Leaflet mobility, chordal entanglement verified. After LA closure, root Dearing done. Cross clamp removed. CPB weaned, protaminised. Pleuro pericardial or mediastinal drain kept.

Aortic valve replacement

Cardio pulmonary bypass established same manner as mentioned above except RA double stage cannulation. LA venting done to decompress the LV and blood less field. Through transverse aortotomy, coronary osteal antegrade cold (4'C) cardioplegia for AR, AS/AR cases, whereas antegrade root cardioplegia was given for pure AS cases. Aortic valve morphology assessed. After excising the aortic valves, sizing done. Using 2 0 pledgetted interrupted everting sutures placed for intra annular valve placement. For some cases, on benefit of bigger size valve inverting type sutures taken to keep valve at supra annular position. In bileaflet, one opening facing right coronary cusp, whereas tilting disc valves major orifice facing non coronary cusp placed for best hemodynamic performance.

Post-operative period

Patient shifted to our cardiothoracic intensive care unit. All the valve replacement patients are electively ventilated for entire overnight. Next day morning if the parameters and clinical status are fit, patient extubated. For first two days ,

hemodynamics which includes blood pressure, pulse, urine output, respiratory rate, drain are monitored and assessed. Then patient shifted to intermediate care unit.

Post-operative echocardiogram usually done on 7th POD. Post op echo assessment includes valve position, function, mean gradient, Paravalvular leak, LV function. Patient discharged at 10 th POD after suture removal.

Anticoagulation

In our institution, first day we start acinocoumarol (acitrom) 2 mg with fist two days heparin coverage. INR checked every 48 hours and acitrom level readjusted according to INR levels. In case of severe atrial fibrillation, high risk cases aspirin 75 mg added to maintain anticoagulation.

Follow up

Patient followed up in CTS department outpatient (no: 121) for first 6 months by predefined method

Every week – first 1 month

Every fortnight – next 2 months

Every month – last 3 months

Investigations including ECG, ECHO, and CHEST X RAY repeated on every 45 days. Out of 393 patients 20% of patients lost to follow up.

ETHICS

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

DATA HANDLING AND STATISTICS

All the data were handled with car to maintain patient confidentiality. Records were maintained in both computer and paper formats. Statistical analysis was carried out as appropriate. Continuous variables were compared using student's t test and categorical variables were compared with a Pearson chi-squares (χ^2) test with SPSS statiscal data analysis software (SPSS Inc. Chicago.ver 17) and are reported with 95% confidence limits. Comparison between groups were made with formula

$$z = \frac{P_x - P'_x}{\sqrt{(SE[P_x])^2 + (SE[P'_x])^2}}$$

This is defined in Colton[21]. Results were considered statistically significantly at the $p < 0.05$ level[20].

OBSERVATION

Observation

EPIDEMIOLOGICAL DATAS

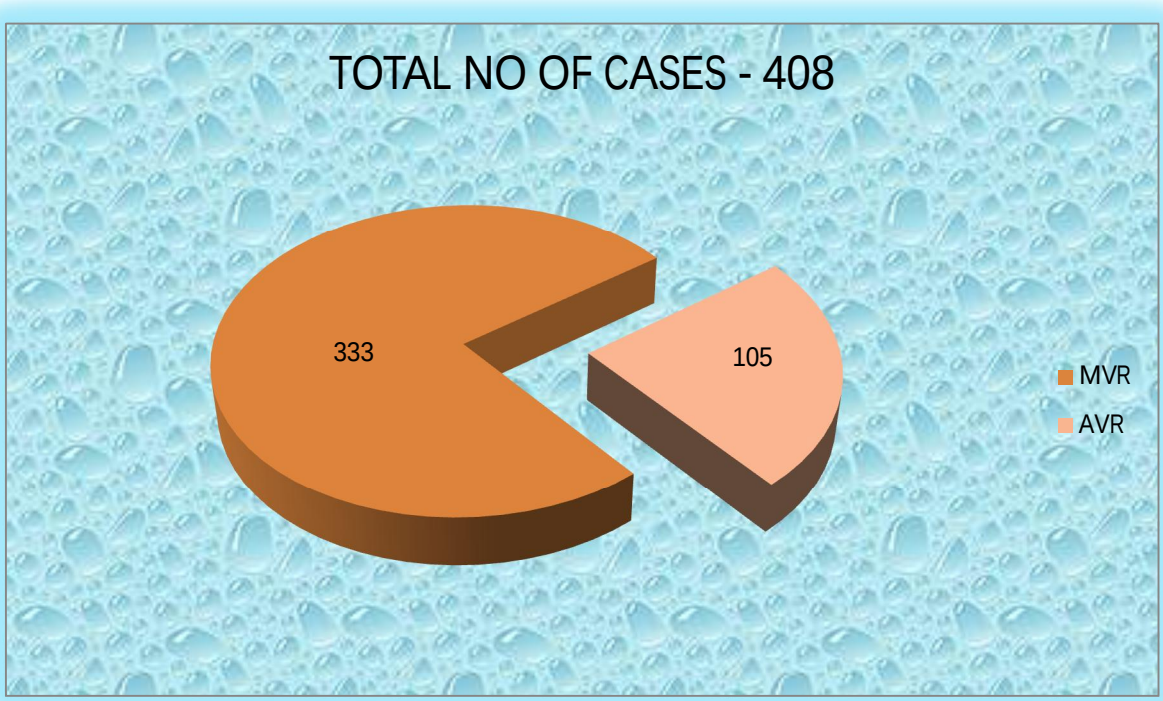
	TYPE OF VALVE	NO	Mean	Std. Deviation	Std. Error Mean
AGE	BL	228	34.42	10.026	.664
	TD	105	33.38	9.339	.911

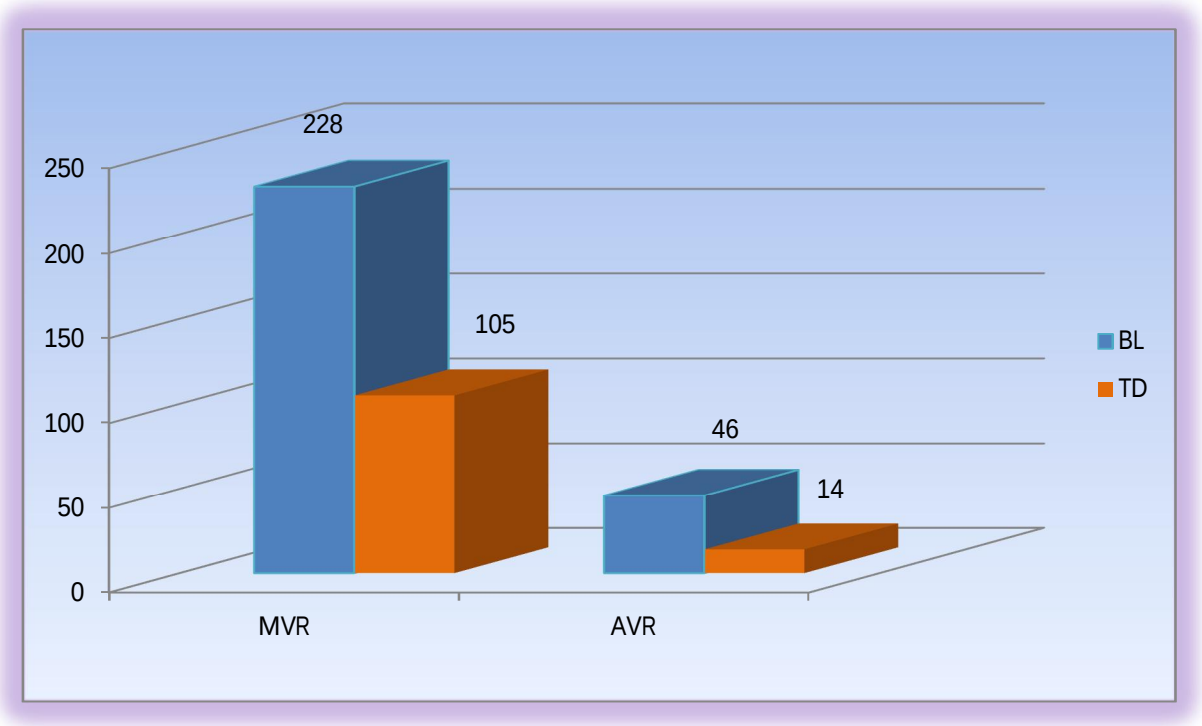
MVR			**TYPE OF VALVE**		
			BL	**TD**	**Total**
SEX	**MALE**	Count	108	37	145
		% within SEX	74.5%	25.5%	100.0%
		% within TYPE OF VALVE	47.4%	35.2%	43.5%
		% of Total	32.4%	11.1%	43.5%
	FEMALE	Count	120	68	188
		% within SEX	63.8%	36.2%	100.0%
		% within TYPE OF VALVE	52.6%	64.8%	56.5%
		% of Total	36.0%	20.4%	56.5%
	Total	Count	228	105	333
		% within SEX	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

AVR			**TYPE OF VALVE**		
			BL	**TD**	**Total**
SEX	**MALE**	Count	35	10	45
		% within SEX	77.8%	22.2%	100.0%
		% within TYPE OF VALVE	76.1%	71.4%	75.0%
		% of Total	58.3%	16.7%	75.0%
	FEMALE	Count	11	4	15
		% within SEX	73.3%	26.7%	100.0%
		% within TYPE OF VALVE	23.9%	28.6%	25.0%
		% of Total	18.3%	6.7%	25.0%
	Total	Count	46	14	60
		% within SEX	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Total number of cases (from sep 2009 to sep 2011)

MVR	333	BILEAFLET	228	St JUDE	193
				SORIN	23
				ATS	12
		TILTING DISK	105	TTK	61
				MEDTRONIC HALL	44
AVR	105	BILEAFLET	46	St JUDE	38
				SORIN	4
				ATS	4
		TILTING DISK	14	TTK	9
				MEDTRONIC HALL	5



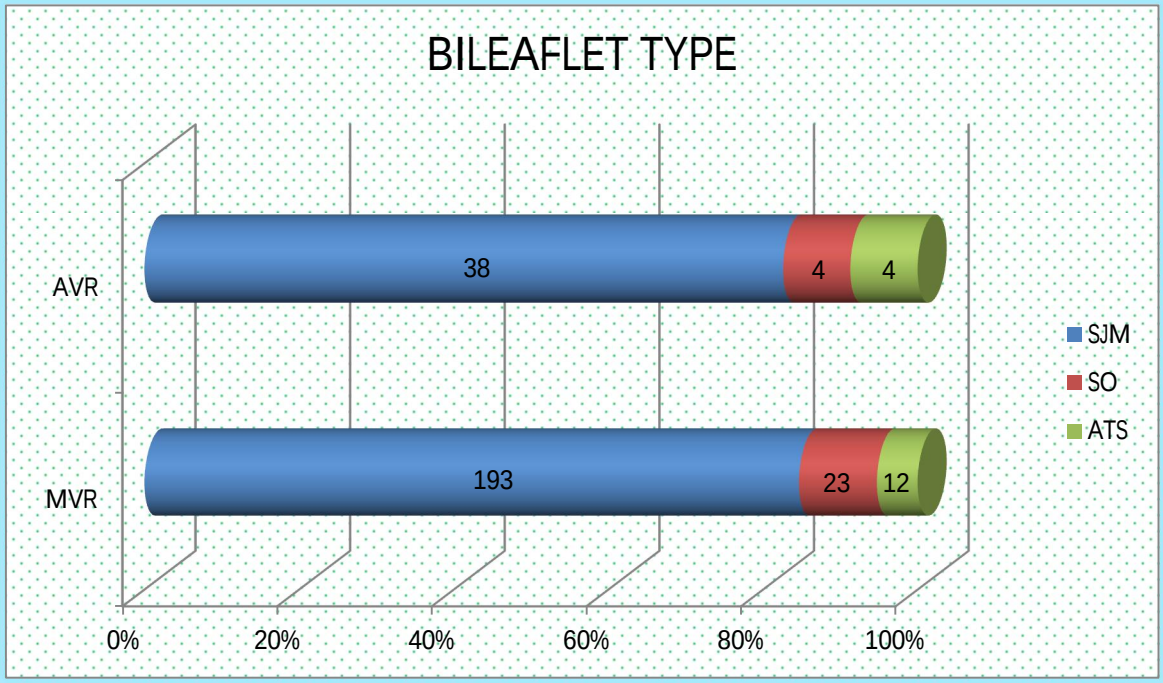


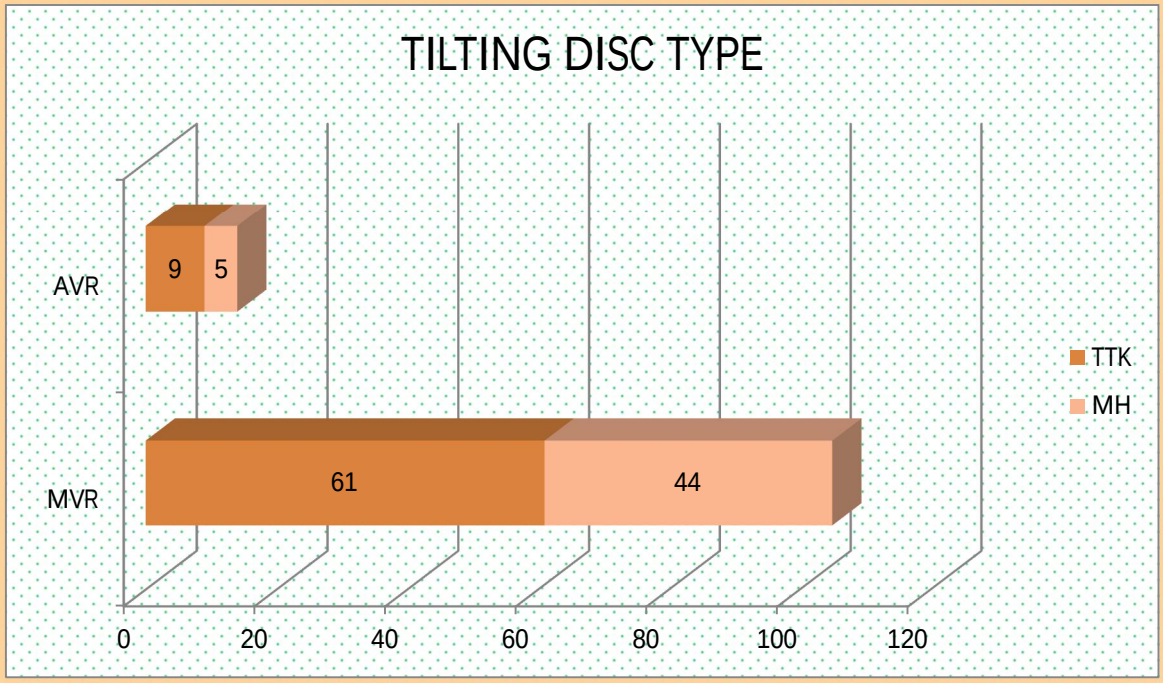
Valvular Pathology

	NO	PATHOLOGY	NO	%
MVR	333	MS	168	50.4%
		MRS	33	10%
		MR	57	17.1%
		MS/MR	75	22.5%
AVR	105	AS	10	16.6%
		CAL AS	10	16.6%
		BCAV/AS	4	6.6%
		ARS	1	0.6%
		AR	19	32%
		AS/AR	16	26.6%

Valve Manufacturer

MVR			TYPE OF VALVE		
			BL	TD	Total
COMPANY	ATS	Count	12	0	12
		% within COMPANY	100.0%	.0%	100.0%
		% within TYPE OF VALVE	5.3%	.0%	3.6%
		% of Total	3.6%	.0%	3.6%
	MH	Count	0	44	44
		% within COMPANY	.0%	100.0%	100.0%
		% within TYPE OF VALVE	.0%	41.9%	13.2%
		% of Total	.0%	13.2%	13.2%
	SJM	Count	193	0	193
		% within COMPANY	100%	0%	100.0%
		% within TYPE OF VALVE	84.6%	0%	58.0%
		% of Total	57.9%	0%	58.0%
	SO	Count	23	0	23
		% within COMPANY	100.0%	.0%	100.0%
		% within TYPE OF VALVE	10.1%	.0%	6.9%
		% of Total	6.9%	.0%	6.9%
	TTK	Count	1	60	61
		% within COMPANY	1.6%	98.4%	100.0%
		% within TYPE OF VALVE	.4%	57.1%	18.3%
		% of Total	.3%	18.0%	18.3%
	Total	Count	228	105	333
		% within COMPANY	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%


