TEN-YEAR OUTCOMES OF SURGICAL TREATMENT OF ISCHEMIC MR- A RETROSPECTIVE STUDY

Dr. Anshuman Vajpeyi

MCh CARDIOTHORACIC AND VASCULAR SURGERY THESIS

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A THESIS SUBMITTED BY

Dr. Anshuman Vajpeyi

TO

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES

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IN PARTIAL FULFILMENT OF THE REQUIREMENTS

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*Clearance was obtained from Institutional Ethics Committee/ Institutional Animal Ethics/ Institutional Committee for stem cell research/ other appropriate committees (if any, specify), for carrying out of study.

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Ten-year outcomes of surgical treatment of Ischemic MR – A retrospective study

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"Ten-year outcomes of surgical treatment of Ischaemic MR-A retrospective study" *for the degree of* ***MCh CARDIOTHORACIC AND VASCULAR SURGERY*** *has been carried out by* ***Dr. Anshuman Vajpeyi*** *under our supervision and guidance. The work done in connectionwith this thesis has been carried out by the candidate himself and is genuine.*

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LIST OF ABBREVIATIONS

Sr No	Abbreviation	Full Form
1.	ACC	American College of Cardiology
2.	ACE	Angiotensin Converting Enzyme
3.	AHA	American Heart Association
4.	AL	Antero-Lateral
5.	AMI	Acute Myocardial Infarction
6.	ANOVA	Analysis of Variance
7.	AS	Antero-Superior
8.	BMI	Body Mass Index
9.	CAD	Coronary Artery Disease
10.	CABG	Coronary Artery Bypass Graft
11.	CI	Confidence Interval
12.	CPB	Cardio Pulmonary Bypass
13.	CRT	Cardiac Resynchronizon Therapy
14.	CTSM	Clinical Trial Supply Management
15.	CVA	Cerebro-vascular Accident

16.	CVR	Controlled ventricular rate
17.	DALY	Dis-Ability Adjusted Life Years
18.	ECG	Electro-cardiogram
19.	EGFR	Estimated Glomerular Filtration rate
20.	EROA	Effective Regurgitation Orifice Area
21.	ESC	European Society of Cardiology
22.	HF	Heart Failure
24.	IHD	Ischemic Heart Disease
25.	IMR	Ischemic Mitral Regurgitation
26.	LA	Left Atrium
25.	LMCA	Left Main Coronary Artery
26.	LV	Left Ventricle
27.	LVEF	Left Ventricular Ejection Fraction
28.	LVESD	Left Ventricular End Systolic Dimension
29.	LVEDd	Left Ventricular End Diastolic Dimension
30.	mm	Millimeter
31.	MI	Myocardial Infraction
32.	MR	Mitral Regurgitation

33.	MV	Mitral Valve
34.	MVP	Mitral valve prolapse
35.	MVR	Mitral Valve Replacement
36.	MVr	Mitral Valve Repair
37.	NYHA	New York Heart Association
38.	PCI	Percutaneous Coronary Intervention
39.	PAH	Pulmonary Artery Hypertension
40.	PL	Postero-Lateral
41.	PI	Postero-Inferior
42.	PMR	Papillary Muscle Rupture
43.	RHD	Rheumatic Heart Disease
44.	RWMA	Regional Wall Motion Abnormality

SYNOPSIS

Mitral regurgitation (MR) is a condition where blood flows backward from the left ventricle to the left atrium due to improper mitral leaflet closure. It is the third most common form of valvular heart disease, affecting approximately 24.2 million people worldwide. There are two types of MR: primary, caused by mitral valve dysfunction, and secondary, resulting from left ventricle remodeling. Primary MR is associated with myxomatous degeneration and mitral valve prolapse, while secondary MR is often linked to coronary artery disease.

Current guidelines recommend different surgical approaches, such as coronary artery bypass grafting (CABG), CABG with mitral valve replacement (CABG+MVR), and CABG with mitral valve repair (CABG+Mvr), for moderate to severe ischemic mitral regurgitation. However, these guidelines do not specify the optimal surgical procedure or the conditions under which one approach should be preferred over others.

To address this gap, the aim of the study is to investigate the long-term outcomes of patients with ischemic mitral regurgitation after undergoing various coronary surgeries, including CABG with or without mitral valve repair or replacement. The study objectives involve assessing the outcomes of different surgical interventions at three different postoperative follow-up periods: 3 months, 1 year, and 10 years. The research will provide valuable information to better understand the efficacy of different surgical approaches in treating ischemic mitral regurgitation

Study was conducted after obtaining relevant permission from the Institute Ethical

Committee (IEC). The study design was retrospective and observational, utilizing secondary recorded data from the Department of Cardiovascular and Thoracic Surgery. Around 1,428 patients with coronary artery disease and mitral regurgitation underwent surgical management between 2001 and 2010. Out of these, 68 cases were eligible and participated in the study. Written informed or telephonic verbal consent was obtained from the participants, and confidentiality was maintained throughout the study.

Patients who had previously undergone specific procedures (e.g., carotid endarterectomy, redo operations, valve replacement, and repair in conjunction with coronary artery bypass graft) or had other congenital heart conditions were excluded from the study.

Data collection involved gathering preoperative, immediate postoperative, and late postoperative data from electronic medical records (EMR). The principal investigator and co-investigators conducted retrospective data analysis and clinical examination during post-operative follow-up.

Statistical analysis was performed using the Statistical Package for Social Science (SPSS) software (version 25.0, IBM Corp., Armonk, NY). The data was systematically compiled in a Microsoft Excel worksheet, and a master table was created.

The patient's mean age was 56.87 ±9.344 years with a range of 43-89 years old at the time of surgery. 5-30 days of hospital stay after the surgery was observed and the mean value is 8 ± 6 days. 36.8% (n=5) of patients had the co-morbidity of Dyslipidemia. 33.8% (n=23) had co-morbidity of Dyslipidemia associated with Hypertension and Diabetes. Among all 68, initially, 10 patients died immediately after surgery. Hence, data from 58

surviving patients were available on the third month and 1-year post-operative follow-up. By the end of our study, that is post-operative follow-up on 10 years, 57 patients were analyzed because 1 patient deceased after 5 years. The survival rate was observed and presented by using Kaplan-Mire estimates. Survived patients after coronary artery bypass surgery only, and coronary artery bypass surgery with mitral valve repair resulted that, all the patients becoming asymptomatic on the follow-up examination after the surgery. Similarly, all survived patients who underwent coronary artery bypass surgery with mitral valve replacement became asymptomatic till 3 months following the surgery. Later a single patient developed symptoms on post-operative examination follow-up of 1 year and that resolved after 10 years follow-up examination was observed.

Patients who underwent coronary artery bypass graft with mitral valve repair surgery needed redo surgery less frequently later. For the remaining group, none of the patients underwent redo surgery.

Left ventricle failure (LVF) was the main frequent post-operative complication that appeared immediately after the surgery. All those patients became deceased due to complications of LVF.

By the endpoint of 10-year follow-up, the surgical impact on mitral regurgitation status signifies that, improvement of mitral regurgitation status to normal level from the baseline level, among patients who underwent coronary artery bypass surgery, coronary artery bypass surgery with mitral valve repair, coronary artery bypass surgery with mitral valve replacement.

All 96.7% (n=30) of the patients who underwent coronary artery bypass surgery only

had improved functional class I status after 10 years of post-operative follow-up. 81.1% (n=9) of patients who underwent coronary artery bypass surgery with mitral valve replacement had improved functional class I status after 10 years of post-operative follow-up. While 5.6% (n=14) of patients who underwent coronary artery bypass surgery with mitral valve repair had improved functional class I status after 10 years of post-operative follow-up.

In our study, the mean age of studied patients is 56 years. This finding is differed from the study findings of Smith et al.(2014) and ElBardissi et al. (2012) as the resulting mean age of their patients is 65 years old, approximately 10 years higher than ours. This may be due to racial and genetic reasons. Approximately 1 week (8 days) hospital stay was observed among 79% (n=54) of the patients in our study and similar days of hospital stay after the surgery were observed in the study of Wetitie Wang et al (2018). There were 88.24 (n=60) % males included in our study and those are higher in numbers than females. Our results of higher male >> female agreed with the results of Kang et al. (2006), in their results, male were 68% (n=39). Avierinos et al.(2008) reported that women undergo mitral valve surgery less often than men and those with severe regurgitation incur excess long-term mortality versus than men. Hence the incidence of males is more than females. The co-morbidity of hypertension associated with diabetes was observed among 19% (n=245) in the study of Dziadzko et al., (2018). And this finding is nearly higher than our results which is 13.2% (n=9) for diabetes and hypertension. The higher prevalence of co-morbidity in patients observed may be the concern of the statement reported by the Diagnostic and Interventional Cardiology. They

stated that Diabetics whose blood sugar, blood pressure, blood fats (lipids), body mass index (BMI) and kidney function rate, were within the therapeutic target range had a persistently high risk of hardening in left-sided valves. The New York Heart Association functional class III was observed at the baseline among 44.4%. In the study of Chow et al. (2020) their results are in accordance with our findings that 44.1% had NYHA class III on the preoperative examination among 68 patients. No patient showed Class III by the end of our study and this status improved after the surgical intervention. Our results of improving mitral regurgitation status are aligned with the study findings of Smith et al. (2014) and Kang et al., (2006) analyzing trends in isolated coronary artery bypass grafting, found positive outcomes in MVR patients. This study suggests that CABG with or without mitral valve replacement or repair improves mitral regurgitation status in cardiovascular patients. These interventions address MR and produce long-term benefits. This study has limitations. Results may be limited by the small sample size. In long-term follow-up studies that examine various coronary artery bypass grafts, patients without mitral valve replacement or repair have a low re-operation rate. These results show that the initial procedures and surgical interventions helped the patients to improve their mitral regurgitation status.

Post-operative complications such as respiratory failure, cerebrovascular events, renal failure and arrhythmias are observed in 17.6%, 11.8%, 14.7% and 20.6% of the study patients. In the study of Koene Rayan et al, (2017) postoperative complications of cerebrovascular events, renal failure and arrhythmias observed among 28%, 25% and 11% of the patients in the study of Chow et al.,(2020) 14.3% patient had postoperative

renal failure. 1.83% of patients had post-operative respiratory failure observed in the research of Simon Chow et al.(2020).

The discussion highlights the changing trends in understanding and treating Ischemic Mitral Regurgitation (IMR). As surgical techniques have improved and standardized, evidence from clinical trials and studies have become stronger. The prevalence of MR severity decreased over time among patients undergoing cardiac surgery. Moderate MR was the most common, followed by mild, while severe MR was relatively rare. Surgical interventions, such as coronary artery bypass surgery alone for mild MR and combined with valve repair for severe MR, have shown positive outcomes in terms of functional capacity, left ventricle remodeling, and MR severity reduction. The low mortality rates observed after surgery indicate the effectiveness of these interventions for long-term survival. However, more research is needed to validate these findings and identify other factors influencing mortality.

The study acknowledges its limitations, including its retrospective nature, which may introduce information bias. The relatively small sample size may limit the generalizability of the results, and the study being conducted in only one institute might have variations in outcomes among different populations and races.

Despite these limitations, the study contributes to the existing literature on IMR management and highlights the importance of comprehensive care and follow-up to address post-operative complications. The low rate of re-do surgery indicates favourable outcomes for most patients without requiring additional surgical interventions.

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1. INTRODUCTION

1.1 General Introduction

It is common to use the words secondary, functional, and ischemic mitral regurgitation (IMR) interchangeably to refer, to distinguish from primary or degenerative MR, which is described as regurgitation brought on by dysfunction of mitral valve leaflets and/or chordae that support them. The MV leaflets and chords are normal in secondary MR. However, structural and functional defects of the left ventricle prevent leaflet coaptation (Nonaka et.al, 2019). MR with ischemia is a subset of secondary MR where coronary artery disease is the underlying cause of left ventricular dysfunction and related ischemia and infarction of the myocardium (Kron et al., 2017).

Valvular heart disease is a swiftly expanding global cause of cardiovascular morbidity and mortality with a shifting geographical distribution (Aluru et al., 2022). Mitral regurgitation (MR) is the third most prevalent form of valvular heart disease, affecting about 24.2 million individuals worldwide. Since MR is predominantly a disease of older adults, it is estimated to have caused 0.88 million DALY and 34,000 fatalities in 2019 (Roth et al., 2020). MR is either equally prevalent in both sexes or slightly more prevalent in males. White patients have significantly higher mitral valve prolapse (MVP) rates than minority patients (Novaro et al., 2013). MR, whether primary or degenerative, is typically a consequence of myxomatous degeneration and mitral valve prolapse. MVP is the most prevalent cardiac mitral valvular pathology in the globe, affecting between 2% and 3% of the population. RHD continues to be prevalent in developing nations and is the leading

cause of mitral valvular pathology leading to hospital admissions. Acute MR can manifest with a sudden onset of dyspnea and flare pulmonary oedema, usually as a result of myocardial infarction. Chronic MR is frequently asymptomatic, but treatment is advised prior to the onset of symptoms. Physical examination reveals a gentle S1 and a holosystolic, bowing murmur best heard at the cardiac apex with radiation to the axilla (as opposed to aortic stenosis, which radiates to the carotid arteries). S3 indicates severe MR and imminent systolic cardiac failure. The prevalence of primary MR has increased by 70% from 1990 to 2017, primarily in developing countries, although age-standardized prevalence has not changed substantially and mortality has decreased by nearly 32%.(Roth et al., 2020)

The Management of Patients with Valvular Heart Disease: 2014 American Heart Association/American College of Cardiology (AHA/ACC) Guideline divided secondary MR into four stages: Stage A, "at risk of MR," Stage B, "progressive MR," Stage C, "asymptomatic severe MR," and Stage D, "symptomatic severe MR." Stage D differs from stage C in that severe MR symptoms continue even after coronary revascularization and adherence to the medical treatment recommended by guidelines. It is interesting that in the 2014 guidelines, the quantitative valve hemodynamic criteria of effective regurgitation orifice area (EROA) 0.20 cm, regurgitation volume 30 mL, and regurgitation fraction 50% were used to designate stages C and D secondary MR i.e., severe MR.(Rick A. et al.,2014)

Mitral regurgitation (MR) is a condition characterized by the retrograde passage of blood from the left ventricle (LV) to the left atrium (LA) due to improper coaptation of the mitral leaflets. The term refers to a broad range of diseases and dysfunctions of the mitral valve apparatus that respond differently to medical and surgical treatments. Therefore, it is

essential to differentiate between primary MR (regurgitation due to organic dysfunction of the mitral valve) and secondary MR (regurgitation due to left ventricle remodeling). The latter includes mitral regurgitation as a result of acute/chronic coronary artery disease (CAD) or idiopathic cardiomyopathy. The second condition is referred to as Ischemic Mitral Regurgitation (IMR). IMR is a common and significant coronary artery disease complication (Lopes et al, 2016). It may manifest either acutely, in the setting of myocardial infarction (MI), typically with cardiogenic shock and hemodynamic instability, or chronically, in the absence of active ischemia, with long-standing CAD. Even in moderate cases, it is independently associated with higher cardiac mortality rates, with a direct correlation between severity and decreased survival. (Lamas et al., 1997) Patients with acute or chronic coronary artery disease must closely monitor this factor due to its significance for patient prognosis and its difficulty in clinical recognition (Tcheng et al., 1992). Current guidelines prescribe valvular surgery for patients with moderate to severe MR undergoing coronary artery bypass graft (CABG) surgery but do not specify which procedure constitutes the optimal surgical approach or under what conditions to prefer over the other.

There are number of possible modalities, but the management of individual patients remains difficult (Carebolla BA et al., 2008). Medical therapy is mandatory; revascularization procedure is not sufficient to reduce mitral regurgitation (Aklog L etal., 2001). The role of combined surgical therapy by mitral valve repair or replacement is not yet defined in the absence of large randomized trial. (Vahanian A rt al., 2007). Hence the need of present study.

Research Question: What are long-term (10 year) outcomes of patients with ischemic mitral regurgitation (IMR) after undergoing coronary surgeries, including coronary artery bypass graft (CABG) with or without mitral valve repair or replacement?

Hypothesis (H): Are there any difference in the outcomes of patients with ischemic mitral regurgitation (IMR) after undergoing between various surgical interventions [a) Coronary artery bypass graft surgery (CABG), b) Coronary artery bypass graft surgery with Mitral valve replacement (CABG + MVR) and c) Coronary artery bypass graft surgery with mitral valve repair (CABG + MVr)] at different postoperative follow up period. (3 months, 1 Year and 10 Years)?

Null Hypothesis (H_0): No, there is not any difference in the outcomes of patients with ischemic mitral regurgitation (IMR) after undergoing between various surgical interventions [a) Coronary artery bypass graft surgery (CABG), b) Coronary artery bypass graft surgery with Mitral valve replacement (CABG + MVR) and c) Coronary artery bypass graft surgery with mitral valve repair (CABG + MVr)] at different postoperative follow up period. (3 months, 1 Year and 10 Years).

Alternative Hypothesis (H_a): Yes, there is difference in the outcomes of patients with ischemic mitral regurgitation (IMR) after undergoing between various surgical interventions [a) Coronary artery bypass graft surgery (CABG), b) Coronary artery bypass graft surgery with Mitral valve replacement (CABG + MVR) and c) Coronary artery bypass

graft surgery with mitral valve repair (CABG + MVr)] at different postoperative follow up period. (3 months, 1 Year and 10 Years).

1.2 Aims and Objectives:

Aim: To investigate the long-term outcomes of patients with ischemic mitral regurgitation (IMR) after undergoing coronary surgeries, including coronary artery bypass graft (CABG) with or without mitral valve repair or replacement.

Objectives: To assess the outcomes of various surgical interventions [a) Coronary artery bypass graft surgery (CABG), b) Coronary artery bypass graft surgery with Mitral valve replacement (CABG + MVR) and c) Coronary artery bypass graft surgery with mitral valve repair (CABG + MVr)] in the treatment of ischemic mitral regurgitation at different postoperative follow up period. (3 months, 1 Year and 10 Years

1.3 Scope of Study

Although MV repair over replacement has demonstrated advantages over replacement in primary MR, the surgical strategy for IMR patients remains controversial due to elevated recurrence rates with MVR and increased operative mortality after MVR. (Shuhaiber et al, 2007) The lack of randomized trials and the selection bias in the majority of retrospective

studies when assigning patients to various surgery modalities (with the sickest patients undergoing MVR) have complicated decision-making. Recently, a number of novel randomized trials investigating IMR have been published, providing us with new information and corroborating some ideas previously suggested by a small number of retrospective cohort studies. It is therefore necessary (and the purpose of this paper) to analyze this novel information, in conjunction with our understanding of the mitral valve apparatus and the pathophysiology of IMR, in an effort to summarize decision-supporting data. (Lopes et al, 2016.)

1.4 Structure of the Thesis

In the chapter of "Introduction" the following subheadings consists, General introduction with research question and hypothesis, aim and objectives of the study along with scope of the study are mentioned earlier. In the chapter of "Literature Review" A Brief description of Ischemic Mitral regurgitation is given. The following points are described with respect to Ischemic Mitral Regurgitations and those are the definition of IMR, classification of IMR, anatomy of IMR with its diagram, treatment for IMR along with repair, replacement and re-do surgery. At last, the impact of quality of life is mentioned in a short context.

In the chapter "Materials and Methods," all the details of study designs, location, selection criteria, sample selection method, conduction of the study, data collection procedure and statistical analytical procedures has described in detail.

The “Result” chapter consisted, of all the results obtained in the present study in a descriptive manner along with tables and figures for each. Results were obtained by demographic details (age, sex) of patients. Then their existing co-morbidity prior to the cardiac surgery has been given. All the variables such as RWMA, NYHA Functional Class, MR status, LVEF, LVIDd, LVIDs etc., were recorded on pre-operative and post-operative examinations has been mentioned. Post-operative complications as well as mortality with reasons were also added.

In the “Discussion” chapter our observations were compared and discussed along with existing literature findings. The possible reasons for those outcomes with the strengths and limitations are also mentioned.

Chapter “Summary and Conclusion” represents, a short description of our discussion with the limitations of this thesis and the conclusion was made by our findings on obtained results and discussion. In the last chapter of “References”, the source of all the referencing literature utilized in this thesis was mentioned. The citations and references followed the guideline of ‘Sage Harvard Referencing 2010’

2. LITERATURE REVIEW

Ischemic Mitral Regurgitation:

Definition: Ischemic Mitral Regurgitation is defined as Mitral Regurgitation due to ischemic heart disease and, as such, it must not be confused with mitral regurgitation from other causes that coexists with ischemic heart disease.

There are two types of MR: primary, caused by mitral valve dysfunction, and secondary, resulting from left ventricle remodeling. Primary MR is associated with myxomatous degeneration and mitral valve prolapse, while secondary MR is often linked to coronary artery disease.

Chart 1 Types of Mitral Regurgitation

	Descriptive Name	Common Etiologies	Treatment
Primary MR	Degene-rative MR	Mitral valve prolapses, Barlow's valve, fibroelastic deficiency disease, connective tissue disorder, infective endocarditis, rheu.matic heart disease, cleft mitral leaflet, history of chest radiation	Predominantly surgical or percutaneous intervention
Second-ary MR	Functional MR	Ischemic heart disease (coronary disease) or nonischemic cardiomyopathy resulting in left ventricular dysfunction, papillary muscle displacement, leaflet tethering, and annular dilation	Medical Optimization followed by possible or surgical or percutaneous intervention

Ischemic mitral regurgitation is caused by chronic changes of LV structure and function due to ischemic heart disease and it worsens the prognosis. Approximately 50% of patients experience myocardial incompetence and subsequent left ventricular remodeling after an infarction and more than 10% of individuals experience significant regurgitation (Smith et al., 2014). Regardless of therapy, ischemic mitral regurgitation is linked to increased mortality (Castleberry et al, 2017). Chordae and valve leaflets structures in affected patients are "innocent bystanders"; annular dilatation, leaflet tethering, reduced closing forces, and papillary muscle displacement cause mitral regurgitation (Kumanohoso et al., 2003). When doing surgical revascularization for multi-vessel coronary artery disease in patients with ischemic mitral regurgitation, surgeons frequently consider concurrent mitral-valve repair. Although ischemic mitral regurgitation (IMR) may occur in patients after coronary artery bypass grafting (CABG), this condition is associated with poor outcomes and the benefits of mitral-valve replacement are still doubtful in such a situation (Fattouch et al., 2010). Those that favour CABG alone for the Revascularization may benefit therapy of moderate ischemic mitral regurgitation, according to some diminish size of the left ventricular chamber and improve regional left ventricular function, restoring the subchordal mitral valve system's ability to operate properly (Penicka et al., 2009). Supporters of the mitral valve citing the negative effects of chronic ischemic mitral regurgitation in addition to CABG, they go on to say that in patients with lowered left ventricular performance, mitral-valve replacement could stop the progression of unfavorable remodeling. Enhance cardiac health and lower the chance of heart failure. Operative mortality related to either treatment has steadily decreased over the past five years, but open heart exposure and

prolonged recovery times perioperative risk is increased by the lengths of cardiopulmonary bypass and aortic cross-clamping that are connected to mitral valve replacement (ElBardissi et al., 2012).

Chart 2 Echocardiographic criteria for the definition of severe valve regurgitation

	Mitral Regurgitation	
Qualitative		
Valve Morphology	Flail leaflet/ruptured papillary muscle/ large coaptation defect	
Colour flow regurgitation Jet	Very large central jet or eccentric jet adhering, swirling, and reaching the posterior wall of the left atrium	
CW Signal of regurgitation Jet	Dense/triangular	
Other	Large flow convergence zone	
Semiquantitative		
Vena contracta width (mm)	≥7 (>8 for biplane)	
Upstream vein flow	Systolic pulmonary vein flow reversal	
Inflow	E-wave dominant ≥1.5 m/sd	
Other	TVI mitral/TVI aortic >1.4	
Quantitative	**Primary**	**Secondary**
EROA (mm^2)	≥40	≥20
RVol (ml/beat)	≥60	≥30
+ enlargement of cardiac chambers/vessels	LV, LA	

Classification: Mitral regurgitation classified in to two groups and those are primary and secondary: as shown chart 1 above.

Severity Classification of IMR: The severity classification thresholds for IMR are lower than primary MR because the disease is more serious and has a greater impact on prognosis. Chart 2 describes these and other criteria.