BILEAFLET TYPE
AVR
MVR
38
4
4
193
23
12
SJM
SO
ATS
0%
20%
40%
60%
80%
100%


TILTING DISC TYPE
AVR
MVR
9
5
61
44
TTK
MH
0
20
40
60
80
100
120

AVR			TYPE OF VALVE		
			BL	TD	Total
COMPANY	ATS	Count	4	0	4
		% within COMPANY	100.0%	.0%	100.0%
		% within TYPE OF VALVE	8.7%	.0%	6.7%
		% of Total	6.7%	.0%	6.7%
	MH	Count	0	5	5
		% within COMPANY	.0%	100.0%	100.0%
		% within TYPE OF VALVE	.0%	35.7%	8.3%
		% of Total	.0%	8.3%	8.3%
	SJM	Count	38	0	38
		% within COMPANY	100.0%	.0%	100.0%
		% within TYPE OF VALVE	82.6%	.0%	63.3%
		% of Total	63.3%	.0%	63.3%
	SO	Count	4	0	4
		% within COMPANY	100.0%	.0%	100.0%
		% within TYPE OF VALVE	8.7%	.0%	6.7%
		% of Total	6.7%	.0%	6.7%
	TTK	Count	0	9	9
		% within COMPANY	.0%	100.0%	100.0%
		% within TYPE OF VALVE-G	.0%	64.3%	15.0%
		% of Total	.0%	15.0%	15.0%
	Total	Count	46	14	60
		% within COMPANY	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

VARIABLES

1.Ease of procedure (valve orientation & positioning)

Ease of procedure is surgeon conclusion who considered this procedure end up without any difficulty in valve orientation in relation to AML, PML in mitral valve, whereas in aortic valve it is the aortic sinuses. Ease of procedure is considered by factors including valve holder type, sewing material which makes the difference in each bites, Rotatable nature of valve and finally the type of valve in which leaflets mobility is not restricted in any given position. (Surgeons were given the opinion not less than the grade of senior resident)

MVR			TYPE OF VALVE		
			BL	TD	Total
EOP	N	Count	7	49	56
		% within EOP	12.5%	87.5%	100.0%
		% within TYPE OF VALVE	3.1%	46.7%	16.8%
		% of Total	2.1%	14.7%	16.8%
	Y	Count	221	56	277
		% within EOP	79.8%	20.2%	100.0%
		% within TYPE OF VALVE	96.9%	53.3%	83.2%
		% of Total	66.4%	16.8%	83.2%
	Total	Count	228	105	333
		% within EOP	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

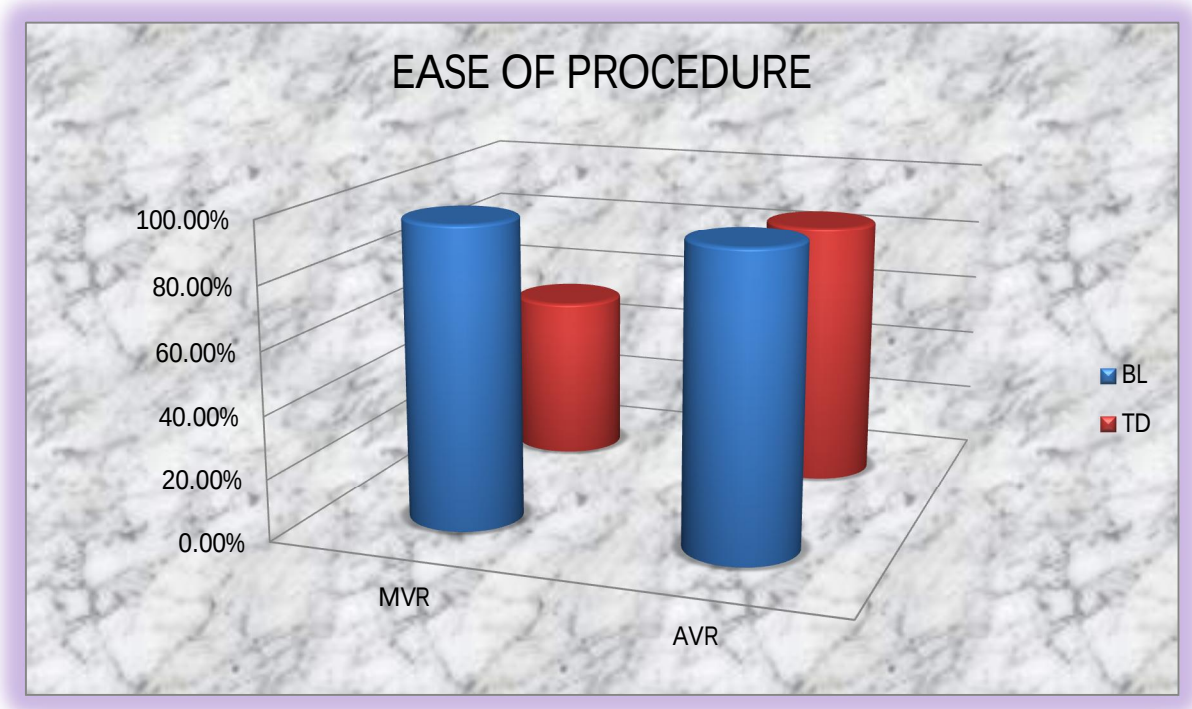
CHI SQUARE 97.680a P=0.0003

There exists a statistical significance between "**bileaflet"** and "**tilting disc**'' with respect to ease of procedure in mitral valve replacement.

AVR			TYPE OF VALVE		
			BL	TD	Total
EOP	N	Count	2	2	4
		% within EOP	50.0%	50.0%	100.0%
		% within TYPE OF VALVE	4.3%	14.3%	6.7%
		% of Total	3.3%	3.3%	6.7%
	Y	Count	44	12	56
		% within EOP	78.6%	21.4%	100.0%
		% within TYPE OF VALVE	95.7%	85.7%	93.3%
		% of Total	73.3%	20.0%	93.3%
	Total	Count	46	14	60
		% within EOP	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

CHI SQUARE – 1.704 P= 0.192

There is no statistical significance between "**bileaflet"** and "**tilting disc**'' with respect to ease of procedure in aortic valve replacement



2. POST OPERATIVE HAEMODYNAMICS

In my analysis Post operative hemodynamics refers to pulse, blood pressure, and peripheral temperature. Post operative hemodynamics assessed from the day of surgery to first two post operative days with intensive care monitoring. Putting each variable in post op hemodynamics into separate analytical method and subdivided into two variables**. ‘‘Normal’’** refers to stable or mild alteration of hemodynamics which invariably did not altered the course of post operative management**. ‘‘Stormy’’** refers to moderate to marked alterations of hemodynamics which altered post operative protocols from the normal(like extended ventilation , high inotropes’, dialysis, etc..).

MVR			**TYPE OF VALVE**		
			BL	**TD**	**Total**
POP HD	**N**	Count	188	96	284
		% within POP HD	66.2%	33.8%	100.0%
		% within TYPE OF VALVE	82.5%	91.4%	85.3%
		% of Total	56.5%	28.8%	85.3%
	S	Count	40	9	49
		% within POP HD	81.6%	18.4%	100.0%
		% within TYPE OF VALVE	17.5%	8.6%	14.7%
		% of Total	12.0%	2.7%	14.7%
	Total	Count	228	105	333
		% within POP HD	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

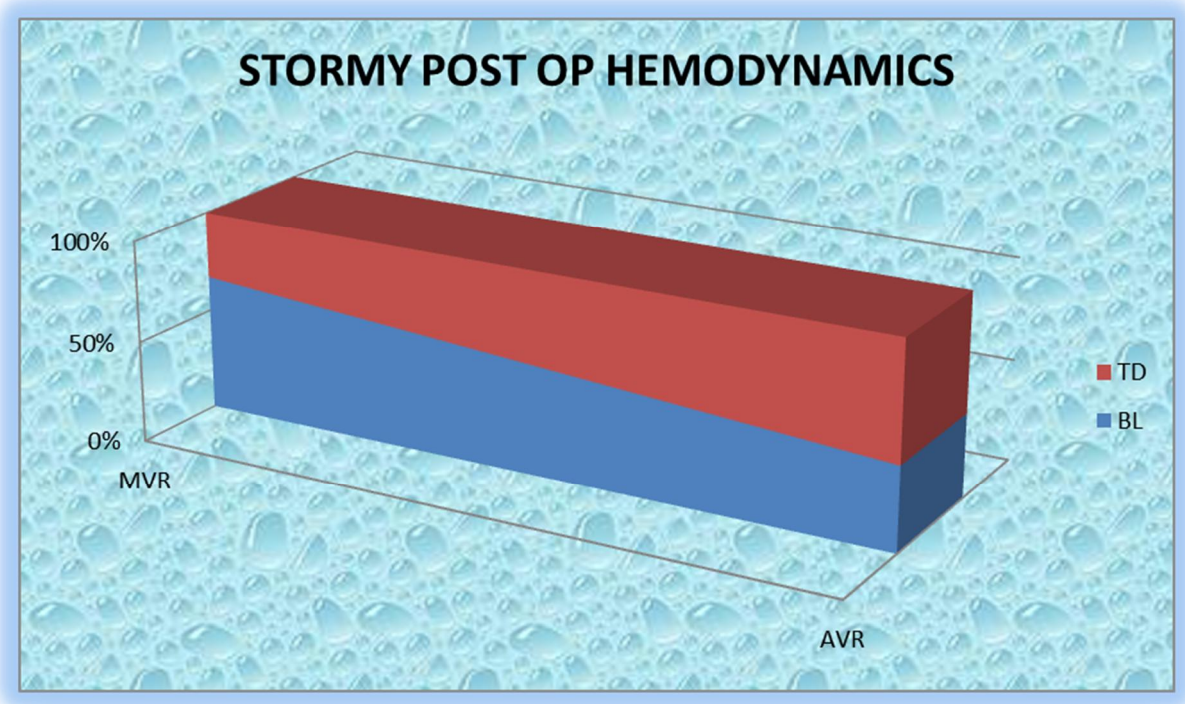
Pearson Chi-Square - 4.612 P=0.032

There exists a statistical significance between “**bileaflet”** and “**tilting disk**’’ with respect to post operative hemodynamics in mitral valve replacement.

AVR			TYPE OF VALVE		
			BL	TD	Total
POP HD	N	Count	39	11	50
		% within POP HD	78.0%	22.0%	100.0%
		% within TYPE OF VALVE	84.8%	78.6%	83.3%
		% of Total	65.0%	18.3%	83.3%
	S	Count	7	3	10
		% within POP HD	70.0%	30.0%	100.0%
		% within TYPE OF VALVE	15.2%	21.4%	16.7%
		% of Total	11.7%	5.0%	16.7%
	Total	Count	46	14	60
		% within POP HD	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=0.298a P=0.585

There is no statistical significance between "**bileaflet"** and "**tilting disk**" with respect to post-operative hemodynamics in aortic valve replacement.



3. POST OPERATIVE TRANSVALVULAR GRADIENT

Post operatively all the patient subjected for transthoracic echocardiographic assessment depends on the post-operative hemodynamics. For example if the patient having stormy post op hemodynamics emergency bed side echo will be done otherwise post op echo electively done between 4 -8 post operative days. Normally native heart valves don't have any transvalvular gradient. Transvalvular gradient refers to mean gradient across each type of mechanical valve. So an ideal valve should have a very minimal gradient.

MVR			TYPE OF VALVE		
			BL	TD	Total
GR	1.5-3	Count	147	70	217
		% within GR	67.7%	32.3%	100.0%
		% within TYPE OF VALVE	64.5%	66.7%	65.2%
		% of Total	44.1%	21.0%	65.2%
	3.1-5	Count	53	30	83
		% within GR	63.9%	36.1%	100.0%
		% within TYPE OF VALVE	23.2%	28.6%	24.9%
		% of Total	15.9%	9.0%	24.9%
	>5.1	Count	28	5	33
		% within GR	84.8%	15.2%	100.0%
		% within TYPE OF VALVE	12.3%	4.8%	9.9%
		% of Total	8.4%	1.5%	9.9%
	Total	Count	228	105	333
		% within GR	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

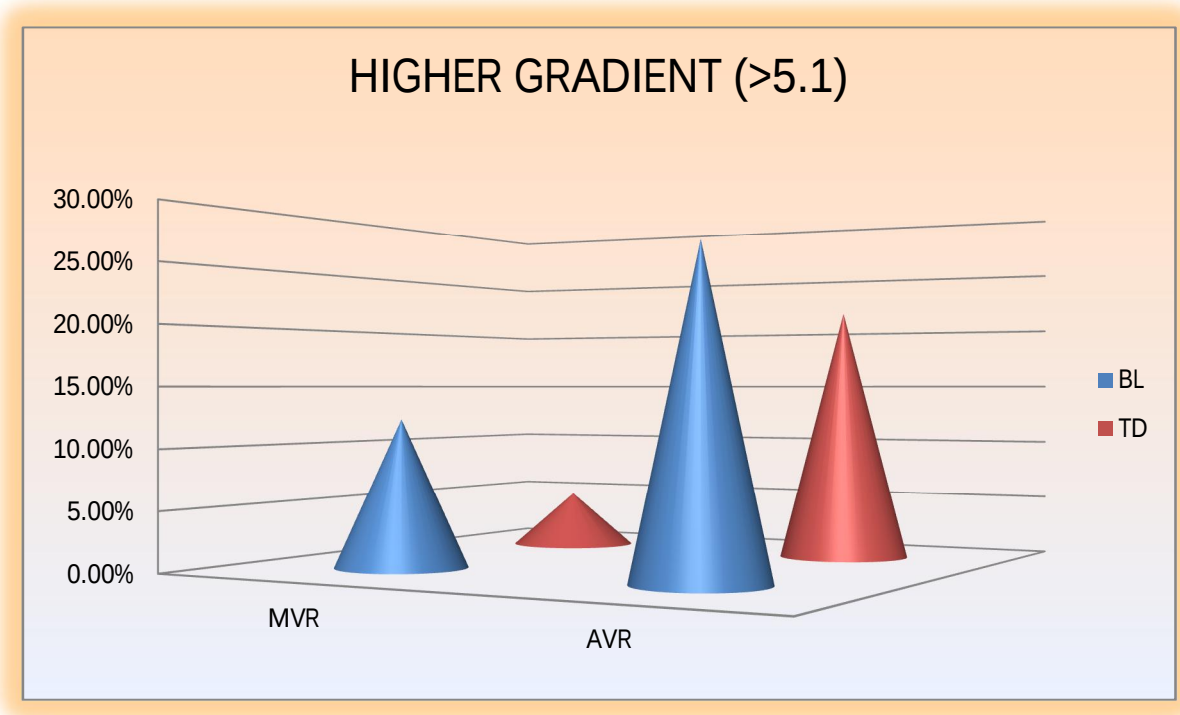
Pearson Chi-Square 4.972 P=0.083

There is no statistical significance between "**bileaflet"** and "**tilting disk**'' with respect to post operative transvalvular mean gradient in mitral valve replacement.