The Mitral Valve Apparatus – Anatomy and Function: To comprehend IMR, it's crucial to remember that the mitral valve's job relies on more than just its leaflets. The Mitral Valve Apparatus consists of various structures, including the left atrial wall, two mitral leaflets, mitral annulus, chordae tendineae, and papillary muscles (which form the Subvalvular apparatus), as well as the left ventricular wall (as shown in Diagram 1). IMR is caused by dysfunction of the arterial blood supply to these structures, which is why it is briefly reviewed (Perloff et al, 1972).

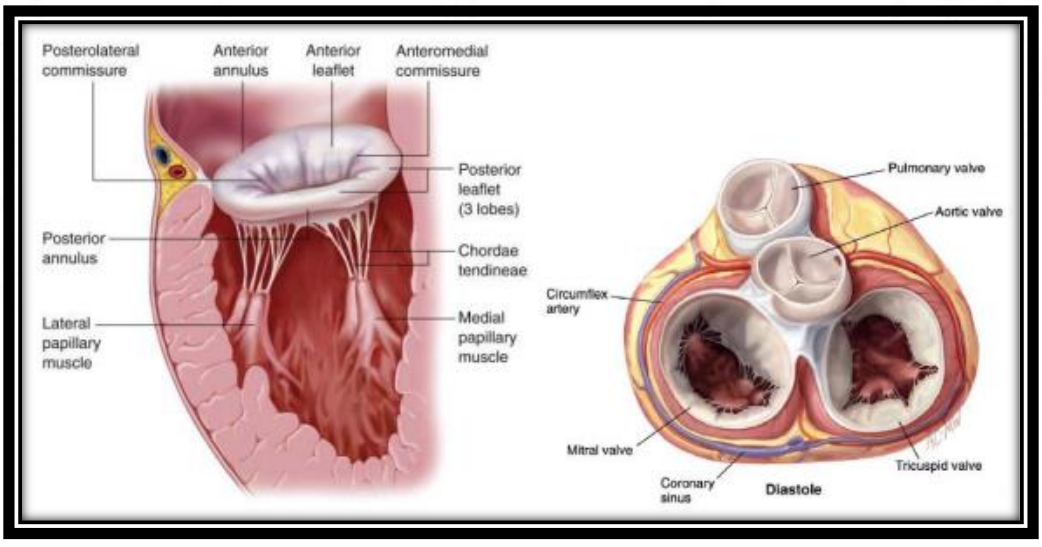

Diagram 1 The Mitral Valve Apparatus and its situation in the heart.

The left atrial wall: The mitral leaflets are affected by the left atrial wall in two ways: 1 is by contracting and relaxing and 2 is by dilating. The initial step creates ventriculoarterial gradient pressures, which are crucial for shutting the leaflets (Levy et al, 1962). However, if there is no mechanism such as atrial fibrillation, complete heart block, or others, it does not always lead to mitral regurgitation. However, if the left atrium becomes dilated, it can cause mitral regurgitation. When the left atrium gets bigger, the back wall moves down and back, which makes it harder for the back part of the mitral valve to close properly (Levy et al 1962). The left atrium gets its supply mainly from the branches of the left circumflex coronary artery(Nikolas et al, 2013).

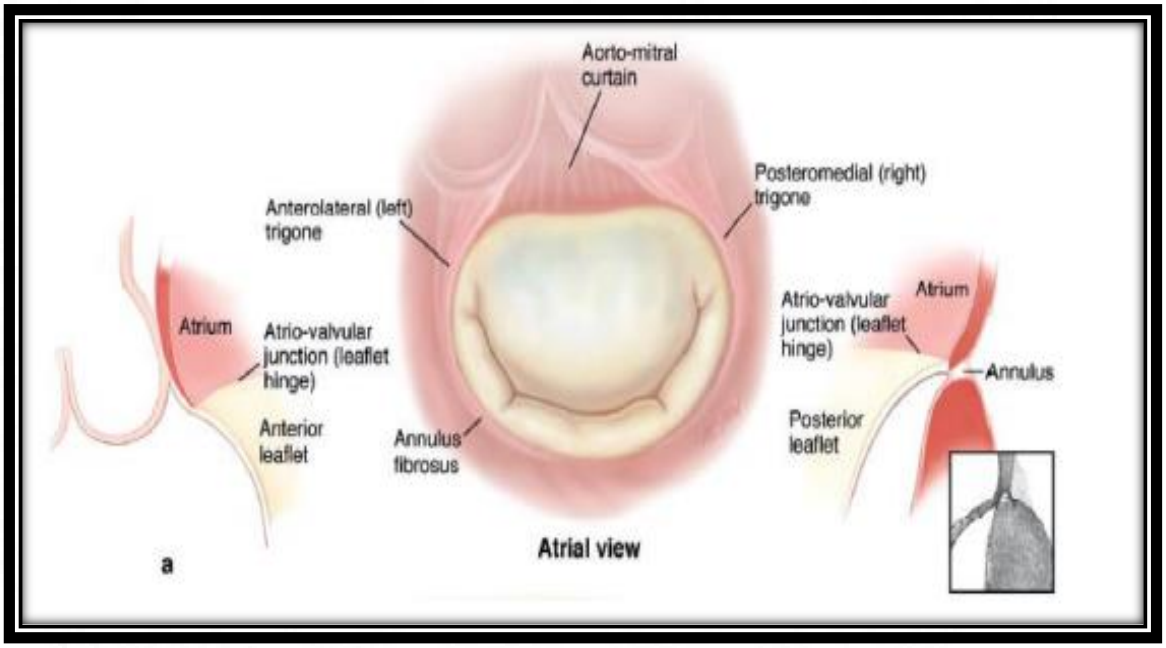

Diagram 2 The Mitral Valve and its relation

Annulus: The mitral valve orifice is shaped like a D and has an anteromedial flat portion where the anterior mitral leaflet attaches in the subaortic region (see Diagram 2). The

fibrous part of the annulus doesn't contract, but the posterolateral part does. It's connected to the LV wall and closes the orifice during systole in an asymmetrical way. It's closely related to the coronary sinus at the back and this affects how we treat it. The annulus has a transverse diameter that is bigger than its anteroposterior diameter. The ratio between the two is 4:3. If the ratio changes, like when the atrium or ventricle gets bigger, it can cause dysfunction (Ray et al, 2014).

Leaflets: The mitral valve has two leaflets: the anterior leaflet (also called the aortic or septal leaflet) and the posterior leaflet (also known as the mural or ventricular leaflet). The bigger leaflet at the front goes into about one third of the annulus and is connected to the aortic valve through the aortic-mitral anulus. The smaller posterior leaflet is inserted in the remaining two thirds of the annulus (Walmsley, 1979). The leaflets take up an area that's about two and a half times bigger than the annulus, which makes for a big cooptation area. When the leaflets don't line up right, some of the area is lost and the chordae get too much stress (Perloff et al, 1972). This can make them break. If the leaflets get damaged directly, for example, due to fibrosis, they lose their pliability and this can cause dysfunction. But in IMR, mitral regurgitation can also happen even if the leaflets are not damaged (Silverman et al, 1968).

Chordae tendinae and papillary muscles- The sub valvular apparatus: The chordae tendinae hold the edges of the mitral valve below the level of the mitral orifice. This helps to draw the leaflets to closure and maintain competence. Most of the chordae tendineae come from the anterolateral and posteromedial papillary muscles of the left ventricle and connect mainly to the loose edges of both leaflets (Rusted et al., 1952). The anterolateral

papillary muscle sends chordae tendinae to the left part of the anterior and posterior leaflets. Each papillary muscle group can have 4 to 12 chordae (sometimes between 2 to 22). But when there is more chordal branching, it leads to a varying number of chordae, which can range on the other hand, the posteromedial papillary muscle attaches the right part of both leaflets from 12 to 80, which insert into the mitral valve leaflet (see Diagram 3) (Victor et al, 1995).

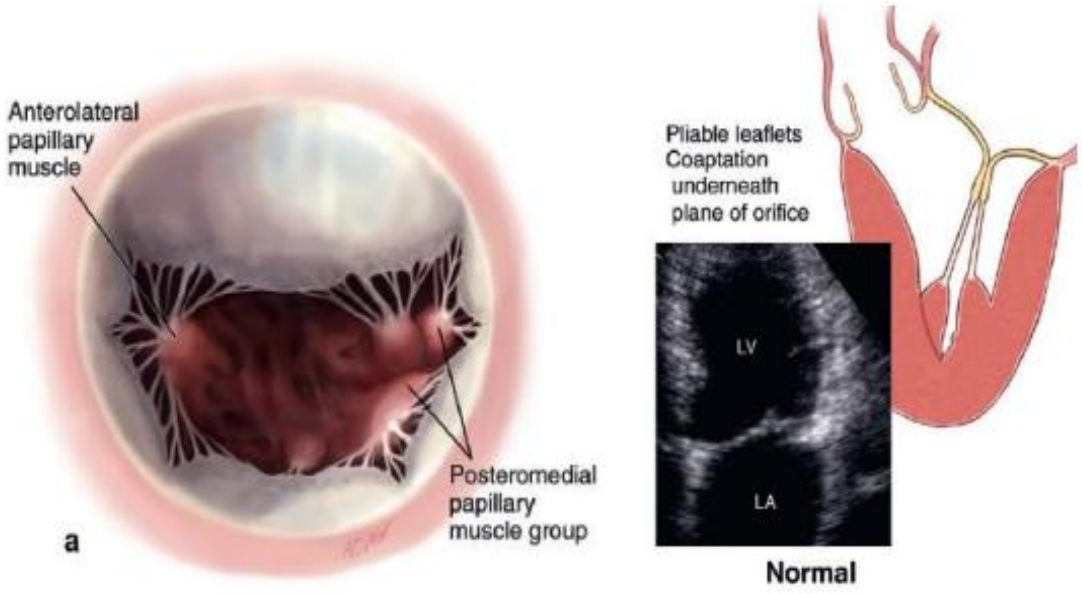

Diagram 3 The Subvalvular Apparatus chordae, papillary muscle and normal leaflet co-aptation

The left ventricle's anterolateral papillary muscle has two blood supplies. These supplies come from the left anterior descending coronary artery and marginal branches of the circumflex coronary artery. The posteromedial papillary muscle gets its blood supply only from branches of the posterior descending coronary artery. This artery comes from either

the right main coronary or left circumflex coronary arteries, depending on which one is dominant in the heart (Nicolas et al,2013). The chance of rupture is higher for the posteromedial papillary muscle than the anteromedial one. We can see in Diagram 3 the sub-valvular apparatus, which includes the chordae, papillary muscles, and normal leaflet coaptation. This is important information for understanding the structure of the heart (Barbour et al, 1986).

The left ventricular wall: The myocardium of the left ventricle is made up of three layers of muscle fibres that are oriented differently. These layers include the subepicardial, middle, and subendocardial layers. The ventricular orifices anchor the superficial and deep layers to fibrous structures of the central fibrous skeleton of the heart. This indicates that valvular function is affected by myocardial contraction. If the left ventricular wall undergoes changes like dilatation or akinesia, it can have a negative effect on the mitral valve's function. This happens because of its connection to the fibrous structures of the heart and the displacement of the myocardium region that's right under the papillary muscles (Nicolas et al, 2013).

The left descending coronary artery provides most of the blood to the interventricular septum via its septal branches and to the anterior wall of the left ventricle via its diagonal branches. The left circumflex coronary artery produces the obtuse marginal arteries which provide blood to the same side edge of the heart and part of the lower surface of the ventricle. The posterior descending coronary artery comes from the right main coronary artery in most people (85-90%). It gives blood to the back part of the interventricular septum and the lower wall of the ventricle (right dominance). In these cases, it forms a loop

of collateral circulation with the LDA. So, like in the last 10-15% of people who have left dominance, the posterior descending coronary artery comes from the circumflex artery. This means that the left ventricle is more dependent on the left coronary artery (Lopes et al,2016).

There are two situations where Ischemic Mitral Regurgitation can happen. The first one is when someone has an Acute Myocardial Infarction (AMI), and a small number of cases happen because of papillary muscle rupture (PMR). The second situation is when someone has long-standing ischemic heart disease and it results in Chronic Mitral Regurgitation.

Acute Mitral Regurgitation complicating Acute Myocardial Infarction. This is called Acute IMR. Let's talk about how it shows up and why it's important.