AVR			TYPE OF VALVE		
			BL	TD	Total
GR-G	1.5-3	Count	16	5	21
		% within GR	76.2%	23.8%	100.0%
		% within TYPE OF VALVE	34.8%	35.7%	35.0%
		% of Total	26.7%	8.3%	35.0%
	3.1-5	Count	18	6	24
		% within GR	75.0%	25.0%	100.0%
		% within TYPE OF VALVE	39.1%	42.9%	40.0%
		% of Total	30.0%	10.0%	40.0%
	>5.1	Count	12	3	15
		% within GR	80.0%	20.0%	100.0%
		% within TYPE OF VALVE	26.1%	21.4%	25.0%
		% of Total	20.0%	5.0%	25.0%
	Total	Count	46	14	60
		% within GR	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=.133a P=0.936

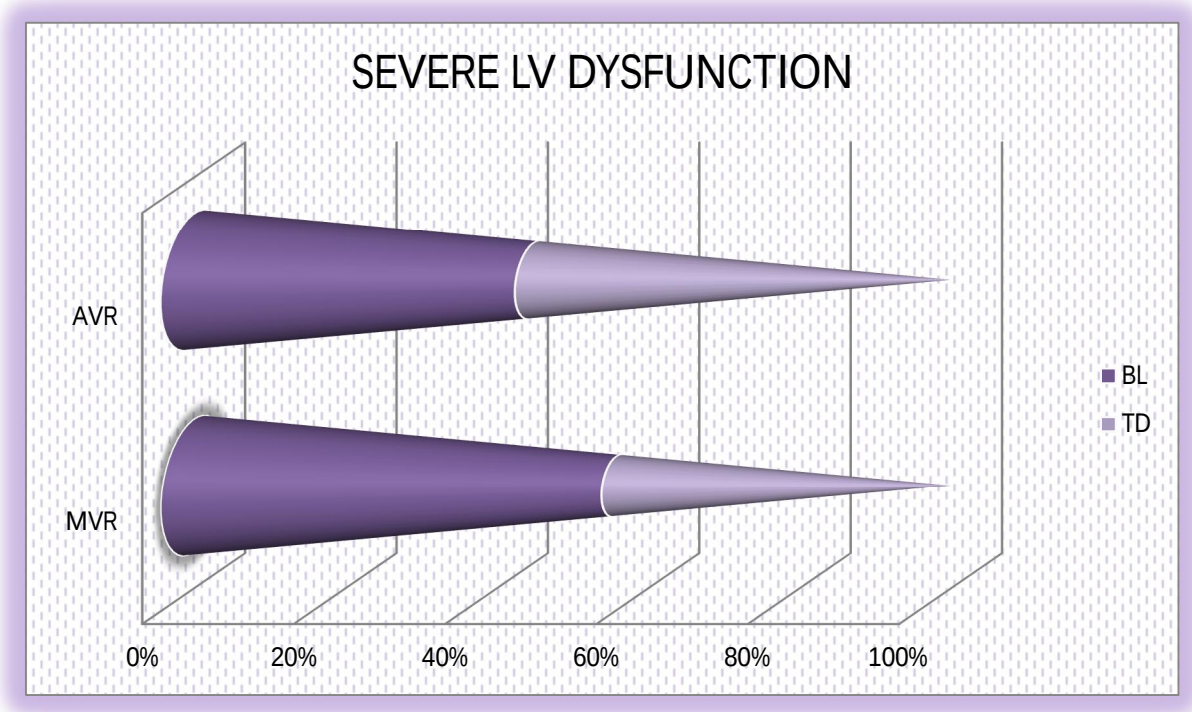
There is no statistical significance between "**bileaflet"** and "**tilting disk**" with respect to post operative transvalvular mean gradient in aortic valve replacement.



4. POST OPERATIVE LV FUNCTION

Post operative LV function assessed echocardiographically by ejection fraction (EF) of left ventricle. Ejection fraction (EDV-ESV/EDV) calculated from the echo by preinstalled software. Categorizations of LV function upon EF as follows

CATAGORY	EF
SEVERE	<30
MODERATE	31-40
MILD	41-54
NORMAL	>55



MVR			TYPE OF VALVE		
			BL	TD	Total
EF	SEVERE	Count	11	4	15
		% within EF	73.3%	26.7%	100.0%
		% within TYPE OF VALVE	4.8%	3.8%	4.5%
		% of Total	3.3%	1.2%	4.5%
	MODERATE	Count	24	11	35
		% within EF	68.6%	31.4%	100.0%
		% within TYPE OF VALVE	10.5%	10.5%	10.5%
		% of Total	7.2%	3.3%	10.5%
	MILD	Count	54	18	72
		% within EF	75.0%	25.0%	100.0%
		% within TYPE OF VALVE	23.7%	17.1%	21.6%
		% of Total	16.2%	5.4%	21.6%
	NORMAL	Count	139	72	211
		% within EF-G	65.9%	34.1%	100.0%
		% within TYPE OF VALVE	61.0%	68.6%	63.4%
		% of Total	41.7%	21.6%	63.4%
	Total	Count	228	105	333
		% within EF	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

Pearson Chi-Square=2.244a P=0.523

There is no statistical significance between "**bileaflet"** and "**tilting disk**'' with respect to post operative LV function in mitral valve replacement.

AVR			TYPE OF VALVE		
			BL	TD	Total
EF	SEVERE	Count	8	3	11
		% within EF	72.7%	27.3%	100.0%
		% within TYPE OF VALVE	17.4%	21.4%	18.3%
		% of Total	13.3%	5.0%	18.3%
	MODERATE	Count	9	0	9
		% within EF	100.0%	.0%	100.0%
		% within TYPE OF VALVE	19.6%	.0%	15.0%
		% of Total	15.0%	.0%	15.0%
	MILD	Count	6	5	11
		% within EF	54.5%	45.5%	100.0%
		% within TYPE OF VALVE	13.0%	35.7%	18.3%
		% of Total	10.0%	8.3%	18.3%
	NORMAL	Count	23	6	29
		% within EF-G	79.3%	20.7%	100.0%
		% within TYPE OF VALVE-G	50.0%	42.9%	48.3%
		% of Total	38.3%	10.0%	48.3%
	Total	Count	46	14	60
		% within EF	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=5.957a P=0.114

There is no statistical significance between "**bileaflet"** and "**tilting disk**" with respect to post operative LV function in aortic valve replacement.

4. VALVE THROMBOSIS

Valve thrombosis is defined as thrombus in or about the valve that is not associated with infection and that interferes with valve function or obstructs blood flow through it. Valve thrombosis was assessed by echo usually in symptomatic patients

During the hospital stay or follow up visit. Rarely it is found incidentally during follow up echo.

MVR			TYPE OF VALVE		
			BL	TD	Total
VT	NO	Count	215	102	317
		% within VT	67.8%	32.2%	100.0%
		% within TYPE OF VALVE	94.3%	97.1%	95.2%
		% of Total	64.6%	30.6%	95.2%
	YES	Count	13	3	16
		% within VT	81.3%	18.8%	100.0%
		% within TYPE OF VALVE	5.7%	2.9%	4.8%
		% of Total	3.9%	.9%	4.8%
	Total	Count	228	105	333
		% within VT	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

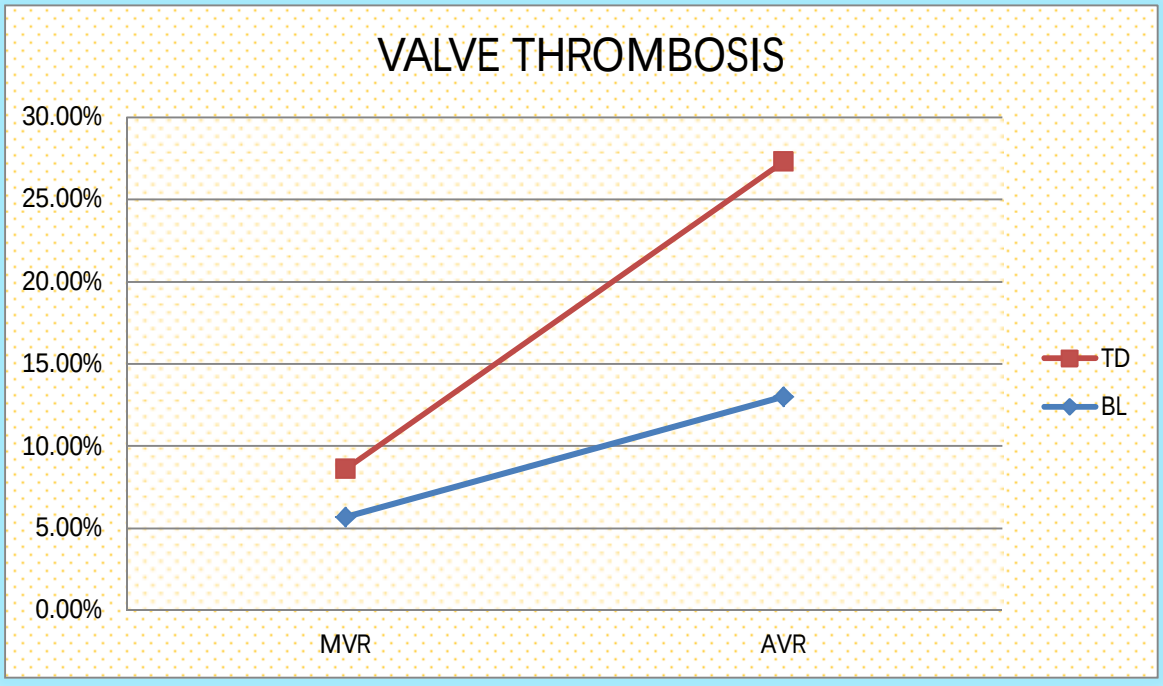
Pearson Chi-Square= 1.272a P=0.259

There is no statistical significance between "**bileaflet"** and "**tilting disc**'' with respect to valve thrombosis in mitral valve replacement.

AVR			TYPE OF VALVE-G		
			BL	TD	Total
VT	NO	Count	40	12	52
		% within VT	76.9%	23.1%	100.0%
		% within TYPE OF VALVE	87.0%	85.7%	86.7%
		% of Total	66.7%	20.0%	86.7%
	YES	Count	6	2	8
		% within VT	75.0%	25.0%	100.0%
		% within TYPE OF VALVE	13.0%	14.3%	13.3%
		% of Total	10.0%	3.3%	13.3%
	Total	Count	46	14	60
		% within VT	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=0.014a P=O.905

There is no statistical significance between "**bileaflet"** and "**tilting disc**" with respect to valve thrombosis in aortic valve replacement.



6. EMBOLIC AND HAEMORRHAGIC COMPLICATIONS

Embolism refers to any embolic event not associated with endocarditis that occurs after the immediate perioperative period and after the emergence from anesthesia. Embolic events are further delineated into neurological events and peripheral embolic events.

A bleeding event refers to any clinically significant bleed requiring hospitalization or transfusion or causing death. A patient does not have to be taking an anticoagulant to sustain a bleeding event

MVR			TYPE OF VALVE		
			BL	TD	Total
EM & HAE	NO	Count	207	98	305
		% within EM & HAE	67.9%	32.1%	100.0%
		% within TYPE OF VALVE	90.8%	93.3%	91.6%
		% of Total	62.2%	29.4%	91.6%
	YES	Count	21	7	28
		% within EM & HAE	75.0%	25.0%	100.0%
		% within TYPE OF VALVE	9.2%	6.7%	8.4%
		% of Total	6.3%	2.1%	8.4%
	Total	Count	228	105	333
		% within EM & HAE	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

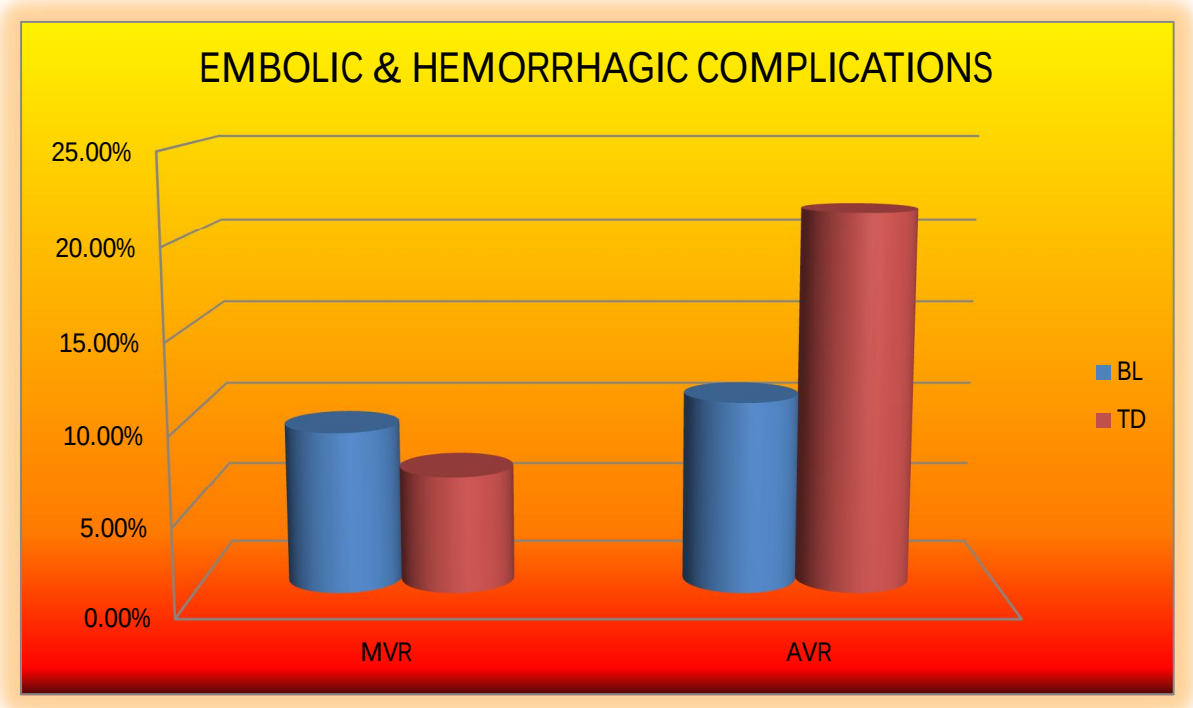
Pearson Chi-Square=0.604a P=0.437

There is no statistical significance between "**bileaflet"** and "**tilting disc**'' with respect to embolic and hemorrhagic complications in mitral valve replacement.

AVR			TYPE OF VALVE		
			BL	TD	Total
EM &HAE	NO	Count	41	11	52
		% within EM &HAE	78.8%	21.2%	100.0%
		% within TYPE OF VALVE	89.1%	78.6%	86.7%
		% of Total	68.3%	18.3%	86.7%
	YES	Count	5	3	8
		% within EM &HAE	62.5%	37.5%	100.0%
		% within TYPE OF VALVE	10.9%	21.4%	13.3%
		% of Total	8.3%	5.0%	13.3%
	Total	Count	46	14	60
		% within TE & HAE	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=1.036a P=0.309

There is no statistical significance between "**bileaflet"** and "**tilting disc**" with respect to embolic and hemorrhagic complications in aortic valve replacement.



7. VALVE RELATED MORTALITY

Cardiac deaths include valve-related deaths, sudden deaths, and non–valve-related cardiac deaths. Total deaths refer to any and all deaths after a valve operation. Unexplained deaths were just that listed as such. In our study we analysed only valve related mortality. Valve-related mortality is any death after a valve operation caused by a morbid event that is not related to progressive heart failure in patients with functioning valves from the day of surgery to 6 months.