Presentation and significance: Moderate to severe mitral regurgitation is a frequent complication of AMI, which occurs in 3% to 19% of patients (Grigioni et al., 2001). Typically, it shows up as a rapid accumulation of fluid in the lungs or unexpected chest pain accompanied by a new heart murmur. We know that if the condition is more severe, the chances of having severe heart failure, recurrent heart attacks, and dying from heart disease are higher. According to ***Lamas et al.'s*** (Lamas et al., 1997) study, patients who had a myocardial infarction with acute IMR had a cardiovascular mortality rate of 29% during the 3.5 years of follow-up. On the other hand, patients without acute IMR had a mortality rate of 12%.(Lopes et al., 2016).

Pathophysiology: IMR is caused by an imbalance between decreased closing forces and increased tethering forces on the mitral valve due to damage to the heart muscle. This is known as pathophysiology (He S et al., 1997). There are different mechanisms that can

cause reduced closing forces. These include a decrease in the strength of the left ventricle's contractions, changes in the way the annulus contracts during systole, a lack of synchronization between the two papillary muscles and global left ventricular desynchrony, particularly in the basal segments (Yiu et al., 2000). The primary cause of heightened tethering forces is alterations in LV structure (remodeling) (Kono et al., 1992). The most common pattern that we observe is related to a posterior infarction. This infarction is usually transmural and it leads to local LV remodeling and distortion. This distortion contributes to the displacement of the posterior papillary muscle towards the apical, posterior, and lateral regions. When the chords are attached, the leaflets move up and don't close properly. This is called type IIIb dysfunction in the Carpentier's Surgical Classification of Mitral Valve Pathology – Diagram 5. (Carpentier et al., 2010) In some patients, the LV remodelling happens globally. This causes the LV to become more spherical and both papillary muscles to move. Annular dilatation also becomes more important in this case (see Diagram 4) (Otsuji et al., 2008).

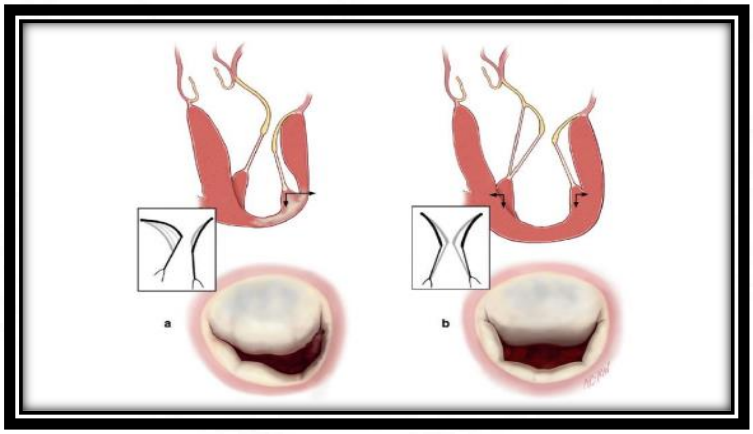

Diagram 4 Papillary Muscle displacement and leaflet tethering in ischemic heart disease. The displacement can be posterior (a) or global/both papillary muscles (b)

Even though papillary muscle necrosis was once thought to be a major reason for IMR, it doesn't always lead to mitral regurgitation. The mechanisms mentioned earlier are more crucial in causing it (Tanimoto et al., 2010). According ***to Kaul et al.'s*** (Kaul et al., 1991) study, it was found that decreasing PM perfusion did not cause prolapse or MR. On the other hand, when there was a decrease in blood flow throughout the body and the left ventricle became enlarged, even though the papillary muscles continued to receive blood and the walls of the left ventricle thickened, it resulted in mitral regurgitation where the mitral valve did not fully close due to the left ventricle not functioning properly (Lopes et al, 2016).

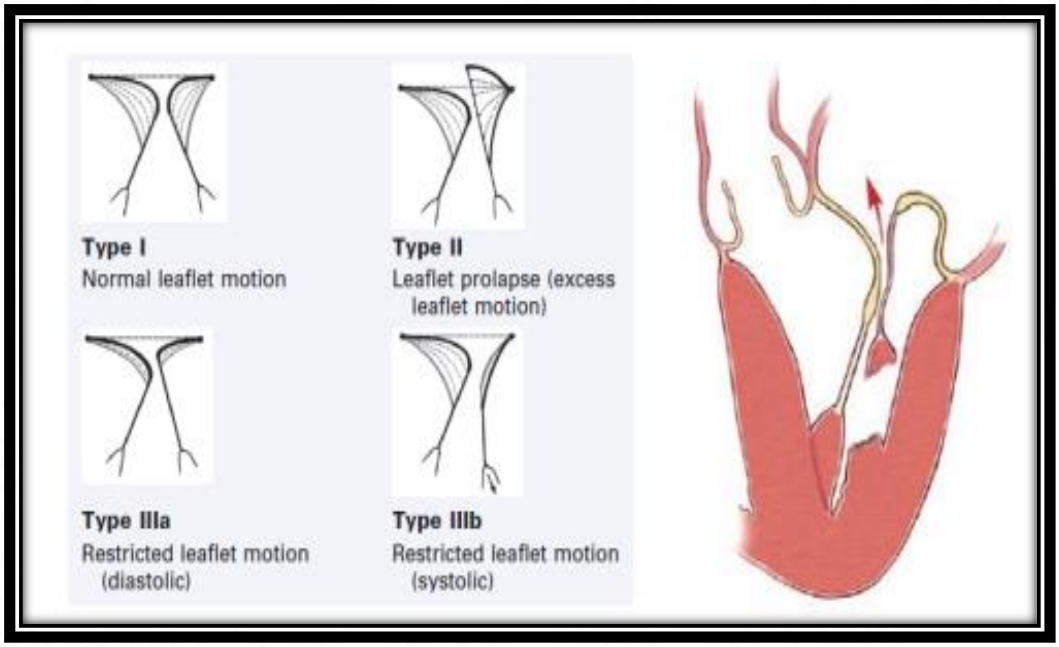

Diagram 5 Carpenter's Functional Classification. And Diagram 6. Papillary Muscle Rupture.

Papillary muscle rupture: When someone has a heart attack, there's a chance that their papillary muscle might rupture. This is a really serious problem that doesn't happen very often. If someone doesn't have surgery, their chances of surviving for 24 hours after the rupture depend on how bad the rupture is. If it's a partial rupture, they have a 70% chance of surviving. But if it's a total rupture, their chances of surviving drop to 25% (Barbour et al, 1986). If a papillary muscle loses its tethering mechanism, it can cause the anterior and posterior leaflet to flail. This happens because both leaflets receive chordae from the two papillary muscles, which is called a type II dysfunction. You can see this in Diagram 6. ***Barbour et al*** (Vlodaver et al, 1977) studied 22 patients who had acute myocardial infarction with PMR. Out of these patients, 22% had severe mitral regurgitation. The risk of rupture is three times higher in the posteromedial papillary muscle than in the anterolateral papillary muscle. This could be due to the weaker blood supply of the posteromedial papillary muscle.

Chronic Mitral Regurgitation (CMR) complicating ischemic heart disease- Chronic IMR: This is a condition where the mitral valve in the heart doesn't close properly, causing blood to leak back into the left atrium. This condition is often seen in patients with ischemic heart disease (IHD), which is a condition where the heart doesn't get enough blood flow due to narrowed or blocked arteries. When CMR complicates IHD, it is referred to as Chronic IMR.

Presentation and significance: The presentation of Chronic IMR can vary depending on the severity of the condition. Some patients may not have any symptoms, while others may experience shortness of breath, fatigue or swelling in the legs. The significance of Chronic

IMR lies in the fact that it can lead to further complications such as heart failure, arrhythmias, and even death if left untreated. Therefore, it is important for patients with Chronic IMR to receive appropriate medical management and follow-up care (Levine, R et al, 2005).

It's hard to tell if the MR is primary or IMR because ischemic heart disease and MR from nonischemic causes often happen together a lot. When chronic coronary artery disease is present in patients, they may show a mitral regurgitation or a murmur that gradually increases over time. This can be detected if they had a previous MI. Assuming there is no other probable cause, we can conclude that the mitral regurgitation is due to ischemia. While performing surgery, we can examine the leaflets, papillary muscles, and left ventricle to verify the diagnosis. Sometimes, it is difficult to differentiate between the fibrosis and dysfunction of these structures and those caused by other causes. Just like acute mitral regurgitation, the more severe the condition gets, the worse it is for survival, no matter what treatment is used (Pastorius et al., 2007).

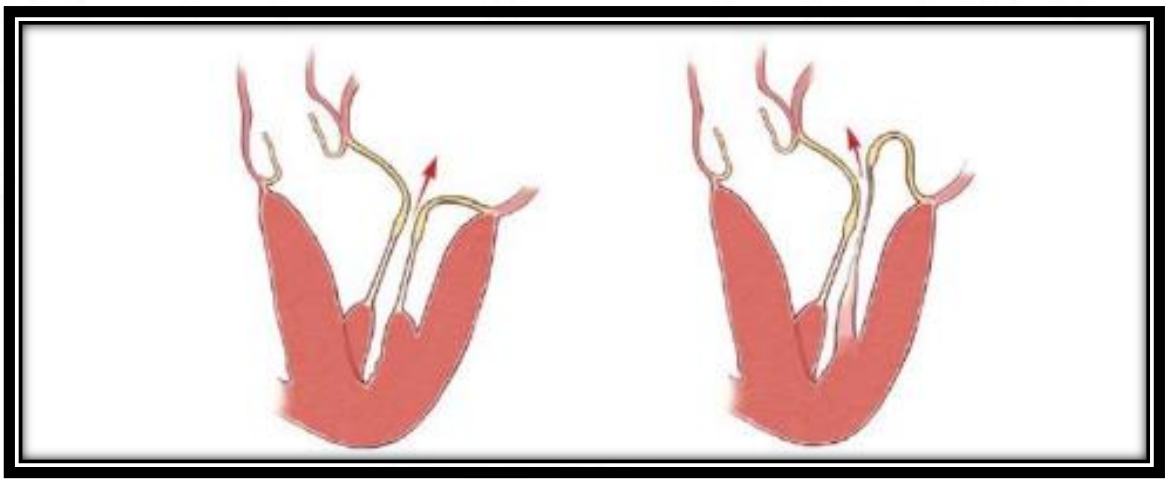

Diagram 7 Annular dilatation (left) and papillary muscle elongation (right) as causes of mitral

Pathophysiology: So basically, when the forces that hold the mitral valve in place get stronger and the forces that close it, get weaker and when the left ventricle of the heart isn't working properly, that's what causes mitral regurgitation over time (Godley et al., 1981). Sometimes, when a papillary muscle gets too long, it can cause the mitral valve to not work properly (called type II dysfunction) and cause regurgitation. This doesn't happen very often though. See Diagram 7 for a visual (Lancellotti et al., 2008).

Treatment For Ischemic Mitral Regurgitation:

Medical Therapy and Cardiac Resynchronization Therapy (CRT): In managing patients with secondary MR, the first treatment to be given is optimal medical therapy. This should be based on the guidelines available for managing HF (Ponikowski et al., 2016). We should consider ACE inhibitors, beta-blockers, and aldosterone antagonists for the treatment of heart failure. If there is fluid overload, diuretics should be used. The goal of medical treatment is to stop myocardial ischemia, lower and reverse LV pathological remodeling, and therefore, decrease the degree of ischemic mitral regurgitation (Lopes., 2016).

We should follow the guidelines when using CRT. This can help reduce MR severity by increasing closed forces and resynchronizing papillary muscles. It's possible that the decrease in tethering forces could be due to LV reverse remodeling. When responders experience a decrease in the severity of regurgitation, there is a significant correlation with increased survival (van Bommel et al., 2011).

Surgical treatment options.

There are three strategies for treating IMR surgically. The first is to only do revascularization with CABG. The second is to do CABG along with a mitral valve repair

technique (shown in Diagram 9). The third is to do CABG at the same time as a mitral valve replacement (shown in Diagram 10) (Lopes., 2016).

Most studies say that surgery is good for severe IMR cases. But for moderate cases, there isn't enough proof that surgery helps people live longer. So sometimes, doctors only do surgery to fix the blood flow in those cases. However, even though isolated CABG might be helpful for some patients who have moderate IMR, most papers suggest using combined surgery.

Performing CABG without a valve procedure. In their study of 136 patients, ***Akog et al***. (Aklog et al., 2001) found that CABG alone improved moderate MR in 51% of the patients, with complete resolution in 9% of those. However, 40% of the patients still had 3+ to 4+ MR. Hence authors have concluded that CABG alone may not be the best therapy for most of these patients. Most studies agree that combined surgery is effective in treating moderate IMR. In their study, ***Bonacchi et al*** (Bonacchi et al., 2006) analyzed the results of three patient groups and compared them. So, there were three groups of patients. Group I had patients with grade III-IV mitral regurgitation who had both CABG and mitral valve surgery. The other two groups had patients with low and moderate regurgitation who only had CABG. The study discovered that patients who had surgery and those with mild regurgitation who only had CABG had similar overall survival rates. However, patients with moderate mitral regurgitation who only had CABG had a significantly higher mortality rate. The researchers discovered that the enhancement of left ventricle ejection fraction (LVEF), along with LV end-systolic and end-diastolic dimension (LVESD and LVEDD, respectively), happened solely in patients who received mitral valve surgery. ***Fattouch et***

al (Fattouch et al., 2009) did work that backs up these findings about LV geometry getting better. They also found that the group who had mitral valve surgery and were in the New York Heart Association (NYHA) functional class had even greater improvements. The improvements included left atrium size, pulmonary artery pressure, and heart failure symptoms at rest. But, similar to the studies conducted by ***Kim et al***(Kim et al., 2005) and ***Goland et al*** (Goland et al., 2009), no significant differences in overall mortality were observed ***Michler et al***(Michler R et al, 2016) conducted a randomized trial which showed that patients who underwent combined surgery had a lower rate of regurgitation recurrence. However, there were no differences observed in mortality, LV geometry or survival. The combination of surgeries was linked to a higher risk of neurological and supraventricular arrhythmias in the early stages. The risk of mitral valve surgery is not small and it's unclear if it actually helps patients live longer. So, doctors may consider other things like other health problems and how well the heart is working when deciding how to treat patients with moderate regurgitation. Patients who are sicker might get better results from only CABG, instead of having to face the higher risk of death from the combined approach (Kang et al., 2006).

CABG with Mitral Valve Procedure:

It has been established that the majority of patients with moderate-to-severe IMR require surgical revascularization with a concomitant mitral valve procedure (mitral valve replacement or repair) in order to experience improvement in mitral regurgitation. But the mortality rate during these procedures is higher compared to primary MR and long-term outcomes are also inferior (although this correlates in part with the greater severity of the

comorbidities among IMR patients). Lately, improved surgical techniques, such as an increase in the preservation of the sub valvular apparatus during MVR (Diagram 10) and the use of the more effective downsized ring annuloplasty (Diagram 8) during repair, have together with improved postoperative management resulted in superior outcomes (chart 3) (Yun et al., 2002).

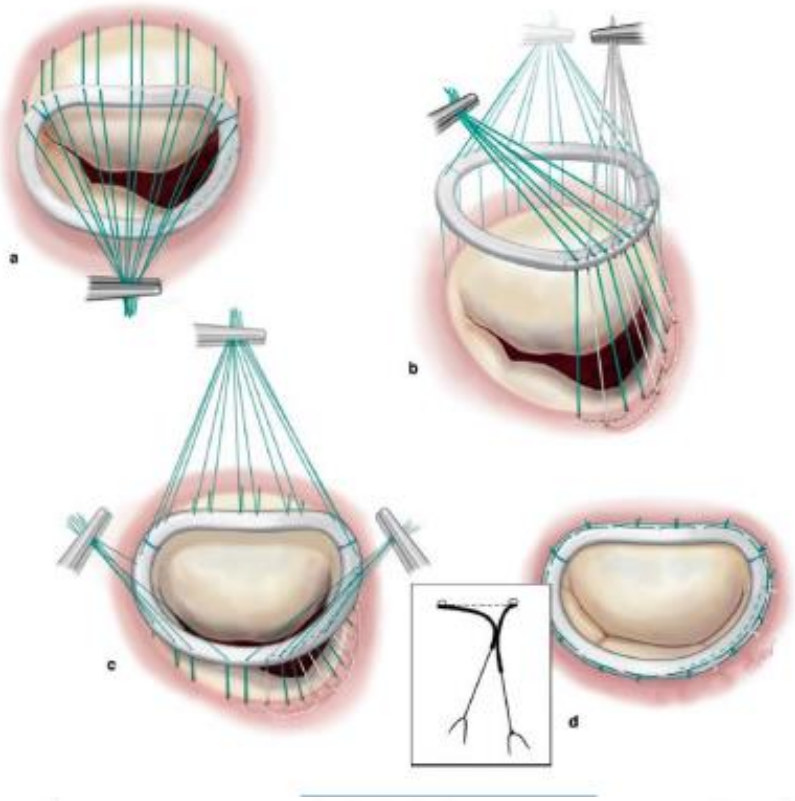

Diagram 8 Undersized ring annuloplasty.

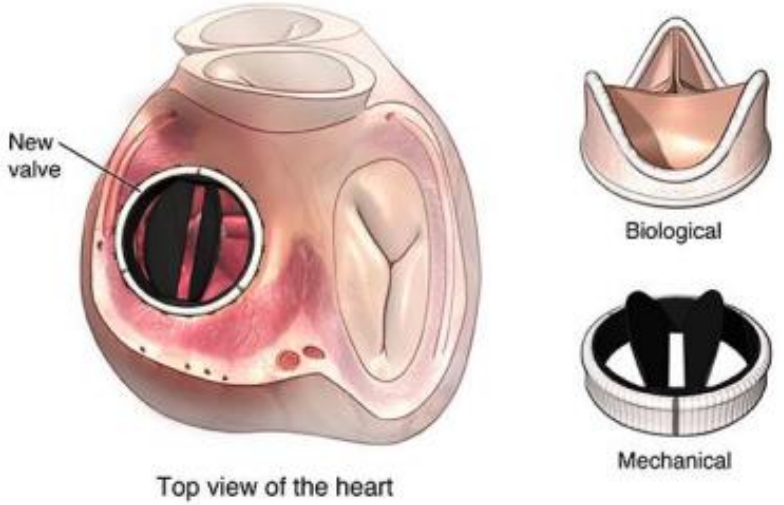

Diagram 9 Mitral valve replacement and types of valves.

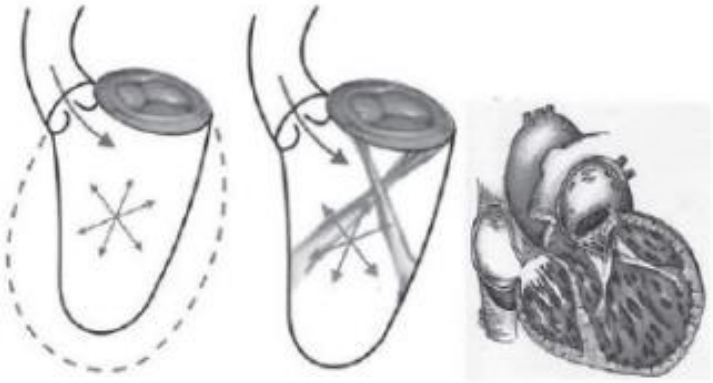

Diagram 10 Preservation of the subvalvular apparatus during replacement

The latest European Society of Cardiology (ESC) guidelines from 2012 on the management of valvular heart disease recommend that severe mitral regurgitation should be corrected at the time of bypass surgery. Combined surgery should also be considered for patients with moderate MR, who are undergoing CABG. In symptomatic patients with severe IMR and severely depressed systolic function, isolated mitral valve surgery might be considered if

comorbidities are low and revascularization is viable. For the remaining patients, including patients with mild IMR and those with severe IMR and depressed ventricular function but no viability for revascularization, optimal medical therapy is recommended. In the event of failure, extended HF treatment is currently the recommended option. These indications summarized in chart 3. The decision regarding which surgical technique to use remains controversial to this day and these latest guidelines do not make any particular recommendations.

Chart 3 Echocardiographic criteria for the definition of severe valve

Indications for mitral valve surgery in chronic secondary mitral regurgitation		
	Class	Level
Surgery is indicated in patients with severe chronic MR undergoing CABG, and LVEF >30%.	I	C
Surgery should be considered in patients with moderate MR undergoing CABG	IIa	C
Surgery should be considered in symptomatic patients with severe MR, LVEF <30%, option for revascularization, and evidence of viability.	IIa	C
Surgery may be considered in patients with severe MR, LVEF >30%, who remain symptomatic despite optimal medical management (including CRT if indicated) and have low comorbidity, when revascularization is not indicated.	IIb	C

This suggests that studies without follow-up beyond 36 months might be unable to detect potential long-term mortality differences.

Mitral Valve Surgery Repair vs. Replacement: The last 20 years have seen the publication of various retrospective cohort studies, which have served as the first sources of evidence-based guidance for patients with IMR of moderate to severe. They are, however, necessarily biased by the use of several surgical procedures on patients in the same research and selection bias in the employment of a particular technique due to their retrospective nature (Lopes, 2016).

Surgery-related mortality the effect that mitral valve repair has on operative mortality has been one of the main arguments in favor of repair over replacement. The bulk of retrospective cohort studies show that patients undergoing MVr as opposed to MVR have lower 30-day death rates (Lopes., 2016). However, there was no discernible difference in 30-day mortality in the one randomized clinical trial by ***Acker et al***(Acker et al., 2014) comparing these methods. These most recent findings imply that differences in operative mortality found in earlier research may be due to selection bias in patients receiving various surgical procedures, with the sickest patients typically undergoing mitral valve replacement.

Late Mortality: The conclusions on late mortality change depending on the length of follow-up. The differences in late mortality between MVr and MVR were found to be non-significant in trials with a median follow-up of 12 to 36 months (Mantovani et al., 2004). The differences in mortality, however, grew as studies extended their follow-up periods

beyond 36 months, with patients receiving MVr showing much lower mortality rates (Magne et al., 2009).

A lot of the authors recognize, however, that on par with operative mortality, the difference in long-term survival might correlate with the baseline differences in comorbidities. Moreover, when propensity scoring is used to account for different baseline comorbidities, the difference is then deemed not statistically significant. The 2-year results on the randomized clinical trial by ***Goldstein et al*** (Avierinos, R et al 2016) concluded that there was no significant cumulative mortality difference between treatment groups, with a rate of 19.0% in the repair group and 23.2% in the replacement group (hazard ratio with mitral-valve repair of 0.79; 95% confidence interval [CI], 0.46 to 1.35; P = 0.39 by the log-rank test). This supports the previous findings by the retrospective cohorts for follow-up up to 3 years but leaves the question of whether results beyond 36 months will differ (Lopes., 2016).

Regurgitation recurrence

One of the major downfalls of mitral valve repair has been the significantly higher rates of at least moderate mitral regurgitation recurrence at mid-term follow-up, which has been shown to affect survival (Crabtree et al., 2008). A study by ***Gelsomino et al*** (Gelsomino et al., 2008) of 220 patients undergoing CABG + undersized annuloplasty, reviewed patients' MR status for up to 5 years. At 5-year echocardiography 72% of the patients presented at least moderate recurrence.

In virtually every retrospective cohort study comparing the two techniques, the replacement has been superior to repair in this aspect, offering a more durable solution, with the meta-analysis by ***Dayan et al*** (Dayan et al., 2014) and ***Virk et a field*** (Virk et al., 2015) concluding a risk of recurrence following MVr of 7 times that of replacement. The latest results from randomized patients corroborate these findings, with 58.8% of MVR patients recurring with moderate-to-severe regurgitation vs. 3.8% of MVR patients ($P<0.001$) at the two-year follow-up mark. The proposed explanation behind such results has been that, while the annular downsizing procedure reduces the effective regurgitation area, it does not correct the underlying pathophysiology of LV wall remodeling (localized or generalized) and subsequent leaflet tethering, resulting, in time, in recurrent regurgitation (Magne et al., 2009).