MVR			TYPE OF VALVE		
			BL	TD	Total
VRM	NO	Count	215	100	315
		% within VRM	68.3%	31.7%	100.0%
		% within TYPE OF VALVE	94.3%	95.2%	94.6%
		% of Total	64.6%	30.0%	94.6%
	YES	Count	13	5	18
		% within VRM	72.2%	27.8%	100.0%
		% within TYPE OF VALVE	5.7%	4.8%	5.4%
		% of Total	3.9%	1.5%	5.4%
	Total	Count	228	105	333
		% within VRM	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

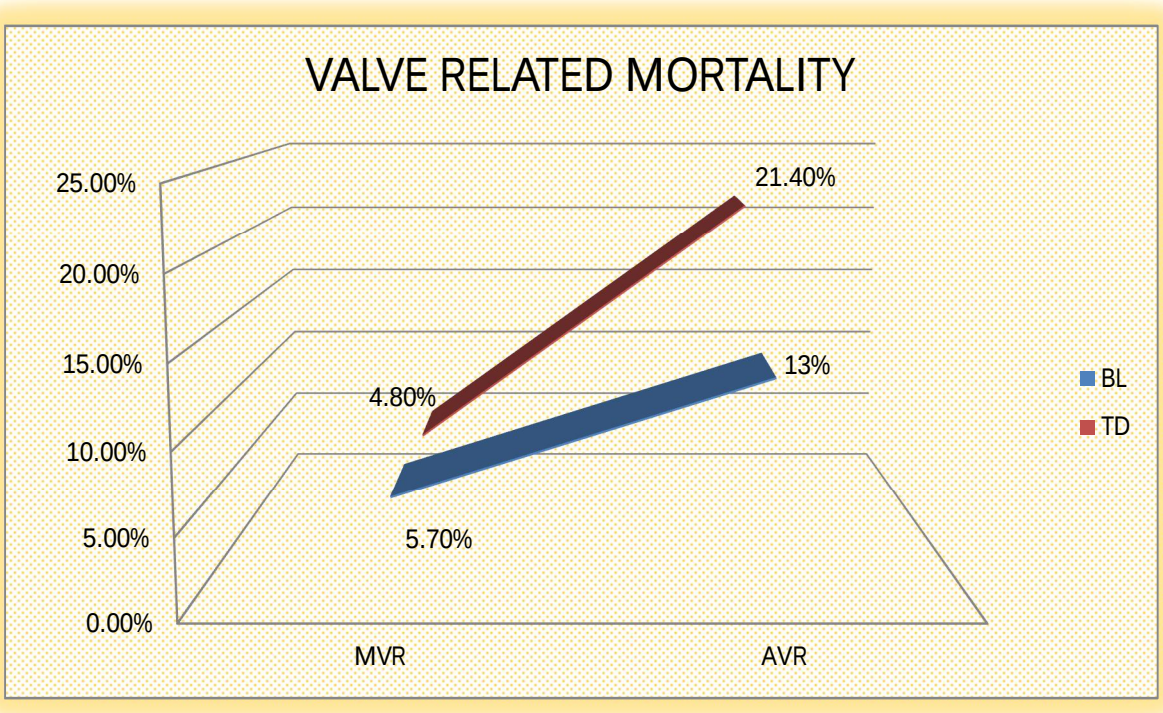
Pearson Chi-Square=0.124a P=O.725

There is no statistical significance between "**bileaflet"** and "**tilting disc**'' with respect to valve related mortality in mitral valve replacement.

AVR			TYPE OF VALVE		
			BL	TD	Total
VRM	No	Count	40	11	51
		% within VRM	78.4%	21.6%	100.0%
		% within TYPE OF VALVE	87.0%	78.6%	85.0%
		% of Total	66.7%	18.3%	85.0%
	Yes	Count	6	3	9
		% within VRM	66.7%	33.3%	100.0%
		% within TYPE OF VALVE	13.0%	21.4%	15.0%
		% of Total	10.0%	5.0%	15.0%
	Total	Count	46	14	60
		% within VRM	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=0.592a P=0.442

There is no statistical significance between "**bileaflet"** and "**tilting disc**" with respect to valve related mortality in mitral valve replacement.



8. FREEDOM FROM COMPLICATIONS FOR 6 MONTHS

Patients followed up in our department from the day of surgery to 6 months follow up were assessed for freedom of complications. Complications considered in this category are cardiac mortality, valve thrombosis, embolism, hemorrhagic diathesis, infective endocarditis, paravalvular leak, re operation, progressive failure, any event mandates in patient admission (like INR). Each parameter was taken up for event free follows ups.

MVR			TYPE OF VALVE		
			BL	TD	Total
FFC-6	NO	Count	47	24	71
		% within FFC-6	66.2%	33.8%	100.0%
		% within TYPE OF VALVE	20.6%	22.9%	21.3%
		% of Total	14.1%	7.2%	21.3%
	YES	Count	181	81	262
		% within FFC-6	69.1%	30.9%	100.0%
		% within TYPE OF VALVE	79.4%	77.1%	78.7%
		% of Total	54.4%	24.3%	78.7%
	Total	Count	228	105	333
		% within FFC-6	68.5%	31.5%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	68.5%	31.5%	100.0%

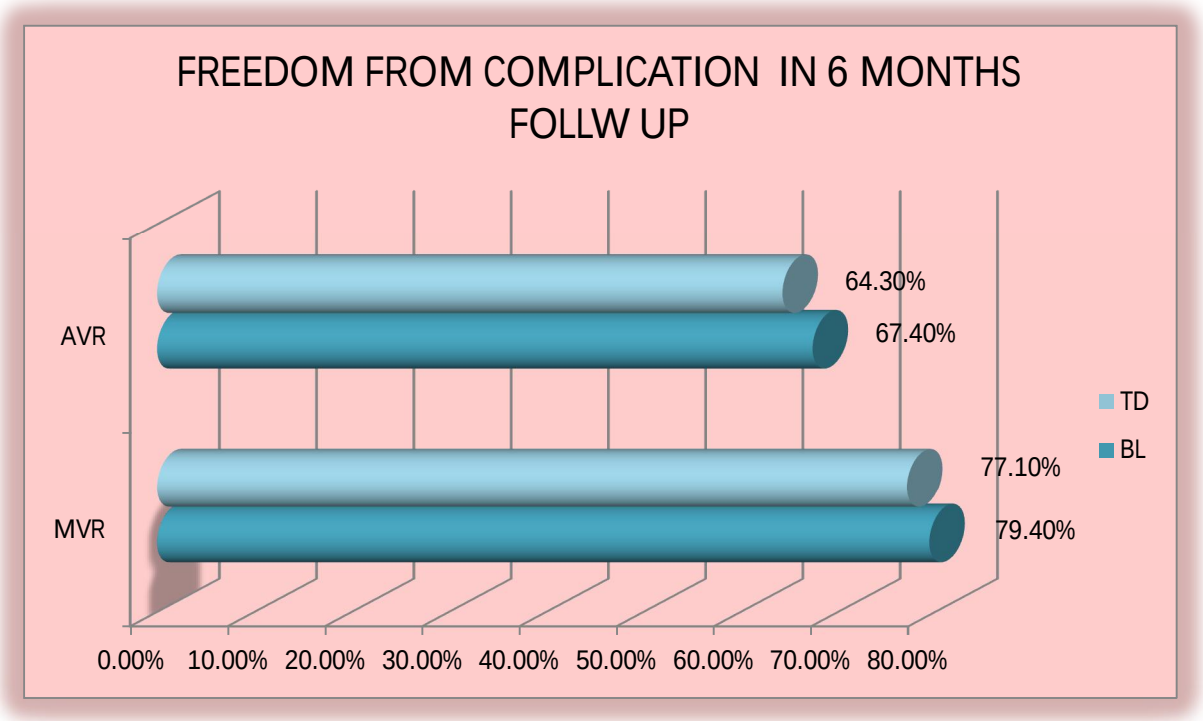
Pearson Chi-Square=0.216a P=0.642

There is no statistical significance between "**bileaflet"** and "**tilting disc**'' with respect to freedom from complication in 6 months follow up in mitral valve replacement.

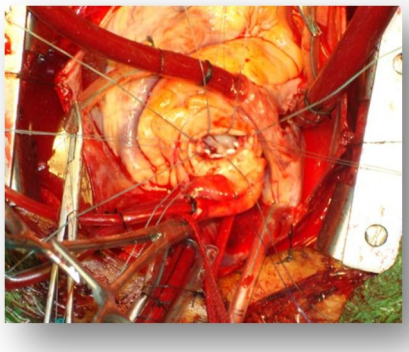
AVR			TYPE OF VALVE		
			BL	TD	Total
FFC-6	NO	Count	15	5	20
		% within FFC-6	75.0%	25.0%	100.0%
		% within TYPE OF VALVE	32.6%	35.7%	33.3%
		% of Total	25.0%	8.3%	33.3%
	YES	Count	31	9	40
		% within FFC-6	77.5%	22.5%	100.0%
		% within TYPE OF VALVE	67.4%	64.3%	66.7%
		% of Total	51.7%	15.0%	66.7%
	Total	Count	46	14	60
		% within FFC-6	76.7%	23.3%	100.0%
		% within TYPE OF VALVE	100.0%	100.0%	100.0%
		% of Total	76.7%	23.3%	100.0%

Pearson Chi-Square=0.047a P=O.829

There is no statistical significance between "**bileaflet"** and "**tilting disc**" with respect to freedom from complication in 6 months follow up in aortic valve replacement.



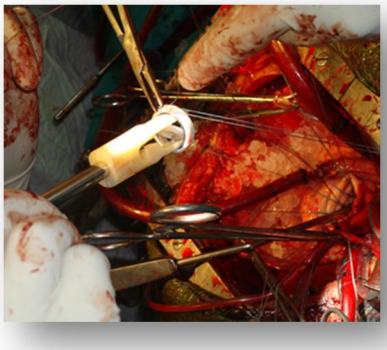
AORTIC VALVE REPLACEMENT



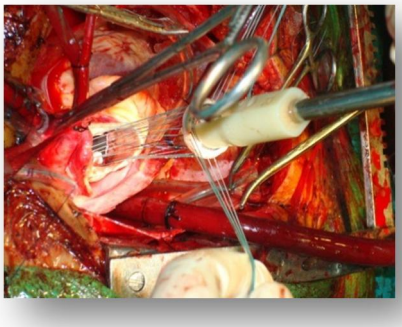
AORTOTOMY

AORTIC TILTING DISC VALVE

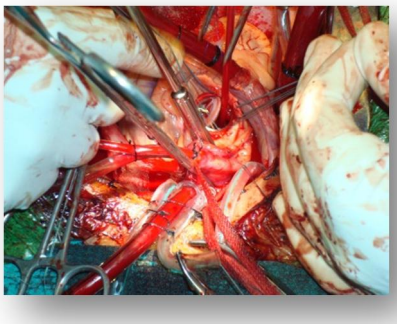
ON HOLDER



ORIENTATION

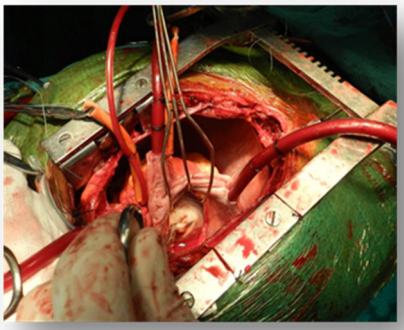


POSITIONING



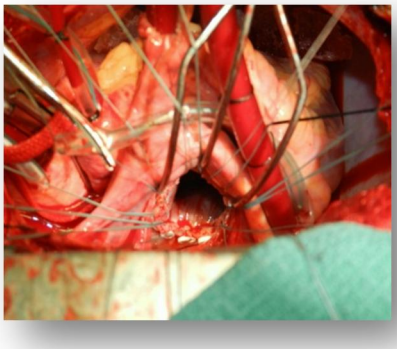
AFTER REPLACEMENT

MITRAL VALVE REPLACEMENT

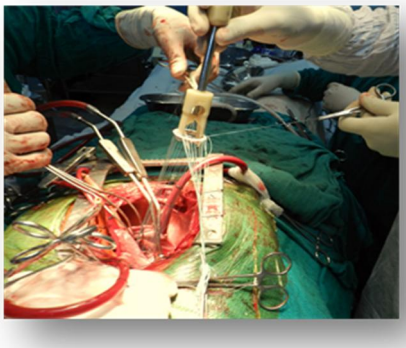


DISEASED MITRAL VALVE

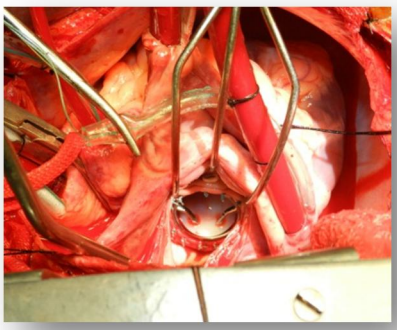
MITRAL TILTING DISC VALVE



EVERTING SUTURES



ORIENTATION



AFTER REPLACEMENT

LEAFTLET TESTING

DISCUSSION

Discussion

The “**Bileaflet”** or “**tilting disc**’’ prosthetic valves remain the most widely used mechanical valve all over the world after the era of **ball and cage** prosthetic valves. Although a number of authors have reported their experience with one of these valves in relation with manufacturing companies, there are few studies from a single center that compare the relative efficacy of both. This may be important because referral patterns may vary from one institution to another, as may operative techniques and postoperative management, which often makes comparisons difficult.

In government general hospital, Chennai, we have had the experience of implantation of nearly 393 of each of these two mechanical prostheses.However, the reality was that they were initially used in different manufacturer labels.In each groups with widely different characteristics was an obstacle to make any conclusions about their comparative analysis. Therefore, a retrospective comparative study of these two type of prostheses “**Bileaflet”** or “**tilting disc**’’and in both groups was conceived and carried out from september 2009 to september 2011.The short-term analysis of the results of this study was largely inconclusive with the two types valves. As the different complications of prostheses do not occur at a constant rate, analysis of the results after a short period of follow-up may have led to cross-sectional errors because of the inclusion of complications of earlier occurrence and of the exclusion of those occurring at a later stage.

In this study , previous valve surgeries like closed mitral commisurotomy, balloon valvuloplasty was not a risk factor and were included. It was not our interest to evaluate the paravavular leak,infective endocarditis as these have been studied by others.Since we believe paravalvular leak in given mechanical valve prosthesis most of the time confounded by technical errors rather than valvular architecture. In our hospital infective endocarditis mainly managed by physicians in medical department before referring to cardiologist and CT surgeons unless surgical intervention needed for them. Hence , actual incidence become more complicated issue.

Eventhough , ease of procedure was purely subjective and not studied by others ,during the changing time from long term bileaflet usage to tilting disk, we observed significant difficulty in positioning and orientation of valve in tilting disk type (3.1% for BL,46.7% for TD in MVR group, 4.3%BL and 14.3 %TD in AVR group).That is due to tilting disk greater orifice positioning in mitral valve procedure along with PML preservation. In this positioning obviously chordal structure obstructing the leaflet mobilty causing greater inconvenience of reimplantation and which caused two operative mortality. Later on we decided to remove posterior leaflet for all tilting disk for greater orifice facing PML side. Some departmental unit surgeons prefers to keep AML side also. But in AVR side ,we detected difficulty in placing valve is not due to the type of valve, it is instead aortic annulus per se, although easy to impalnt is bileaflet.There are two occasion worth to mention where the tilting disk mechanical valve was inversely positioned at aortic position , shortly detected and rectified. So we have to accept a little confusion exist for tilting disk even in aortic positioning. Joachim Laas et al, described ideal orientation of each type of valve in aortic position.

Post operative hemodynamics was stormy in respect to each type valve(17.5% BL,8.6%TD) in MVR clearly demarcates the significant difference ($p<0.0001$). In bileaflet group , despite the high volume(BL 228) the stormy post operative period is evident. Aortic group (15.2% BL,21.4%TD) hemodynamics showing higher incidence of stormy hemodynamics in tilting disc . But this is not statistically significant[23].

The true fact reflecting the valve performance are transvalvular mean gradient.
Which is truly inherent nature of valve by opening and closing mechanism,hinge and pivotting system.Higher grdients which is more than 5.1 and above were observed in bileaflet velve types (12.3% BL,4.8% TD in MVR / 26.1% BL , 21.4%in AVR).Higher gradients hypothetically related to pivotting mechnism in bileaflet type. Although this values did not arrive statistical significance , higher gradients observed in bileaflet valve as comparable with other studies.

Post operative LV dysfunction was slightly higher in bileaflet in mitral valve replacements,(severe LV dysfunction 4.8% BL,3.8% TD in MVR) whereas in Aortic groups tilting disk types have shown higher incidence (17.4% BL , 21.4% in AVR). without reaching the statiscal significance on either side. Severe LV dysfunction was not truly related to valve type as it is confounded by lot of factors including per op cross clamp time, type and extent of myocardial protection, disease nature (MR>MS), (AS>AR) ,pre operative failure status etc[22]..