The justification for why some patients recurs and others don't may lie in differing weights that the already described pathophysiological mechanisms play in different patients. There have been some studies that attempted to pinpoint predictors of regurgitation recurrence. ***Ciarka et al*** (Ciarka et al., 2010) studied LV and left atrial volumes and dimensions, LV sphericity index, mitral annular area, as well as mitral valve geometry parameters in patients undergoing CABG + MVR. They concluded that, of the studied parameters, the distal mitral anterior leaflet angle (hazard ratio 1.48, 95% confidence interval 1.32 to 1.66, $p <0.001$) and posterior leaflet angle (hazard ratio 1.13, 95% confidence interval 1.07 to 1.19, $p <0.001$) were independent determinants of MR recurrence at mid-term follow-up. However, it is of note that the study included both idiopathic dilated cardiomyopathy and IMR patients. ***Kron et al***. (Kron, I et al, 2015) recently studied the 116 IMR patients that

underwent CABG + repair in the randomized trial for the CTSN, using logistic regression in an attempt to determine the probability of recurrence based on echocardiographic measurements or clinical characteristics. They concluded that the presence of basal aneurysms and dyskinesis were the only characteristics strongly associated with recurrent moderate or severe MR. Both the studies require further validation as the establishment of reliable recurrence predictors could be one of the most important elements guiding surgery decisions.

Mitral valve re-operations: Interestingly enough, the higher rates of regurgitation recurrence associated with MVr do not correlate, in the majority of studies, with significantly higher reoperation rates. Through the use of regression analysis, ***Lorusso et al*** (Lorusso et al., 2013) concluded, however, that mitral valve repair was a strong predictor of reoperation (hazard ratio, 2.84; P<.001). The meta-analysis by ***Virk et al***.(Virk et al., 2015) also noted an increased trend towards reoperation among MVr patients, when earlier studies with low use of sub-valvular apparatus preservation were excluded from the sensitivity analysis (Lopes., 2016).

Echocardiographic dimensions: Given their retrospective nature, the majority of published papers do not possess comprehensive reports on echocardiographic measurements (LVEF, LVESD, LVEDD) and even fewer reports on postoperative evolution. However, the few that do report improved left ventricular ejection fraction and reduced end-systolic and end-diastolic diameters after surgery. There was no significant

difference between techniques in regard to post-operative geometric improvement (Bonacchi et al., 2006).

Quality of life

Perhaps insufficiently investigated as an outcome, there have been few noted differences in quality-of-life scores between patients undergoing different techniques. ***Goldstein et al*** (Avierinos, R et al 2016) reported greater overall improvement on the Minnesota Living with Heart Failure questionnaire scores among patients undergoing MVR (mean change in heart-failure symptoms from baseline was 20.0 in the repair group versus 27.9 in the replacement group [P = 0.07]). There was also greater improvement from baseline scores among patients who did not have regurgitation recurrence (26.6 for patients without recurrence vs 16.2 those with recurrence). These differences only became apparent after the 12-month mark. However, in terms of NYHA class, there were no significant differences in improvement between the different techniques (Rankin et al., 1988).

3. MATERIAL AND METHODS

STUDY DESIGN: A retrospective, observational study was conducted to evaluate the results of various surgical modalities for Ischemic mitral regurgitation that are done in a tertiary care center of a medical college and to report therapeutic conduct with patients suffering from Ischemic mitral regurgitation.

STUDY AREA: Study was conducted in the Department of Cardiovascular and Thoracic Surgery.

ORGANISING THE STUDY:

i. Ethical consideration:

Relevant permission was taken from the Institutional Ethics Committee (IEC) of a Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivendrum (SCTIMST) prior to the study's conduction.

ii. Approval from authorities:

Permission was obtained for the conduction of a study in the cardiovascular and thoracic surgery department and from the Dean of that particular medical college and the same was informed to the authority of the cardiovascular and thoracic surgery department in SCTIMST.

iii. Designing of Patient, consent form and data collection sheet: The following forms were designed for the purpose of the study

1) Consent form- A consent form to be signed by participants was prepared. The patients were explained the purpose of the study, the advantages and the disadvantages associated with the study in Malayalam (local language) and in English.

2) Data collection sheet- Secondary data were obtained from the Department of Cardiothoracic and vascular, surgery of SCTIMST. And from those, we collected cases of a CABG for ischemic MR, CABG+MVR and CABG+MVr done in the year 2001-2010. Information such as Age, Gender, Preoperative parameters, Co-morbidities, Intra-operative parameters and postoperative parameters along with follow up was compiled.

SAMPLE SIZE DETERMINATION:

The present study is a retrospective study hence no need for determination of sample size. We got total 1428 number of patients with coronary artery disease and MR who underwent surgical management between the years 2001-2010. Of those 68 numbers of cases only participated in our study according to our eligibility criteria. hence data were analyzed with those numbers.

SAMPLE SIZE: 68 patients.

SAMPLING TECHNIQUE: Convenience sampling.

ELIGIBILITY CRITERIA: Gender, class, caste, ethnicity, race, will NOT be used as Inclusion and/or Exclusion criteria**.**

Inclusion criteria:

-Patients who are ready to give consent for the participation of the study.

-Patients with coronary artery disease having ischemic MR who underwent CABG with or without Mitral valve repair/ replacement.

. **Exclusion criteria:** Patients who had previously undergone a procedure such as carotid endarterectomy, redo operations, valve replacement and repair in conjunction with a coronary artery bypass graft (CABG), or who had another congenital heart condition.

ARMAMENTARIUM USED FOR DATA COLLECTION:

Secondary Data from the computer records were obtained and compiled on a data collection form. Patients were appointed on call for further examination.

CLINICAL PROCEDURE AND EXAMINATION:

After obtaining permission from IEC, Data was collected with a semi-structured questionnaire from hospital records and analyzed, details of patients who are lost to follow-up were only collected over the phone and requested to come on follow-up. Permission of the patient was taken before asking questions, Preoperative, intraoperative and postoperative data were collected, and retrospective analysis of data was performed by the principal investigator and co-investigators after the procedure. All the patients 'yearly follow up after the procedure were assessed clinically as well as ECHO and ECG as per departmental protocol. These data were collected through electronic medical records.

(EMR). The data was kept by the principal investigator. Patient details were kept confidential.

STATISTICAL PROCEDURE:

The statistical procedures were carried out in two steps:

1. **Compilation and presentation of data:**

   Compilation of data was done in a systematic manner. Using Microsoft Excel worksheet (Microsoft, USA, version 8.1) A master table was made, accordingly, the data was subdivided and distributed which was presented in the form of individual tables and Figures.

2. **Statistical Analysis:**

   Statistical analysis using IBM Statistical Package for Social Science (Statistics for Windows, version 21.0, Armonk, NY: IBM Corp.) was done and the comparison of data was carried out by applying statistical tests in order to find the statistical significance of the results.

   Statistical tests employed for the obtained data:

- Quantitative data were expressed in terms of mean and standard deviation.
- Qualitative data will be expressed in terms of percentages and proportions.
- Descriptive statistics of each variable were presented in terms of Mean, standard deviation, and standard error of the mean.

- The Kruskal wallis test was applied to analyze the statistical significance of the data.
- A p-value of <0.05 was considered statistically significant whereas a p-value of <0.001 was considered highly significant.

4. RESULTS

A retrospective study is conducted with the aim to study patients included between the ages of 42-89 years. A total of 68 patients, male and female are enrolled in the study.

Table 1 Distribution of study patients according to their age.

Sr. No.	Age Group (Years)	No. of patients n (%)	Mean Age	Standard Deviation
1.	41-50	11(16.17)	**56.87**	**±9.344**
2.	51-60	27(39.70)		
3.	61-70	23(33.82)		
4.	71-80	6(8.82)		
5.	81-90	1(1.49)		
Total		**68(100)**		

Distribution of study patients according to their age: The age of the study patients was between 42-89 years old. And the mean age is 57 years with a standard deviation ±9.344. The maximum 39.7% (n=27) patients from age between the group of 51-60 years. Followed to this 33.82% (n=23), 16.17% (n=11), and 8.82% (n=6) of study patients were from the age group 61-70, 41-50 and 71-80 years respectively. A single 1.49% (n=1) patient had an age group between 81-90 years that was 79 years. **(Table 1) (Figure 1)**

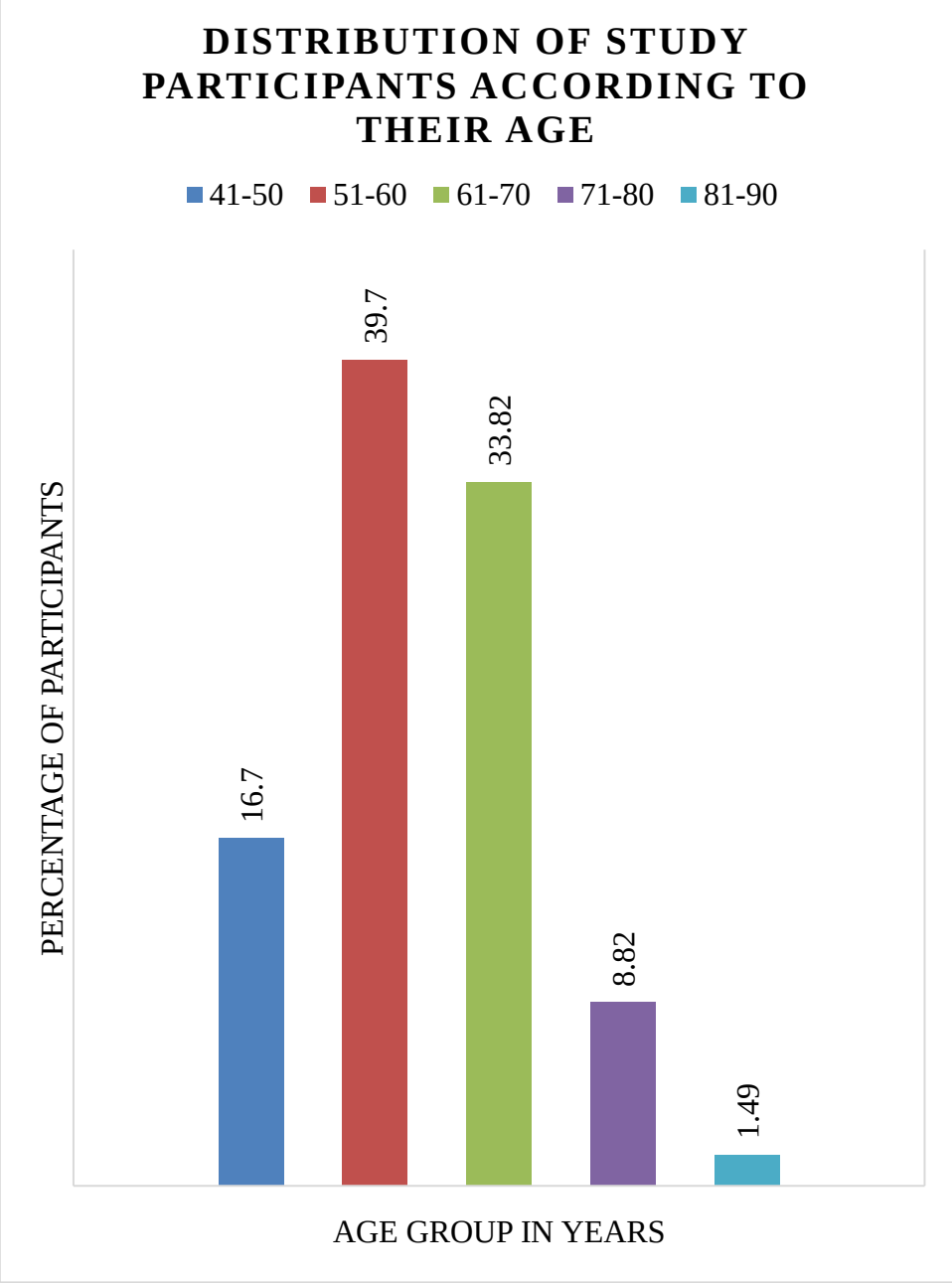

Figure 1 Distribution of study patients according to their age.

Table 2 Distribution of study patients according to their sex.