Valve thrombosis as we referred with echocardiogram higher 6 months incidence in bileaflet side. Perhaps, it is attributed to poor anticoagulation profile, this can be valve nature on the side thrombosis. In this study , we observed lower incidence of valve thrombosis in tilting disk valve types in mitral group (5.7% BL,2.9% TD in MVR) but more or less the same incidence observed in aortic group (13% BL , 14.3%TD in AVR)[29,30] without statistical significance. Nearly 70-75% patient who have had valve thrombosis developed embolism.

Embolic and hemorrhagic complications after heart valve replacement is related to the level of anticoagulation, which differs among studies[35]. In our study the target levels of anticoagulation were the same for both the **Bileaflet"** and "**tilting disc**'' valves. However, beyond the initial few months required for stabilization, control of anticoagulation was not centralized. Further, we do not have complete records **of** the actual level of prothrombin time or INR at the time in Embolic and hemorrhagic complications. Recent recommendations are for a target INR **of** 2.5 to 3.5 for all mechanical valves. The comparative study by Anthunes[24] et al did not detect a statistically significant difference in freedom from thromboembolism at 5 years between the St. Jude Medical valve (92% ± 4%) and the Medtronic Hall valve (89% ± 4%). All western studies (Fiore et al) were indicated less incidence of thromboembolism in bileaflet without statistical significance. In our study paradoxically, we observed more incidence of embolism and hemorrhages occurred in bileaflet as compared with tilting disk in mitral group. (9.2% BL,6.7% TD in MVR) (10.9% BL , 21.4 TD%in AVR) looking into aortic valve group reflects western study results.. Again it is not statistically significant in any of the side[31,32,33].

Valve related mortality excluding unexplained death and non-cardiac death rate is not comparable in mitral group (5.7% BL,4.8% TD in MVR) but aortic group revealing higher incidence valve related mortality in tilting disk type (13% BL , 21.4%TD in AVR). Both of this is absolutely not significant statistically. In our govt general hospital, due to long post mortem waiting list, it was not possible to conduct postmortem in unexplained deaths. Moreover, some ethical issue also lies in it. If it could be done in all cases, there should be some comparative results on one side[34].

Freedom from complications in short term period of 6 months contains many variables which may be giving some confounding errors. Since we have taken post op failure and also an inclusion criterion, these additional parameters also changes the trend to more volume side. For example in MVR bileaflet type, large numbers of the tilting disk sufficiently gives more number of follow up and readmissions etc. However freedom from complications during 6 months follows up is almost equal in both groups. (79.4% BL vs77.1% TD in MVR / 67.4 %BL vs 64.3% TD in AVR).[34]

Finally we can arrive at some epidemiological datas from our study. Mean age group including both valve replacements was 33.9 ± 9.685 SD. Male patients had undergone higher number of mitral valve replacement (50.5% M,43.5%F in MVR)compared to female patient which is vice versa in aortic valve replacement. (25% M,75%F in AVR) But both groups are not ststistically significant. Importantly in disease pattern the stenotic lesions predominates regurgitation lesions (Mitral 60.4:17.1 Aortic 39.6:32) excluding mixed lesions in our population.

Results

This retrospective study enlighten the following results,

- Bileaflet valve positioning and orientation in respect to Mitral valve replacement is obviously easier than tilting disk (96.9% vs 53.3%),which is statistically significant.(P = 0.0003). Whereas in Aortic valve replacement, tilting disc are valve not equally easier with bileaflet valve (95.7% vs 85.7%) and indicating some difficulties.But no statistical significance exist with each other in aortic valve replacements.(p= 0.192)
- In bileaflet type Post operative hemodynamics after mitral valve replacement was significantlystormy as compared with tiltling disc (17.5% vs 8.6%). Hence we have to reject the null hypothesis to say this is statistically significant (P=0.032). Although, stormy post operative hemodynamics higher in tilting disk than bileaflet type (15.2% vs 21.4%) in aortic valve replacements, it is not statistically significant. (p=0.585)
- We observed higher transvalvular gradient in bileaflet type mechanical valves in both valvular replacements. (12.3% BL vs 4.8% TD in MVR / 26.1% BL vs 21.4% in AVR).Ultimately this is not a statistical significant data, but the fact is higher transvalvular grdient have been associated with significant post operative mortality and morbidity. What so ever ,we have not sub-catagorized mean gradient with other variables in this study.
- LV dysfunction after the mitral valve replacements was not significantly higher in bileaflet valve.(severe LV dysfunction 4.8% vs 3.8% in MVR) (p=0.523). Similar scenario but vice versa in aortic group. Tilting disc showing

higher incidence (17.4% vs 21.4% in AVR) without statistical significance (p=0.114) Severe LV dysfunction not truly related to valve type as it is confounded by lot of other factors.

- We detected little lower incidence of valve thrombosis in tilting disc valve types in mitral group (5.7% BL,2.9% TD in MVR) but more or less the same incidence observed in aortic group (13% BL , 14.3%TD in AVR).There was no statistical significance in both group.
- Embolism and hemorrhages looks slightly higher in bileaflet group on instance. But considering the large volume of mitral group this is more or less equal occurrence (9.2% BL,6.7% TD in MVR) (p=0.437). More incidence of embolism and hemorrhages occurred in tilting disc as compared with bileaflet in small aortic group (10.9% BL , 21.4 TD%in AVR) (p=0.309). But none of the group rejected the null hypothsis.
- Valve related mortality is not comparable in mitral group (5.7% BL,4.8% TD in MVR) (p=O.725). but aortic groups revealing higher incidence in tilting disc type (13% BL , 21.4%TD in AVR). Both of this was absolutely not significant statistically.
- Freedom from complications during 6 months follow up is almost equal in both groups. (79.4% BL,77.1% TD in MVR/ 67.4 %BL , 64.3% TD in AVR).

Conclusion

In this study, we came to the conclusion with the best available evidence for comparing the results between **“bileaflet”** and **“tilting disc’’** offer similar excellent clinical performance for both MVR and AVR . In MVR, our short term results suggest an advantage in favor of the **bileaflet** mechanical valve in terms of ease of procedure and an advantage in favors of **tilting disc** valve in respect to Post operative hemodynamics. Other variables in terms of transvalvular gradient, LV function, valve related mortality, valve thrombosis, embolic & hemorrhagic complications, freedom from complications during 6 months follow up did not show the statistical difference between **“bileaflet”** and **“tilting disc’’** in both groups. These differences await further clarification with more patients followed up for a longer period of time[23, 24, 25].

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ANNEXURE

MVR – MITRAL VALVE REPLACEMENT

AVR- AORTIC VALVE REPLACEMENT

BL- BILEAFLET MECHANICAL VALVE

TD - TILTING DISK MECHANICAL VALVE

SJM – St JUDE MEDICAL VALVE

TTK – TTK CHITRA VALVE

MH – MEDTRONIC HALL MECHANICAL VALVE

ATS - ATS MEDICAL OPEN PIVOT BILEAFLET HEART VALVE

SO - SULZER CARBOMEDICS PROSTHETIC HEART VALVE

EOP - EASE OF PROCEDURE

POP HD – POST OPERATIVE HEMODYNAMICS

GR - TRANS VALVULAR GRADIENT

EF- EJECTION FRACTION

LV – LEFT VENTRICLE

LVF – LEFT VENTRICULAR FUNCTION

VT- VALVE THROMBOSIS

EM & HAE – EMBOLISM AND HEMORRHAGIC COMPLICATIONS

VRM – VALVE RELATED MORTALITY

FFR-6 – FREEDOM FROM COMPLICATIONS DURING 6 MONTHS FOLLOW UP

AML - ANTERIOR MITRAL LEAFLET

PML – POSTERIOR MITRAL LEAFLET

TEE – TRANS ESOPHAGEAL ECHO

PATIENT CONSENT FORM

‘‘COMPARATIVE STUDY BETWEEN BILEAFLET AND TILTING DISC MECHANICAL VALVE PROSTHESIS - A RETROSPECTIVE ANALYSIS’’

Patient name: age/sex: IP no:

study Centre:

Check these boxes

1. I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask the question and all my questions and doubts have been answered to my complete satisfaction. ☐
2. I understand that my participation in this study is voluntary and I am free to withdraw at any time without giving any reason, without my legal rights being affected. ☐
3. I understand that the sponsor of the clinical study, others working on the sponsor’s behalf, the ethics committee and the regulatory authorities will not my permission to look my health records both in respect of current study and further research that may be conducted in relation to it, even if I withdraw from the study. I agree to this access. However I understand that my Identify will not be revealed in any information released to third parties, unless as required under law. I agree not to restrict the use of any data of results that arises from this study ☐
4. I agree to take part in above study and to comply with the instructions given during the study and to faithfully co-operate with study team, and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ☐
5. I hereby give permission to undergo complete clinical examination and diagnostic tests whatever needed for above the study. ☐

Patient signature; Patient thumb impression:

Investigator’s name; Signature:

Place: Date:

COMPARATIVE STUDY BETWEEN BILEAFLET AND TILTING DISC MECHANICAL VALVE PROSTHESIS - A RETROSPECTIVE ANALYSIS

Operative History

Preoperative Status:

Operation Notes:

Per operative Findings:

Postoperative Period:

COMPARATIVE STUDY BETWEEN BILEAFLET AND TILTING DISC MECHANICAL VALVE PROSTHESIS - A RETROSPECTIVE ANALYSIS

Post OP Complications & Management

Follow up:

MASTER CHART

MVR

SN	NAME	AGE	SEX	IP NO	UNIT	DOS	DIAGNOSIS	PRO	SIZE	COMP	TYPE OF VALVE	EOP	POP HD	GR	EF	VT	E & HAE	VRM	FFC-6
1	BACKKIYAM	48	F	56420	CT3/SVK	3.9.09	MS/MR	MVR	29	SJM	BL	Y		3.5	60				
2	MUTHUSELVI	48	F	60024	CT6/RV	3.9.09	MS	MVR	25	SJM	BL	Y	S	4	40			Y	N
3	SAGAYAMERY	28	F	26592	CT1/MV	4.9.09	MS/MR	MVR	25	SJM	BL	Y		4.5	50				
4	MURUGAN	31	M	59916	CT2/TSM	4.9.10	MS/MR	MVR	27	SJM	BL	Y		2	50				
5	MANICKAM	47	M	52435	CT2/TSM	5.9.09	MS	MVR	27	SJM	BL	Y	S	3	60				
6	SIVARAMAN	38	M	56226	CT3/SVK	7.9.09	MR	MVR	29	SJM	BL	Y		4	65				
7	SELVARAJ	48	M	66417	CT4/TV	7.9.10	MS	MVR	25	SJM	BL	Y		3.5	35				
8	VIJAYA	34	F	76689	CT1/MV	8.9.09	MS/MR	MVR	25	SJM	BL	Y	S	2	60				
9	ABDUL AHAMAD	15	M	66435	CT4/TV	11.9.09	MS/MR	MVR	27	SJM	BL	Y		4.5	60				
10	AMUL	32	F	41315	CT1/MV	11.9.10	MR	MVR	25	SJM	BL	Y		4	45				
11	BALU	38	M	58955	CT5/KS	12.9.09	MRS	MVR	29	SJM	BL	Y	S	1.5	35				
12	RAMYA	15	F	61951	CT2/TSM	12.9.10	MS	MVR	25	SJM	BL	Y		3.5	45				
13	SAMUVEL	32	M	62225	CT3/SVK	14.9.09	MS/MR	MVR	29	SJM	BL	Y		1.5	65				
14	MARIMUTHU	40	M	62505	CT5/KS	15.9.09	MR	MVR	27	SJM	BL	Y	S	2	35				
15	MATHU	48	M	62810	CT5/KS	16.9.09	MS/MR	MVR	27	SJM	BL	Y		4	65				
16	VENUGOPAL	45	M	68448	CT4/TV	18.9.09	MS	MVR	27	SJM	BL	Y		3	40				
17	KANCHANA	25	F	30454	CT1/MV	22.9.09	MS	MVR	25	SJM	BL	Y		2	60				
18	ANITHA	30	F	71178	CT6/RV	24.9.09	MS/MR	MVR	25	SJM	BL	Y		8	25		Y		N
19	LAVANYA	14	F	68410	CT6/RV	25.9.09	MS	MVR	25	SJM	BL	Y		2	60				
20	SELVI	37	F	63886	CT2/TSM	26.9.09	MS	MVR	29	SJM	BL	Y		2	50				
21	SUMATHYMARY	32	F	62751	CT5/KS	26.9.09	MS	MVR	27	SJM	BL	Y		2	65				
22	JEYAPERUMAL	23	M	65882	CT2/TSM	30.9.09	MS	MVR	29	SJM	BL	Y		4	35				
23	VADIVELU	28	M	63070	CT6/RV	1.10.09	MS/MR	MVR	27	SJM	BL	Y	S	2	65				
24	PUSHPA	43	F	53743	CT1/MV	1.10.09	MS	MVR	27	SJM	BL	Y		3	65				
25	MANI	38	M	70251	CT3/SVK	3.10.09	MS	MVR	27	SJM	BL	Y		2	60				
26	BANU	30	F	74711	CT4/TV	6.10.09	MS	MVR	25	SJM	BL	Y		3	65				

27	MARUTHAMMAL	39	F	73259	CT6/RV	12.10.09	MS/MR	MVR	27	SJM	BL	Y	S	9	30	Y	Y	Y	N
28	RADHA	31	F	76626	CT5/KS	13.10.09	MS	MVR	27	SJM	BL	Y		2	60				
29	BABU	15	M	84846	CT1/MV	13.10.09	MS	MVR	27	SJM	BL	Y		3	60				
30	AMALA	43	F	61968	CT2/TSM	14.10.09	MRS	MVR	27	SJM	BL	Y	S	3.5	40				
31	VALLI	35	F	74451	CT3/SVK	19.10.09	MS/MR	MVR	27	SJM	BL	Y		3	60				
32	MAHESWARI	22	F	73268	CT1/MV	19.10.10	MRS	MVR	25	SJM	BL	Y		2	65				
33	AMMULU	30	F	67407	CT1/MV	20.10.09	MS/MR	MVR	27	SJM	BL	Y		1.5	65				
34	RAMU	35	M	77264	CT6/RV	22.20.09	MS	MVR	25	SJM	BL	Y		2	35				
35	MANGAIYARKARASI	37	F	76309	CT3/SVK	23.10.09	MR	MVR	29	SJM	BL	Y		4.5	60				
36	BARATH	38	M	62787	CT5/KS	24.10.09	MRS	MVR	27	SJM	BL	Y		2	50				
37	PERUMAL	25	M	52131	CT1/MV	10.11.09	MR	MVR	29	SJM	BL	Y	S	9	25		Y		N
38	PRABAKARAN	32	M	78212	CT2/TSM	11.11.09	MRS	MVR	27	SJM	BL	Y		3	45				
39	NAGAMUTHU	42	M	85475	CT5/KS	11.11.09	MS	MVR	27	SJM	BL	Y		3	60				
40	VIJAY	12	M	85258	CT6/RV	12.11.09	MS/MR	MVR	27	SJM	BL	Y		4	35				
41	LALITHA	48	F	46308	CT1/MV	17.11.09	MS	MVR	25	SJM	BL	Y		3	45				
42	KUMUTHA	31	F	87434	CT6/RV	18.11.09	MS	MVR	27	SJM	BL	Y	S	3	45				
43	ARUMUGAM	48	M	88384	CT2/TSM	18.11.09	MS	MVR	27	SJM	BL	Y		2	40				
44	LAKSHMI	34	F	80325	CT2/TSM	21.11.09	MS	MVR	27	SJM	BL	Y	S	2.5	60				
45	ESWARAN	45	M	88384	CT2/TSM	9.12.09	MS	MVR	27	SJM	BL	Y		2	35				
46	KOWSIYA	35	F	90641	CT3/SVK	10.12.09	MS	MVR	25	SJM	BL	Y		2	60				
47	VENKATESAN	38	M	83784	CT3/SVK	10.12.09	MS/MR	MVR	27	SJM	BL	Y		2	45				
48	GUNA	18	F	88929	CT4/TV	13.12.09	MR	MVR	27	SJM	BL	Y		3	60				
49	NIRMAL	16	M	84023	CT1/MV	18.12.09	MRS	MVR	25	SJM	BL	Y	S	10	25	Y		Y	N
50	AMBIKA	20	F	95238	CT4/TV	22.12.09	MR	MVR	27	SJM	BL	Y	S	2.5	65				
51	manju	25	f	91159	CT5/KS	23.12.09	MS/MR	MVR	27	SJM	BL	Y		3.5	35				
52	SHANMUGAM	45	M	91449	CT6/RV	4.1.10	MRS	MVR	27	SJM	BL	Y		1.5	60				
53	KAMARAJ	63	M	86156	CT1/MV	5.1.10	MS/MR	MVR	27	SJM	BL	Y		4	60				
54	SELVAMANI	35	M	96726	CT2/TSM	6.1.10	MR	MVR	29	SJM	BL	Y		2	45				
55	ELLAMMAL	29	F	90868	CT4/TV	8.1.10	MRS	MVR	27	SJM	BL	Y		4.5	50				

56	JANAKI	30	F	84035	CT1/MV	8.1.10	MS/MR	MVR	27	SJM	BL	Y	S	2	45				
57	DHANALAKSHMI	19	F	102219	CT2/TSM	9.1.10	MS	MVR	27	SJM	BL	Y		8	60	Y	Y		N
58	SUNDARI	30	F	101318	CT5/KS	9.1.10	MR	MVR	25	SJM	BL	Y		2	65				
59	KALYANI	21	F	94276	CT4/TV	11.1.10	MS	MVR	27	SJM	BL	Y		3	60		Y		N
60	KAVITHA	29	F	86150	CT1/MV	12.1.10	MS	MVR	27	SJM	BL	Y		2	35				
61	NIRMALA	40	F	82702	CT3/SVK	13.1.10	MS	MVR	25	SJM	BL	Y		3	60				
62	RAMESH	24	M	99976	CT2/TSM	16.1.10	MS	MVR	29	SJM	BL		S	2	65			Y	N
63	RANGASAMY	46	M	91476	CT6/RV	18.1.10	MS	MVR	27	SJM	BL	Y		3	40	Y			N
64	SIRUMBAYI	40	F	10315	CT5/KS	18.1.11	MS	MVR	27	SJM	BL	Y		2.5	45				
65	MOHD ISMAIL	36	M	10061	CT1/MV	19.1.10	MS	MVR	29	SJM	BL	Y		2.5	60				
66	SUDHA	32	F	88726	CT3/SVK	21.1.10	MS	MVR	25	SJM	BL	Y		1.5	60				
67	ramu	50	m	1808	CT4/TV	22.1.10	MR	MVR	27	SJM	BL	Y	S	4	35				
68	SRIRAMULU	26	M	357	CT5/KS	23.1.10	MS	MVR	27	SJM	BL	Y	S	7	60			Y	N
69	ELUMALAI	55	M	97374	CT2/TSM	23.1.10	MS	MVR	27	SJM	BL	Y		1.5	60				
70	DHANDAPANI	24	M	88091	CT1/MV	29.1.10	MS/MR	MVR	27	SJM	BL	Y	S	3.5	50				
71	SHANKAR	21	M	4713	CT2/TSM	3.2.10	MS	MVR	27	SJM	BL	Y		2.5	60	Y	Y		N
72	JOTHI	31	F	87719	CT3/SVK	4.2.10	MS	MVR	27	SJM	BL	Y		3	60				
73	SUGUNA	18	F	5647	CT5/KS	6.2.10	MS/MR	MVR	27	SJM	BL	Y		4.5	35				
74	GANDHI	33	M	5475	CT6/RV	8.2.10	MR	MVR	25	SJM	BL	Y		4	65				
75	MARIA	18	F	8784	CT2/TSM	10.2.10	MS/MR	MVR	27	SJM	BL	Y		2	45				
76	PERUMAL	18	m	101888	CT1/MV	12.2.10	MRS	MVR	27	SJM	BL	Y		3	45				
77	MOORTHY	27	M	8828	CT2/TSM	13.2.10	MS/MR	MVR	27	SJM	BL	Y		2	65				
78	MANONMANI	36	F	3576	CT5/KS	13.2.11	MR	MVR	27	SJM	BL	Y		4	50				
79	PARASURAMAN	38	M	9104	CT3/TV	15.2.10	MS	MVR	27	SJM	BL	Y		33	60				
80	SELVI	20	F	98702	CT3/TV	18.2.10	MS	MVR	25	SJM	BL	Y		2.5	65				
81	RAVICHANDRAN	38	M	7957	CT3/TV	22.2.10	MS	MVR	25	SJM	BL	Y		1.5	65				
82	THANGARAJ	22	M	8846	CT1/TSM	25.2.10	MS	MVR	25	SJM	BL	Y		2	60				
83	KOMALA	40	F	10794	CT1/TSM	2.3.10	MS/MR	MVR	25	SJM	BL	Y		3.5	65				
84	USHA	20	F	13648	CT5/RV	3.3.10	MR	MVR	25	SJM	BL	Y		3	45				

85	MALATHY	32	F	94127	CT3/TV	4.3.10	MS/MR	MVR	25	SJM	BL	Y		1.5	70				
86	SHANTHI	37	F	7368	CT3/TV	8.3.10	MS	MVR	25	SJM	BL	Y	S	1.5	60			Y	N
87	KASIMALAI	38	F	100219	CT3/TV	11.3.10	MS/MR	MVR	25	SJM	BL	Y		2	70				
88	DARUNISHA	35	F	15707	CT5/RV	13.3.10	MS	MVR	25	SJM	BL	Y		8	70	Y			N
89	VAITHIYANATHAN	45	M	9415	CT3/TV	15.3.10	MS	MVR	25	SJM	BL	Y		3	45				
90	KAMATCHI	34	F	97191	CT2/SVK	17.3.10	MS	MVR	25	SJM	BL	Y		2.5	70		Y		N
91	GIRIJA	32	F	9431	CT3/TV	18.3.10	MS	MVR	25	SJM	BL	Y		2	35				
92	INDRA	25	F	14408	CT1/TSM	19.3.10	MS/MR	MVR	25	SJM	BL	Y	S	4.5	60				
93	ILAKKIYAPRIYA	19	F	9697	CT4/KS	19.3.10	MS	MVR	25	SJM	BL	Y		2.5	65		Y		N
94	LAKSHMI	30	F	13969	CT6/RKS	22.3.10	MS	MVR	25	SJM	BL	Y		4	50				
95	RAMACHANDRAN	20	M	13376	CT4/KS	23.3.10	MS	MVR	25	SJM	BL	Y		2.5	65				
96	KARTHIK	17	M	7074	CT2/SVK	24.3.10	MS/MR	MVR	27	MH	TD	Y		4	35				
97	MARIAPPAN	43	M	11491	CT2/SVK	25.3.10	MR	MVR	29	MH	TD	Y		1.5	40				N
98	NAGOMI	22	F	9975	CT5/RV	27.03.10	MR	MVR	29 ,27	MH	TD		S	10	25			Y	N
99	VAJARAVEL	46	M	5052	CT2/SVK	3.4.10	MS	MVR	29	MH	TD	Y		2	50				
100	CHINNATHAMBI	40	M	22859	CT3/TV	5.4.10	MS	MVR	25	SJM	BL	Y		1.5	45				
101	MANIKANDAN	18	M	17214	CT4/KS	6.4.10	MR	MVR	27	MH	TD		S	4	30		Y	Y	N
102	MAHALAKSHMI	39	F	101915	CT6/RKS	8.4.10	MS	MVR	25	SJM	BL	Y		2.5	60				
103	NALLATHANGAL	38	F	23135	CT4/KS	9.4.10	MS/MR	MVR	25	SJM	BL	Y		3	65				
104	ARULRAJ	24	M	20211	CT1/TSM	13.4.10	MR	MVR	27	MH	TD	Y		1.5	55				
105	DEVI	30	F	22897	CT3/TV	15.4.10	MS/MR	MVR	25	SJM	BL	Y		1.5	65				
106	LALITHA	27	F	21740	CT1/TSM	16.4.10	MS	MVR	25	SJM	BL	Y	S	5	35				
107	PATCHIAMMAL	40	F	26714	CT3/TV	19.4.10	MS	MVR	25	SJM	BL	Y		2	70				
108	SIVKUMAR	30	M	28149	CT4/KS	20.4.10	MR	MVR	29	MH	TD			4	55				
109	JAYANTHI	25	F	28949	CT4/KS	23.4.10	MS/MR	MVR	29	MH	TD	Y		3.5	35				
110	BAGGYALAKSHMI	24	F	24238	CT1/TSM	26.4.10	MS	MVR	27	MH	TD			2	60				
111	KALAIARASI	27	F	25325	CT5/RV	28.4.10	MS/MR	MVR	25	SJM	BL	Y	S	8	65		Y	Y	N
112	MANJULA	38	F	10399	CT6/RKS	29.4.10	MS	MVR	27	MH	TD	Y		3	60				N
113	SAKTHIVEL	15	M	28953	CT4/KS	30.4.10	MR	MVR	25	SJM	BL	Y		3	65				

114	VADIVEL	25	M	28081	CT1/TSM	30.4.10	MS	MVR	27	MH	TD			4	60				
115	DURAISAMY	29	M	31984	CT1/TSM`4.5.10		MS	MVR	25	SJM	BL	Y		5	45	Y			N
116	PERUMAL	22	M	32630	CT2/SVK	5.5.10	MR	MVR	25	SJM	BL	Y		4	70				
117	BHAKKIYAVATHY	35	F	29532	CT5/RKS	5.5.10	MS	MVR	25	SJM	BL	Y		1.5	45				N
118	RANI	30	F	29917	CT1/TSM	7.5.10	MS	MVR	27	MH	TD	Y		1.5	65				
119	MAHARAJAN	39	M	34974	CT5/RKS	17.5.10	MS	MVR	25	SJM	BL	Y		3.5	65				
120	RANI	45	F	23617	CT6/TSM2	20.5.10	MS/MR	MVR	27	MH	TD			3	60				
121	BAKKIYUM	42	F	33847	CT1/TSM	21.5.10	MR	MVR	27	MH	TD	Y		4	55				
122	MANDAPATHAL	28	F	30329	CT6/TSM2	3.6.10	MR	MVR	25	SJM	BL	Y		4.5	50				
123	SELVARAj	29	M	20222	CT1/TSM	4.6.10	MR	MVR	27	MH	TD			2	55				
124	sridhar	19	M	29992	CT5/RKS	5.6.10	MRS	MVR	27	MH	TD			5	60				
125	seethalakshmi	40	F	20189	CT1/TSM	8.6.10	MS/MR	MVR	27	MH	TD	Y		3	65				
126	NAGARAJ	29	M	37097	CT4/RV	8.6.10	MS	MVR	25	SJM	BL	Y		1.5	70				
127	HARIKRISHNAN	46	M	38344	CT2/TV	9.6.10	MS/MR	MVR	25	SJM	BL	Y		8	60		Y		N
128	DEVARAJ	42	M	36747	CT3/KS	10.6.10	MS	MVR	25	SJM	BL	Y		1.5	60				
129	RATHI	39	F	33932	CT1/TSM	11.6.10	MS	MVR	27	MH	TD	Y		2	70				
130	THANTONY	28	F	28434	CT6/TSM2	14.6.10	MS/MR	MVR	27	MH	TD			4	65				
131	KUPPU	38	F	42820	CT3/KS	17.6.10	MS	MVR	27	MH	TD	Y	S	9	25				N
132	ASHOKAN	40/M		35984	CT6/TSM2	17.6.10	MS/MR	MVR	27	MH	TD			3.5	65				
133	MALATHY	34	F	30022	CT1/TSM	18.6.10	MS	MVR	27	MH	TD	Y		4	60				
134	KATHIRAVAN	16	M	35216	CT5/RKS	19.6.10	MS/MR	MVR	27	MH	TD			2	50				N
135	ANDAL	37	F	46682	CT6/TSM2	21.6.10	MS	MVR	27	MH	TD	Y		4	60				
136	BASKAR	44	M	45512	CT5/RKS	23.6.10	MS	MVR	27	MH	TD			2	55				
137	GEETHA	32	F	42115	CT1/TSM	25.6.10	MS	MVR	27	MH	TD	Y		3.5	65				N
138	KARUPAYYE	35	F	34954	CT4/RV	25.6.10	MS	MVR	27	MH	TD			3	55				
139	VIJAYAKUMAR	29	M	24462	CT6/TSM2	28.6.10	MS	MVR	27	MH	TD	Y		5	60				
140	KILLIAMMAL	40	F	44129	CT1/TSM	29.6.10	MS	MVR	29	MH	TD			3	60				
141	ROSAMMAL	42	F	43393	CT5/RKS	30.6.10	MS	MVR	27	MH	TD			1.5	60				
142	JEYAPERUMAL	17	F	42464	CT2/TV	7.7.10	MS	MVR	27	MH	TD		S	5	55		Y	Y	N

143	KASINATHAN	35	M	51243	CT3/KS	8.7.10	MS	MVR	27	MH	TD	Y		3	65				
144	JAYANTHI	36	F	51238	CT6/TSM2	12.7.10	MS	MVR	27	MH	TD			5	65				N
145	PICHAMUTHU	33	M	40345	CT2/TV	14.7.10	MS/MR	MVR	27	MH	TD			3	50				
146	MURUGAPPAN	27	M	46614	CT2/TV	21.7.10	MS	MVR	25	SJM	BL	Y	S	7	30				N
147	MUTHAMMAL	25	F	434492	CT5/RKS	21.7.10	MR	MVR	27	SJM	BL	Y		2	65				
148	PADMANABAN	22	M	52256	CT6/TSM2	22.7.10	MR	MVR	27	SJM	BL	Y		1.5	45				
149	DAKSINAMORTHI	50	M	54951	CT4/RV	23.7.10	MS	MVR	25	SJM	BL	Y		3	70	Y			N
150	MEENA	50	F	49468	CT1/TSM	23.7.10	MRS	MVR	29	MH	TD	Y		1.5	65				
151	AMBIKA	45	F	45151	CT1/TSM27.7.10		MS	MVR	29	MH	TD			5	55				N
152	FIROSE	38	F	43156	CT5/RKS	31.7.10	MS	MVR	29	MH	TD	Y		3	65				
153	LAKSHMI	32	F	46167	CT1/TSM	3.8.10	MS/MR	MVR	25	SJM	BL	Y		5	45				
154	ANJALAI	30	F	50511	CT1/TSM	6.8.10	MS/MR	MVR	25	TTK	TD	Y		1.5	45				
155	UMAPATHY	42	M	58370	CT5/RKS	25.8.10	MS	MVR	27	SJM	BL	Y	S	1.5	65		Y	Y	N
156	SUNDARAJAN	33	M	55629	CT3/KS	26.8.10	MRS	MVR	25	SJM	BL	Y		3.5	60				
157	DHANAM	27	F	46690	CT6/TSM2	26.8.10	MS	MVR	27	SJM	BL	Y		1.5	50				
158	SHANKAR	38	M	54088	CT1/TSM	27.8.10	MS	MVR	27	SJM	BL	Y		3	60				
159	RAJARATHINAM	35	M	45666	CT2/TV	27.8.10	MS	MVR	25	SJM	BL	Y		1.5	65	Y			N
160	VIJAYALAXMI	28	F	43091	CT4/RV	28.8.10	MR	MVR	25	SJM	BL	Y		3	45				
161	DAKSINAMORTHI	35	M	62585	CT6/TSM2	28.8.10	MS/MR	MVR	27	SJM	BL	Y	S	6	70				
162	AMUDHA	26	F	57093	CT1/TSM	31.8.10	MS	MVR	25	SJM	BL	Y		3	45				
163	SARANRAJ	15	M	53718	CT4/RV	3.9.10	MS	MVR	27	SJM	BL	Y		3.5	60		Y		N
164	SARAVANAN	15	M	50552	CT1/TSM	3.9.10	MR	MVR	25	SJM	BL	Y		1.5	60				
165	HASSAN MOIDEEN	48	M	68499	CT1/TSM	7.9.10	MS	MVR	25	SJM	BL	Y		8	60				
166	VALLI	33	F	70389	CT2/KS	8.9.10	MS/MR	MVR	25	SJM	BL	Y		1.5	45				N
167	UMA	28	F	70393	CT2/KS	15.9.10	MS	MVR	25	SJM	BL	Y		5	60				
168	JEYANTHI	33	F	65077	CT6/TSM2	16.9.10	MS	MVR	27	SJM	BL	Y		2.5	70	Y			N
169	PANDIYAN	25	M	54844	CT4/VJ	17.9.10	MR	MVR	27	SJM	BL	Y		1.5	60				
170	KAVITHA	24	F	72222	CT2/KS	18.9.10	MS	MVR	25	SJM	BL	Y		2.5	65				
171	VADIVEL	36	F	67894	CT5/RKS	20.9.10	MS/MR	MVR	27	SJM	BL	Y		1.5	60				