Sr. No.	Sex	No. of Patients n(%)
1	Male	60(88.24)
2	Female	8(11.76)
Total		**68 (100)**

Distribution of study patients according to their sex: Amongst all 100% (n=68) the study patients 88.24% (n=60) were male and 11.76% (n=8) were female. (**Table 2) (Figure 2)**

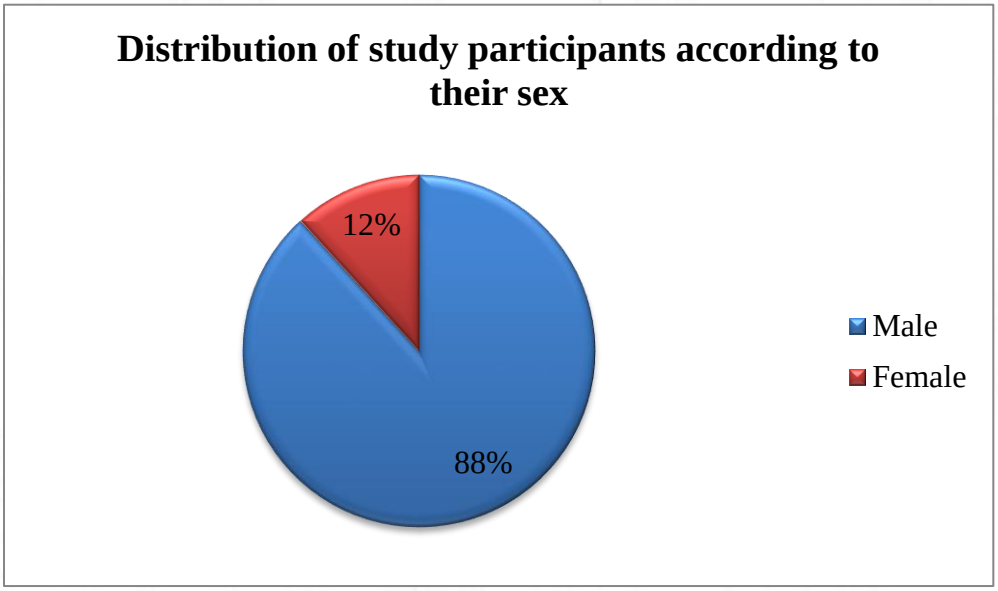

Figure 2 Distribution of study participants according to their sex.

Table 3 : Distribution of study patients according to their existing co-morbidity.

Sr. No.	Co-Morbidity	No. of Patients n (%)
1	Nil	1(1.5)
2	Only Hypertension	9(13.2)
3	Dyslipidemia	25(36.8)
4	Hypertension with Diabetes	9(13.2)
5	Hypertension, Diabetes and Peripheral Arterial Disease	1(1.5)
6	Hypertension, Diabetes and Dyslipidemia	23(33.8)
Total		**68(100)**

Distribution of study patients according to their co-morbidity: Amongst all 100% (n=68) the study patients most 36.8% (n=25) of the patients had Dyslipidemia, following to them 33.8% (n=23) had combined co-morbidity with Hypertension, Diabetes and Dyslipidemia. Following to them 13.2% (n=9) patient had Hypertension associated with Diabetes. Similar number that is 13.2% (n=9) had Hypertension. Only a single patient had combined co-morbidity with Hypertension, Diabetes and Peripheral Arterial Disease. Only one 1.5% (n=1) patient was without any co- morbidity. (**Table 3) (Figure 3)**.

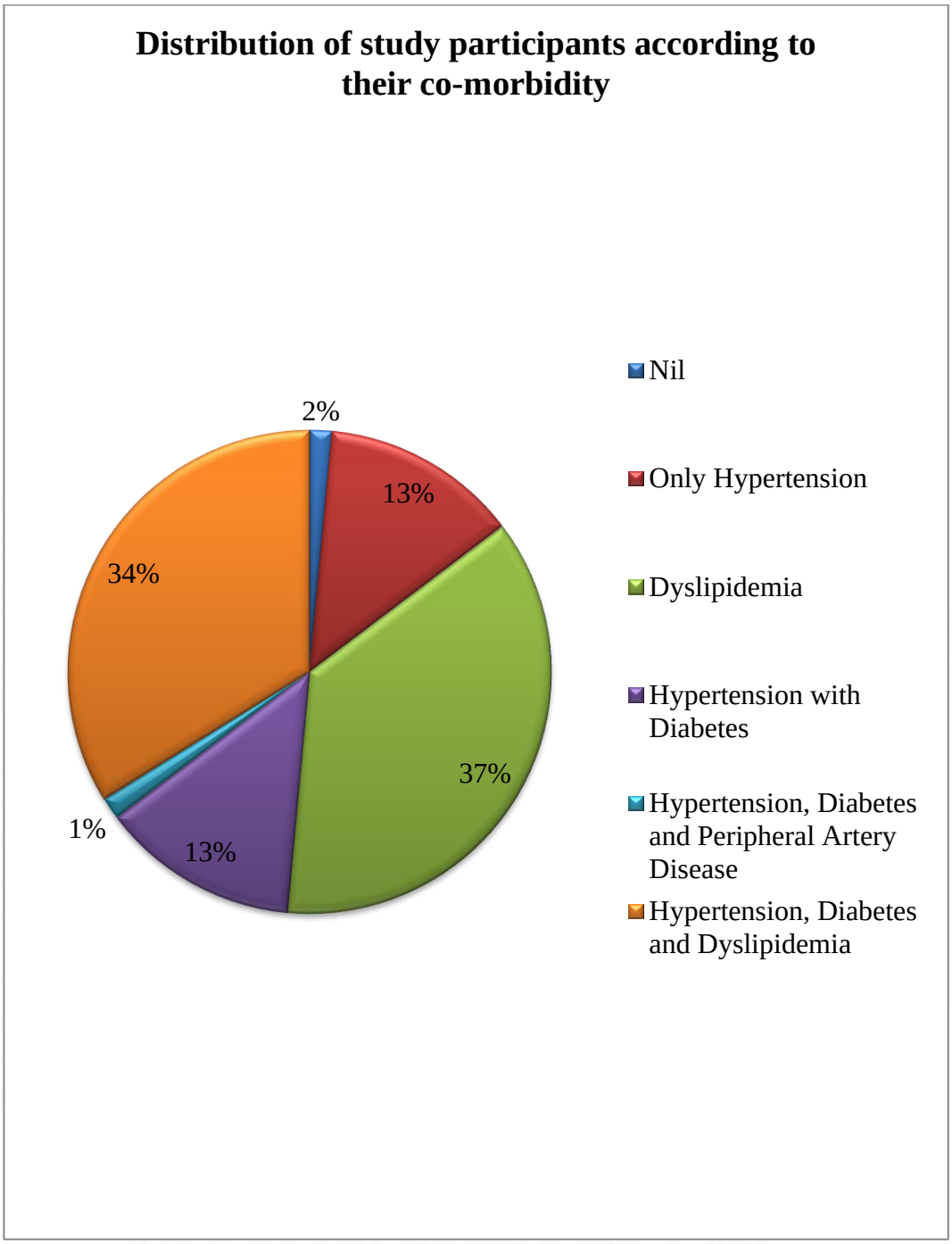

Figure 3 : Distribution of study patients according to their existing co-morbidity.

Table 4 Distribution of study patients according to their New York Heart Association (NYHA) Functional Class

Sr. No.	NYHA Functional Class	Pre-Operative	After 3 Months follow up	After 1 Year Follow up	At 10 years Follow up
1	Class I	1(1.5)	40(69)	50(86.2)	53(93)
2	Class II	30(44.1)	18(31)	8(13.8)	4(7)
3	Class III	30(44.1)	0	0	0
4	Class IV	7(10.3)	0	0	0
Total		**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their New York Heart Association (NYHA) Functional Class: Amongst all 100% (n=68) of the study patients, most of the patients 44.1% (n=30) had Class III functional class, as per New York Heart Association on pre-operative examination. After the surgery, follow up examination at 3months, 1 year and 10 years not a single patient showed NYHA Class III. Similarly, 10.3% (n=7) patients were with NYHA class IV on examination before the surgery and after the surgery, not a single patient showed NYHA class IV at 3months, 1 year and 10 years follow up examination.

Contradictory as above, a single patient that is 1.5%(n=1) had NYHA class I at pre-operative examination and those were improved post-operatively by 69% (n=40) at 3 months follow up, at 1 year follow up it became 86.2% (n=50) then it improved to 93% (n=53) by the end of 10 years after the surgery.

While 44.1% (n=30) patients had functional class II prior to surgery. 31% (n=18), 13.8% (n=8), 7% (n=4) patients only had NYHA Functional Class II on examination at 3months, 1 year and 10 years follow up respectively. (**Table 4) (Figure 4)**

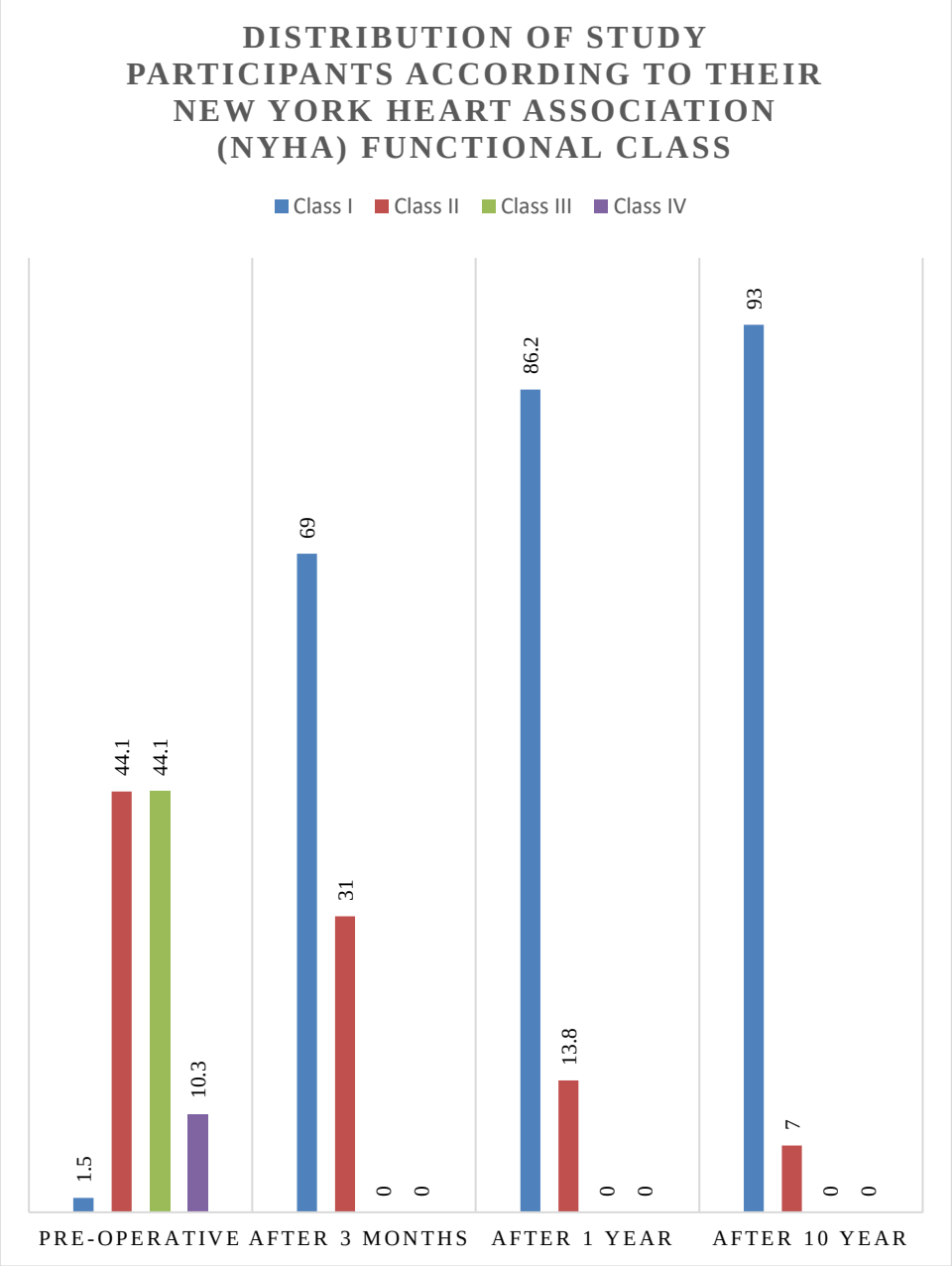

Figure 4 Distribution of study patients according to their New York Heart Association (NYHA) Functional Class

Table 5 Distribution of study patients according to their symptoms.