172	KALAIVANI	44	F	51705	CT1/SJM	21.9.10	MS	MVR	27	SJM	BL	Y		1.5	60				
173	MURUGALAXMI	28	F	35540	CT3/RV	23.9.10	MR	MVR	27	TTK	TD	Y		1.5	50		Y		N
174	JEYANTHI	27	F	67385	CT6/TSM2	23.9.10	MS	MVR	27	TTK	TD		S	5	60				
175	LATHA	30	F	54867	CT5/RKS	25.9.10	MRS	MVR	25	SJM	BL	Y		3	60				
176	PADMANABAN	34	M	78114	CT6/TSM2	30.9.10	MS	MVR	25	SJM	BL	Y		6	60				
177	ANGAMMAL	39	F	68868	CT1/TSM	5.10.10	MS/MR	MVR	25	SJM	BL	Y		1.5	45				
178	SUMATHI	38	F	61318	CT1/TSM	8.10.10	MS	MVR	29	MH	TD			2	45				
179	VETRI	29	M	67085	CT2/KS	9.10.10	MRS	MVR	25	SJM	BL	Y		3	65				
180	VANDI	26	M	74394	CT2/KS	13.10.10	MS/MR	MVR	25	SJM	BL	Y	S	7	25		Y	Y	N
181	PARVATHI	45	M	79750	CT2/KS	14.10.10	MS	MVR	25	SJM	BL	Y		5	70				
182	RANITHANGAM	34	F	75841	CT6/TSM2	18.10.10	MS	MVR	27	SJM	BL	Y		1.5	60				
183	SARADHA	46	F	74070	CT3/RV	18.10.10	MRS	MVR	25	SJM	BL	Y		3.5	60				
184	SRIDEVI	19	F	76336	CT3/RV	21.10.10	MS	MVR	27	SJM	BL	Y		1.5	60				N
185	MANI	55	M	79805	CT4/VJ	22.10.10	MS	MVR	27	SJM	BL	Y		1.5	45				
186	MALAR	35	F	71136	CT5/RKS	23.10.10	MR	MVR	27	SJM	BL	Y		1.5	60	Y			N
187	RADHA	37	F	79347	CT6/TSM2	25.10.10	MS/MR	MVR	27	SJM	BL	Y	S	2	60				
188	RATHIMANI	49	F	61280	CT5/RKS	26.10.10	MS	MVR	27	SJM	BL	Y		6	65				
189	RADHA	37	F	79347	CT6/TSM2	28.10.10	MS/MR	MVR	27	SJM	BL	Y		2.5	60				
190	RAJKUMAR	27	M	67590	CT3/RV	28.10.10	MR	MVR	27	SJM	BL	Y		1.5	45				
191	HARIDASS	36	M	71601	CT4/VJ	29.10.10	MS	MVR	29	MH	TD	Y		3	60				
192	BOOPAlan	36	m	39429	CT1/TSM	29.10.10	MS	MVR	27	SJM	BL	Y		1.5	60				
193	VADIVEL	40	M	76350	CT2/KS	3.11.10	MS	MVR	25	SJM	BL	Y		2.5	65				
194	VASU	39	M	65740	CT1/TSM	2.11.10	MRS	MVR	29	MH	TD			4	65	Y	Y		N
195	KESHAVAN	38	M	62732	CTV/RKS	3.11.10	MS	MVR	29	MH	TD			2	60				
196	LALITHA	33	F	80119	CT3/RV	8.11.10	MRS	MVR	25	SJM	BL	Y		10	60		Y		N
197	SATHEESH	48	M	74535	CT2/KS	10.11.10	MS	MVR	25	SJM	BL	Y	S	2.5	60				
198	MURALI	33	M	81986	CT3/RV	11.11.10	MS/MR	MVR	25	SJM	BL	Y		5	60				
199	CHITRA	30	F	74686	CT1/TSM	11.11.10	MR	MVR	25	SJM	BL	Y		2.5	60		Y		N
200	SAKTHIVEL	17	M	88445	CT2/KS	13.11.10	MS	MVR	25	SJM	BL	Y		1.5	70				

201	AMSA	45	F	65344	CT5/RKS	15.1.10	MS	MVR	25	SJM	BL	Y		2.5	60				
202	SELVI	37	F	78880	CT1/TSM	16.11.10	MS	MVR	25	SJM	BL	Y	S	9	30				
203	SELSHA	35	F	65684	CT1/TSM	23.11.10	MS/MR	MVR	25	SJM	BL	Y		2.5	60	Y			N
204	SUNANTHA	29	F	86514	CT3/RV	25.11.10	MS	MVR	27	SJM	BL	Y		2.5	60				
205	SATHYA	24	F	98912	CT4/VJ	26.11.10	MS	MVR	29	MH	TD			3.5	60				
206	VIRAMMMAL	19	F	79787	CT3/RV	29.11.10	MR	MVR	27	SJM	BL	Y		2.5	60				
207	KANCHANA	24	F	59126	CT5/RKS	1.12.10	MS	MVR	27	SJM	BL	Y		2.5	65				
208	IYYAPPAN	34	M	71773	CT1/TSM	3.12.10	MS/MR	MVR	27	SJM	BL	Y		2.5	65				
209	AHAMAD KEERAN	15	M	86199	CT2/KS	4.12.10	MRS	MVR	25	SJM	BL	Y		1.5	60				
210	REKHA	24	F	91334	CT6/TSM2	6.12.10	MS	MVR	25	SJM	BL	Y		5	45				N
211	MANOHARAN	40	M	49572	CT3/RV	6.12.10	MR	MVR	27	SJM	BL	Y		1.5	60				
212	SULOCHANA	40	F	71216	CT1/TSM	7.12.10	MS	MVR	27	SJM	BL	Y		2.5	45				
213	VALLI	35	F	93577	CT6/TSM2	9.12.10	MS/MR	MVR	25	SJM	BL	Y		5	60				
214	KRISHNAMORTHI	27/M		85719	CT1/TSM	10.12.10	MS	MVR	29	SJM	BL		S	1.5	60			Y	N
215	ANBURAJ	26	M	89744	CT2/KS	11.12.10	MRS	MVR	25	SJM	BL	Y		1.5	70				
216	RAMU	29	M	95714	CT6/TSM2	13.12.10	MS	MVR	25	SJM	BL	Y		7	60		Y		N
217	BALENDRAN	41	M	69687	CT1/TSM	14.12.10	MS	MVR	29	MH	TD	Y		3	65				N
218	PARI	52	M	90250	CT2/KS	15.12.10	MRS	MVR	25	SJM	BL	Y		2.5	65				
219	JAYARAMAN	50	M	91225	CT3/RV	16.12.10	MS/MR	MVR	25	SJM	BL	Y		7	65				
220	MOHD ILIYAS	36	M	24566	CT1/TSM	17.12.10	MR	MVR	27	SJM	BL	Y		1.5	60				
221	ELUMALAI	47	M	71072	CT5/RKS	18.12.10	MS	MVR	27	SJM	BL	Y		2.5	65				
222	SOLAIMMAL	54	F	78035	CT3/RV	20.12.10	MS	MVR	27	SJM	BL	Y		1.5	45				
223	THANGAPPAN	45	M	89550	CT1/TSM	21.12.10	MS	MVR	29	MH	TD	Y	S	4	60				
224	SHEEBA	30	F	16106	CT4/VJ	28.12.10	MS	MVR	27	SJM	BL	Y		2.5	65				
225	RAJASEKAR	30	F	94991	CT3/RV	29.12.10	MS/MR	MVR	27	SJM	BL	Y		2.5	60				
226	SARANGABANI	50	M	95163	CT3/RV	3.1.11	MRS	MVR	25	SJM	BL	Y		2.5	45				
227	MUTHUSAMY	45	M	91748	CT1/TSM	4.1.11	MS	MVR	27	SJM	BL	Y		1.5	60				
228	KANNAGI	30	F	104706	CT6/TSM2	6.1.11	MR	MVR	25	SJM	BL	Y		3	45				
229	SUDARMANI	55	M	103406	CT3/RV	6.1.11	MS	MVR	27	SJM	BL	Y	S	3	60				

230	kannagi	30	F	104706	CT6/TSM2	6.1.11	MS/MR	MVR	25	SJM	BL	Y		7	30					
231	SUBRAMANI	55	M	103406	CT3/RV	6.1.11	MS	MVR	27	SJM	BL	Y		1.5	70					
232	MUNIAMMAL	40	F	104300	CT6/TSM2	10.1.11	MRS	MVR	27	SJM	BL	Y		1.5	60					
233	NAGARAAN	52	M	80127	CT3/RV	10.1.11	MRS	MVR	25	SJM	BL	Y		5	70		Y			N
234	KARPAGAM	44	F	99733	CT5/RKS	12.1.11	MS	MVR	27	SJM	BL	Y		1.5	60					
235	MENAGA	40	F	104352	CT1/TSM	18.1.11	MR	MVR	27	SJM	BL	Y	S	3	65					
236	PALANIVEL	41	F	10887	CT6/TSM2	20.1.11	MRS	MVR	25	SJM	BL	Y		1.5	65					
237	KANAGA	40	F	77005	CT1/TSM	21.1.11	MS	MVR	25	SJM	BL	Y		1.5	45					
238	SRINIVASAN	35	F	33701	CT4/VJ	21.1.11	MS/MR	MVR	25	SJM	BL	Y	S	5	60		Y			N
239	VEMBU	38	F	105384	CT5/RKS	29.1.11	MS	MVR	27	SJM	BL	Y		3	65					
240	BALASUBRAMANI	45	M	104001	CT6/TSM2	31.1.11	MS	MVR	27	TTK	TD	Y		3	45					N
241	SUMATHI	30	F	438	CT1/TSM	4.2.11	MS	MVR	25	TTK	TD			4	60					
242	MURUGAN	22	M	102713	CT2/KS	5.2.11	MS	MVR	27	TTK	TD	Y		1.5	50					
243	PUSHPA	23	F	100454	CT1/TSM	8.2.11	MS/MR	MVR	27	TTK	TD	Y		3	60					
244	NAGAMANI	35	F	92950	CT4/VJ	11.2.11	MR	MVR	27,25	TTK	TD			2	65					
245	MOHD KANI	26	M	92282	CT2/KS	12.2.11	MS	MVR	27	TTK	TD	Y	S	9	35			Y		N
246	THIRUMURUGAN	45	M	7505	CT6/TSM2	14.2.11	MS/MR	MVR	25	TTK	TD			3	65					
247	REVATHY	21	F	7886	CT3/RV	14.2.12	MS	MVR	25	TTK	TD	Y		2	60		Y			N
248	SULOCHANA	24	F	9043	CT1/TSM	15.2.11	MS/MR	MVR	25	TTK	TD			2.5	65					
249	LATHABABU	26	F	33456	CT6/TSM2	14.3.11	MR	MVR	25	SO	BL	Y		4	60					
250	LALITHA	40	F	2857	CT1/TSM	15.3.11	MS	MVR	27	SO	BL	Y		1.5	45					
251	VEERAMANI	42	M	9230	CT4/RV	15.3.12	MS	MVR	25	SO	BL	Y	S	5	40					N
252	KRISHNAMORTHI	50	M	97559	CT5/RKS	16.3.11	MS	MVR	27	SO	BL	Y		1.5	65					
253	PUGALENTHI	19	M	9538	CT2/KS	16.3.12	MS	MVR	25	SO	BL	Y		7	60					
254	MOHAN	34	M	6357	CT6/TSM2	21.3.11	MS/MR	MVR	27	SO	BL		S	3	45			Y		N
255	SUGUNA	32	F	8411	CT5/RKS	23.3.11	MRS	MVR	25	SO	BL	Y		4	65					
256	RANI	43	F	9256	CT1/TSM	5.4.11	MS	MVR	27	SO	BL	Y	S	1.5	55					
257	GOTHANDARAMAN	22	M	827	CT4/VJ	5.4.11	MS/MR	MVR	25	SO	BL	Y		13	25	Y	Y			N
258	KUMAR	34	M	23288	CT2/KS	6.4.11	MR	MVR	27	SO	BL	Y		3	55					

259	KUPAMMAL	42	F	106275	CT3/RV	7.4.11	MR	MVR	25	SO	BL	Y		1.5	45				
260	SHANTHY	35	F	44197	CT1/TSM	8.4.11	MS	MVR	27	SO	BL	Y		4	60				
261	PRAKASH	31	M	6071	CT5/RKS	9.4.11	MR	MVR	27	SO	BL	Y		3	55				
262	RAMAR	40	M	26145	CT4/VJ	15.4.11	MS/MR	MVR	25	SO	BL	Y	S	5	35				N
263	RAMESH	38	M	4392	CT1/TSM	19.4.11	MRS	MVR	27	SO	BL	Y		3	45				
264	AMMU	21	F	5966	CT5/RKS	20.4.11	MR	MVR	27	SO	BL	Y		4	65				
265	RANI	55	F	7601	CT3/RV	21.4.11	MS	MVR	25	SO	BL	Y		1.5	50				
266	SELVI	45	F	24606	CT2/KS	23.4.11	MS/MR	MVR	27	SO	BL	Y		4	35	Y			N
267	JEGANANTHAN	37	M	101611	CT4/RKS	13.5.11	MS	MVR	27	TTK	TD	Y		1.5	45				
268	SIVAGAMI	32	F	21554	CT5/NNR	14.5.11	MS	MVR	27	TTK	TD			2	60				N
269	KASIAMMAL	48	f	6746	CT1/TSM	17.5.11	MS/MR	MVR	27	TTK	TD	Y		4	60				
270	LOGANATHAN	22	M	10121	CT6/TMP	16.5.11	MS	MVR	27	TTK	TD	Y		2	60				
271	RAJI	37	F	36819	CT5/NNR	18.5.11	MS	MVR	27	TTK	TD			3	50				
272	SEKAR	27	M	8280	CT4/RKS	20.5.11	MS	MVR	27	TTK	TD	Y		1.5	60				
273	RAMANATHAN	37	M	36579	CT1/TSM	20.5.11	MS	MVR	29	TTK	TD	Y		3	45				
274	TAMILMANI	27	F	28091	CT3/RV	25.5.11	MS/MR	MVR	27	TTK	TD	Y		2	65				N
275	SATHYAMOORTHI	31	M	15778	CT1/TSM	24.5.11	MR	MVR	29	TTK	TD			4	60				
276	GOMATHI	28	F	10555	CT4/RKS	24.5.11	MR	MVR	27	TTK	TD	Y		2	65				
277	BUVANESHWARI	45	F	37992	CT1/TSM	27.5.11	MR	MVR	27	SO	BL	Y		2	45				
278	MURUGESAN	39	M	30427	CT5/NNR	28.5.11	MRS	MVR	29	TTK	TD	Y		2	60				
279	KALAISELVAM	46	M	9828	CT6/TSM2	30.5.11	MR	MVR	29	SO	BL		S	10	40			Y	N
280	ANJAMMAL	35	F	42769	CT3/RV	2.6.11	MS	MVR	25	SO	BL	Y		4	65				
281	THIRUNAVUKARASU	28	M	18609	CT2/KS	1.6.11	MS/MR	MVR	27	TTK	TD			1.5	65				N
282	VELLATHAI	45	F	28441	CT1/TSM	7.6.11	MS	MVR	29	SO	BL	Y		2	50				
283	fehadra	44	F	33861	CT2/KS	11.6.11	MS/MR	MVR	25	TTK	TD	Y	S	5	35				
284	MURUGESAN	40	M	43271	CT3/RV	11.6.11	MS	MVR	25	SO	BL	Y		3	50				
285	srinivasan	45	M	27354	CT1/TSM	17.6.11	MS	MVR	29	MH	TD			1.5	60				
286	THILAGAM	49	F	41397	CT5/NNR	18.6.11	MS/MR	MVR	27	TTK	TD			2	65				
287	santhammal	30	F	46780	CT6/TMP	20.6.11	MS	MVR	25	TTK	TD	Y		2	50				

288	MALLIKA	32	F	44738	CT5/NNR	21.6.11	MRS	MVR	27	TTK	TD			3	60				
289	GOMATHY	14	F	37309	CT4/RKS	21.6.11	MS	MVR	27	TTK	TD	Y		2.5	60				
290	PRIYA	17	F	16648	CT5/NNR	22.6.11	MS/MR	MVR	27	TTK	TD			4	50				
291	VASANTHA	41	F	46356	CT3/RV	23.6.11	MS	MVR	27	TTK	TD	Y		2.5	65				
292	BALAKRISHNANA	35	M	36645	CT1/TSM	24.6.11	MS/MR	MVR	27	TTK	TD			2.5	60				
293	KALA	39	F	46242	CT5/NNR	25.6.11	MS	MVR	25	TTK	TD	Y		3	45				
294	SRINIVASAN	54	M	46588	CT6/TMP	27.6.11	MS	MVR	27	TTK	TD			3.5	65				N
295	LAKSHMI	51	F	47877	CT3/RV	27.6.11	MS/MR	MVR	25	TTK	TD	Y		2.5	40				
296	THIRUMALAI	37	M	39391	CT4/RKS	1.7.11	MS	MVR	27	TTK	TD			1.5	60				
297	KANIGA	45	F	37991	CT1/TSM	1.7.11	MS	MVR	25	TTK	TD	Y		2.5	65				
298	AMBIKA	30	F	43647	CT2/KS	2.7.11	MRS	MVR	25	TTK	TD	Y		2	60				
299	PANJALAI	45	F	48452	CT6/TMP	4.7.11	MR	MVR	25	TTK	TD		S	10	25	Y		Y	N
300	BASKAR	40	M	38478	CT5/NNR	6.7.11	MS	MVR	25	TTK	TD			3	65				
301	KULLAMMAL	32	F	48639	CT6/TMP	7.7.11	MR	MVR	27	ATS	BL	Y		1.5	60				
302	MADHIVANAN	45	M	51916	CT1/TSM	7.7.11	MS	MVR	27	ATS	BL	Y		5	45				
303	SARALA	38	F	57051	CT5/NNR	9.7.11	MR	MVR	25	TTK	TD	Y		3	60				
304	CHANDRA	19	F	56102	CT6/TMP	11.7.11	MS	MVR	25	TTK	TD	Y		5	60				N
305	JAYALAXMI	44	M	54273	CT1/TSM	12.7.11	MR	MVR	27	ATS	BL		S	7	30			Y	N
306	SARAVANAN	25	M	53127	CT3/RV	14.7.11	MS	MVR	27	ATS	BL	Y		5	40				
307	VELAYUTHUM	42	M	53129	CT6/TMP	14.7.11	MS	MVR	27	ATS	BL	Y		3	50				
308	MARY	36	F	48565	CT5/NNR	16.7.11	MS/MR	MVR	25	TTK	TD			3	40				
309	MINI	39	F	51158	CT2/KS	16.7.11	MS	MVR	25	TTK	TD	Y		1.5	40				
310	SRINIVASAN	45	M	60871	CT6/TMP	21.7.11	MS/MR	MVR	27	ATS	BL	Y	S	10	25		Y		N
311	RAJAKUMARI	45	F	46241	CT5/NNR	23.7.11	MRS	MVR	25	TTK	TD	Y		2	50				
312	RANI	42	F	45181	CT2/KS	23.7.11	MS	MVR	27	ATS	BL			1.5	50				
313	ELLAMMAL	40	F	47284	CT3/RV	25.7.11	MS	MVR	25	TTK	TD			7	35				
314	SARADHA	38	F	44893	CT1/TSM	28.7.11	MS	MVR	29	ATS	BL			7	65				
315	SANTH SUBASINI	40	F	47505	CT2/KS	3.8.11	MR	MVR	25	TTK	TD	Y		2	60				
316	VIJAYA RANGAN	48	M	51628	CT1/TSM	5.8.11	MS/MR	MVR	27	ATS	BL	Y		4	35				

317	MALARKODI	47	F	53130	CT4/RKS	9.8.11	MS	MVR	27	ATS	BL	Y	8	55			N
318	SANKAR	39	M	47061	CT1/TSM	12.8.11	MR	MVR	27	ATS	BL		4	50			
319	BARKUNAN	50	M	38054	CT1/TSM	16.8.11	MS/MR	MVR	27	ATS	BL	Y	3.5	50			
320	SARALA	30	F	47340	CT1/TSM	23.8.11	MS	MVR	27	SJM	BL	Y	3	45			N
321	SAKILA	33	F	49853	CT2/KS	24.8.11	MS	mvr	27	TTK	TD		2.5	60			
322	RANJITH	15	M	68063	CT6/TMP	25.8.11	MS/MR	MVR	27	TTK	TD	Y	4	60			
323	DROPATHY	19	F	63771	CT1/TSM	26.8.11	MRS	MVR	27	TTK	TD	Y	2	65			
324	KUPAMMAL	30	F	53373	CT4/RKS	26.8.11	MR	MVR	27	TTK	TD		2	60	Y	Y	N
325	DEVIKA	37	F	57474	CT2/KS	27.8.11	MR	MVR	27	TTK	TD	Y	3	60			
326	NITHYA	20	F	60550	CT3/RV	29.8.11	MR	MVR	27	TTK	TD	Y	3.5	45			
327	MALA	24	f	59199	CT6/TMP	29.8.11	MS	MVR	25	TTK	TD		2	60			
328	RAJATHI	40	F	49592	CT1/TSM	2.9.11	MR	MVR	27	TTK	TD		2	50			
329	MALLIKA	40	F	59394	CT2/KS	3.9.11	MS	MVR	25	TTK	TD		1.5	40			
330	SELVI	19	F	62632	CT5/NNR	5.9.11	MRS	MVR	27	TTK	TD	Y	2	60		Y	N
331	RAJESWARI	35	F	62769	CT3/RV	7.9.11	MS/MR	MVR	25	TTK	TD		5	35			
332	MANJULA	20	F	67707	CT6/TMP	8.9.11	MRS	MVR	27	TTK	TD	Y	2.5	65			
333	BABY	33	F	73941	CT6/TMP	12.9.11	MS	MVR	27	TTK	TD	Y	1.5	50			

AVR

SN	NAME	AGE	SEX	IP NO	UNIT	DOS	DIAGNOSIS	PRO	SIZE	COMPA	TYPE OF VALVE	EOP	POP HD	GR	EF	VT	E & HAE	VRM	FFC-6
1	VAIDHEESWARAN	34	M	64431	CT4/TV	4.9.09	CA+ AS	AVR	21	SJM	BL	Y		1.5	50				
2	VIJAY	18	M	62349	CT3/SVK	8.9.09	AR	AVR	21	SJM	BL	Y		2.5	55	Y			N
3	RAMESH	30	M	61167	CT6/RV	14.9.09	AR	AVR	21	SJM	BL	Y		2	50				
4	RADHAKRISHNAN	55	M	52443	CT2/TSM	23.9.09	AS	AVR	21	SJM	BL	Y		2	60				
5	ARJUNAN	38	M	52508	CT4/TV	29.9.09	AS	AVR	23	SJM	BL	Y		3.5	55				
6	RAMAN	39	M	57232	CT6/RV	5.10.09	AS/AR	AVR	23	SJM	BL	Y		4	55				
7	RAMU	43	M	64289	CT3/SVK	8.10.09	CA+ AS	AVR	21	SJM	BL	Y	S	10	30			Y	N
8	RANI	45	F	70682	CT4/TV	20.10.09	AS/AR	AVR	17	SJM	BL	Y		5	30				
9	VENKATACHALAM	38	M	76438	CT3/SVK	22.10.09	AS	AVR	19	SJM	BL	Y	S	4	65		Y		N
10	SHEK FARUDH	24	M	82594	CT3/SVK	6.11.09	AS/AR	AVR	19	SJM	BL	Y		10	40	Y			N
11	MANIMARAN	42	M	77261	CT3/SVK	7.11.09	BCAV/AS	AVR	21	SJM	BL	Y		6	50				
12	SADASIVAN	25	M	52131	CT1/MV	11.12.09	AR	AVR	21	SJM	BL	Y		2	60				
13	VASIM AHAMAD	19	M	90537	CT3/SVK	17.12.09	CA+ AS	AVR	19	SJM	BL	Y		9	30		Y	Y	N
14I	RAJESWARI	40	F	88930	CT4/TV	12.2.10	AS/AR	AVR	19,17	SJM	BL		S	10	25			Y	N
15	KESAVAN	36	M	83402	CT6/RKS	18.2.10	AS	AVR	19	SJM	BL	Y		5	35				
16	SELVARAJ	35	M	94977	CT2/SVK	20.2.10	CA+ AS	AVR	19	SJM	BL	Y	S	4	55				
17	HARIKRISHNAN	26	M	741	CT6/RKS	4.3.10	AR	AVR	19	SJM	BL	Y		4	65				
18	RAJESWARI	34	F	7001	CT6/RKS	8.3.10	AS/AR	AVR	19	SJM	BL	Y		5	50				N
19	MALA	38	F	21137	CT4/KS	26.3.10	CA+ AS	AVR	19	SJM	BL	Y	S	7	30			Y	N
20	MUNIAN	40	M	11937	CT5/RV	10.4.10	AS/AR	AVR	21	SJM	BL	Y		3	60				
21	RAJENDREN	42	M	25348	CT5/RKS	8.5.10	AS	AVR	19	SJM	BL	Y		7	35	Y			N
22	KASHBAN	22	M	25568	CT6/TSM2	31.5.10	AR	AVR	21	MH	TD	Y		2	45				
23	MOHAN	25	M	44173	CT1/TSM	6.7.10	AR	AVR	23	SJM	BL	Y		1.5	65				
24	GUNASEKAR	24	M	46199	CT1/TSM	13.7.10	AR	AVR	23	SJM	BL	Y		1.5	50				
25	KAMALANATHAN	23	M	8018	CT4/RV	3.8.10	ARS	AVR	19	SJM	BL	Y		5	60				
26	MANISHKUMAR	21	M	58773	CT2/TV	4.8.10	AS/AR	AVR	23	SJM	BL	Y		1.5	57				

27	VASUKI	29	F	51276	CT3/KS	5.8.10	CA+ AS	AVR	17	SJM	BL	Y		9	57	Y	Y		N
28	RAJESWARI	45	F	60827	CT6/TSM2	9.8.10	AS	AVR	19	SJM	BL	Y		1.5	60				
29	SAKUNTHALA	38	F	52702	CT1/TSM	24.8.10	AS/AR	AVR	23	SJM	BL	Y		3	65				
30	MANIVEL	43	M	68067	CT2/TV	28.8.10	AS/AR	AVR	23	SJM	BL	Y		4	60				
31	DURAI	54	M	67784	CT6/TSM2	6.9.10	AS/AR	AVR	19	MH	TD			4	55	Y			N
32	PERUMAL	45	M	67355	CT4/VJ	24.9.10	AS/AR	AVR	23	SJM	BL	Y		6	35				
33	MAHALINGAM	39	M	61320	CT1/TSM	1.10.10	CA+ AS	AVR	21	MH	TD	Y	S	5	50				
34	VEERAPANDIAN	18	M	72933	CT3/RV	4.10.10	AS	AVR	23	SJM	BL	Y		4	57	Y	Y		N
35	KANIAPPAN	40	M	47212	CT3/RV	7.10.10	AR	AVR	19	SJM	BL	Y		3	60				
36	ARUN	18	M	45182	CT3/RV	25.10.10	AR	AVR	19	MH	TD	Y		4	60				
37	CHERAN	32	M	93571	CT6/TSM2	29.11.01	AR	AVR	23	SJM	BL	Y		4	57				
38	SENTHIL	31	M	97535	CT5/RKS	22.12.10	AS	AVR	23	SJM	BL	Y		5	35				
39	VEDHAVALLI	38	F	88475	CT2/KS	5.1.11	AR	AVR	19	SJM	BL	Y		4	60				N
40	SEKAR	34	M	89099	CT4/VJ	18.1.11	BCAV/AS	AVR	19	TTK	TD	Y		12	45		Y		N
41	NAGARAJ	47	M	99183	CT2/KS	22.1.11	AR	AVR	23	SJM	BL	Y		4	60				
42	LOGANATHAN	60	M	1894	CT4/VJ	22.3.11	AR	AVR	19	MH	TD	Y	S	10	30		Y	Y	N
43	NARAYANAN	47	M	15772	CT1/TSM	25.3.11	CA+ AS	AVR	18	SO	BL	Y	S	7	30			Y	N
44	RAJENDRAN	45	M	6358	CT6/TSM2	7.4.11	AS/AR	AVR	20	SO	BL	Y		1.5	50				
45	VELMURUGAN	29	M	13153	CT6/TSM2	11.4.11	AS/AR	AVR	23	SJM	BL	Y		3	30				
46	VASANTHA	60	F	23882	CT4/VJ	19.4.11	BCAV/AS	AVR	18	SO	BL	Y		5	35				
47	KARTHIKEYAN	27	M	28996	CT3.RV	25.4.11	AS/AR	AVR	17	SJM	BL	Y		3	60				
48	VIRUDAMMAL	47	F	21902	CT1/TSM	26.4.11	CA+ AS	AVR	18	SO	BL	Y		4	40				N
49	JANAKI	20	F	27693	CT2/KS	25.5.11	AR	AVR	21	TTK	TD	Y		4	60				
50	KASINATHAN	35	M	36472	CT3/RV	26.5.11	AS/AR	AVR	21	TTK	TD			5	50				
51	SUBRAMANI	42	M	35566	CT3/RV	13.6.11	AR	AVR	21	TTK	TD	Y		4	50				
52	RANI	37	F	50621	CT3/RV	2.7.11	AS/AR	AVR	19	TTK	TD	Y	S	11	25	Y	Y	Y	N
53	MANI	52	M	31511	CT1/TSM	5.7.11	CA+ AS	AVR	20	ATS	BL	Y		1.5	60				
54	AMIRTHALINGAM	36	M	52295	CT2/KS	20.7.11	AS	AVR	21	TTK	TD	Y		1.5	65				
55	REVATHY	24	F	44767	CT1/TSM	2.8.11	AR	AVR	20	ATS	BL		S	9	30	Y	Y	Y	N

56	BALAKRISHNAN	55	M	53633	CT4/RKS	2.8.11	BCAV/AS	AVR	23	TTK	TD	Y	1.5	60		
57	AJITKUMAR	13	M	49145	CT3/RV	4.8.11	AR	AVR	16	ATS	BL	Y	7	35		
58	GUNASEKARAN	19	M	62261	CT3/RV	11.8.11	AR	AVR	20	ATS	BL	Y	5	40		
59	UMA	20	F	45919	CT4/RKS	16.8.11	AS	AVR	19	TTK	TD	Y	2	30	Y	N
60	VIJAYA	35	F	75785	CT2/KS	10.9.11	AR	AVR	19	TTK	TD	Y	3	60		