Sr. No.	Symptoms	Pre-Operative	After 3 months follow up	After 1 year follow up	At 10 years follow up
1	Asymptomatic	26(38.2)	58(100)	57(98.3)	57(100)
2	Symptomatic	42(61.8)	0	1(1.7)	0
Total		**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their symptoms: Amongst all 100% (n=68) patients, 61.8% patients were symptomatic at the time of surgery and those all became asymptomatic after the surgery at 3 months follow up and 10 years follow up. Only 1 patient developed symptom observed at 1 year follow up. (**Table 5) (Figure 5)**

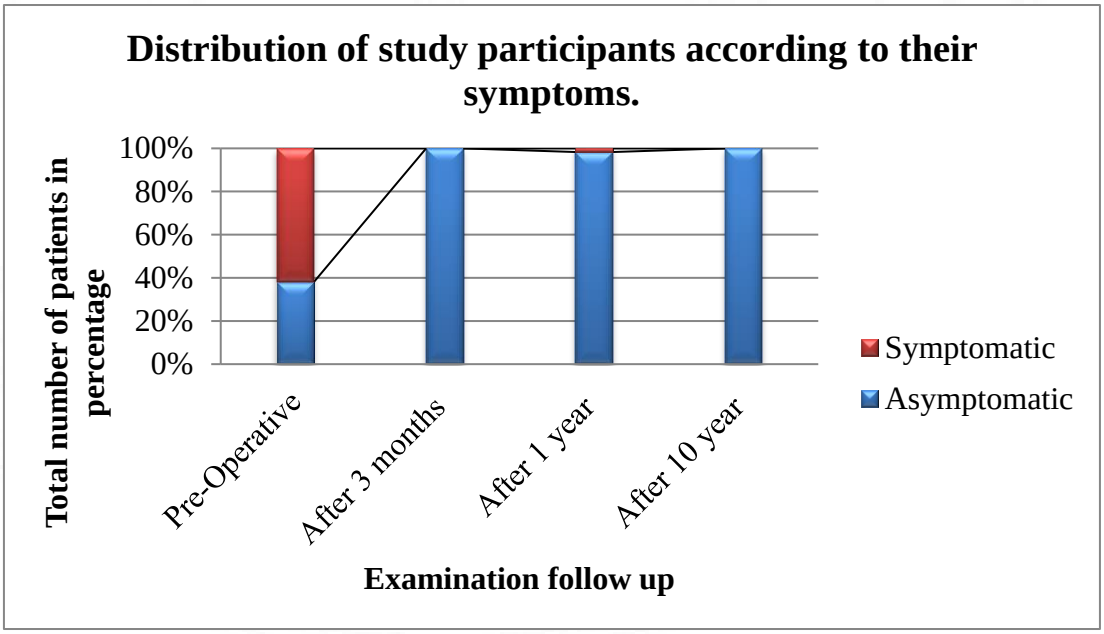

Figure 5 Distribution of study patients according to their symptoms.

Table 6 Distribution of study patients according to their left ventricular ejection fraction (LVEF) on preoperative examination.

Sr. No.	LVEF	No. of Patients n(%)	Mean LVEF	Standard Deviation
1.	25-30	11(16.18)	**44.99%**	**±10.56**
2.	31-40	20(29.41)		
3.	41-50	13(19.11)		
4.	51-60	20(29.41)		
5.	61-70	4(5.89)		
Total		**68(100)**		

Distribution of study patients according to their left ventricular ejection fraction (LVEF) on preoperative examination: Amongst all 100% (n=68) of the study patients, the highest 29.41% (n=20) of study patients had LVEF between 51-60%. Similarly, that 29.41% (n=20) patients had LVEF between 31-40%. Followed by 19.11% (n=13) and 16% (n=11) patients had LVEF 41-50% and 25-30% respectively. A few that is 5.89% (n=4) study patients had LVEF between 61-70%. (**Table 6) (Figure 6)**

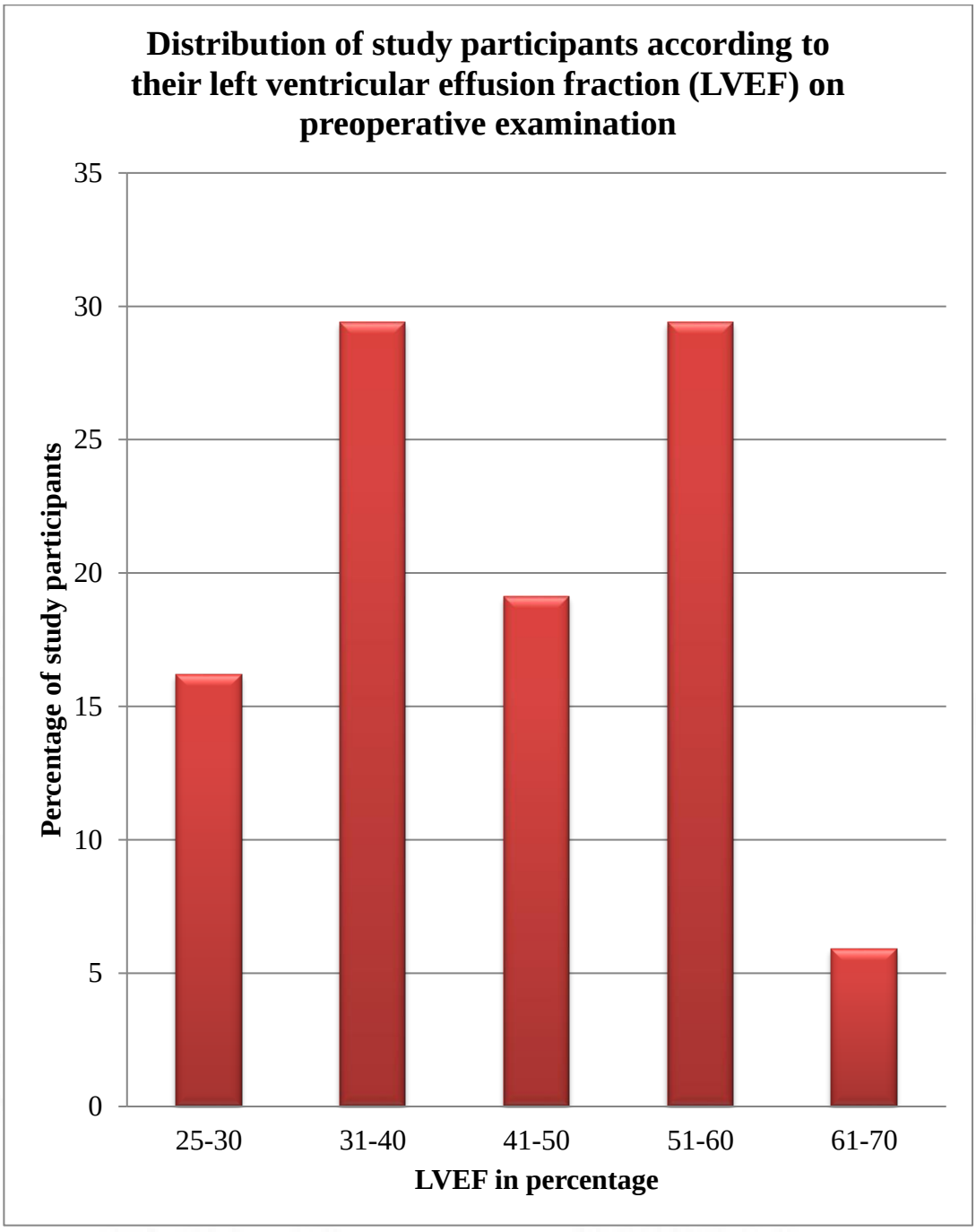

Figure 6 Distribution of study patients according to their left ventricular ejection fraction (LVEF) on preoperative examination

Table 7 Distribution of study patients according to their Left Ventricular Ejection Fraction (LVEF) pre-operative and post-operative follow-up.

Sr.No.	Parameters	Post-operative	After 3 Months Follow up	After 1 Year Follow up	At 10 Year Follow up
1	Ejection Fraction (mean)%	45.0	50.36	51.62	52.79

Distribution of study patients according to their Left Ventricular Ejection Fraction (LVEF) pre-operative and post-operative follow-up: Amongst all 100% (n=68) of the study patients, the mean value of Left Ventricular Ejection Fraction was 45.01%, on pre-operative examination and it was increasing up to 50.36%, 51.62%, 52.79% at the following examination of 3 months, 1 year, and 10years respectively. (**Table 7) (Figure 7)**

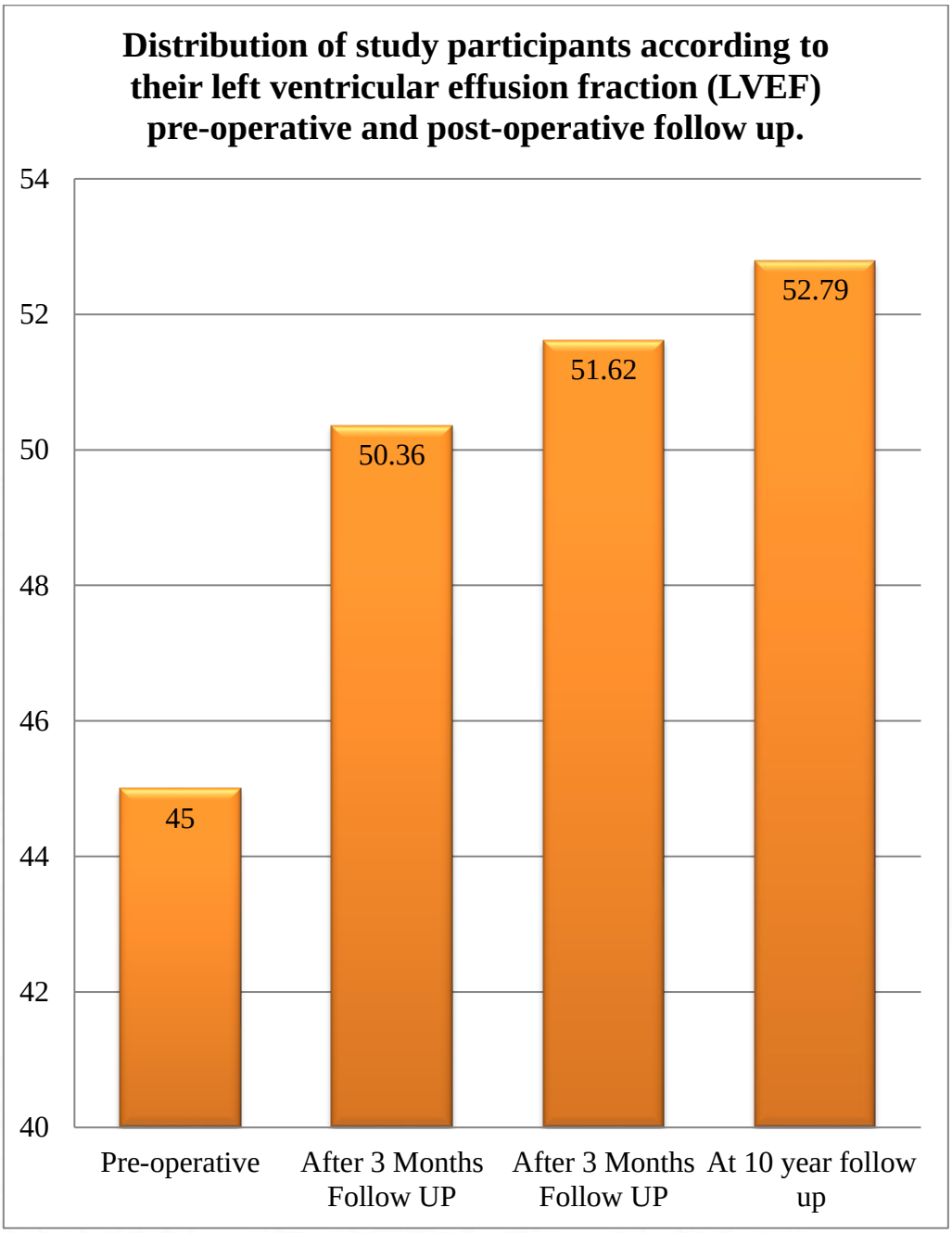

Figure 7 Distribution of study patients according to their Left Ventricular Ejection Fraction (LVEF) pre-operative and post-operative follow-up.

Table 8 Distribution of study patients according to their Left Ventricular Internal Dimension in diastole (LVIDd).

Sr. No.	LVIDd	No. of Patients (n)%	Mean LVIDD	Standard Deviation
1.	41-50	19(27.98)	**52.38**	**±4.48**
2.	51.60	49(72.02)		
Total		**68(100)**		

Distribution of study patients according to their Left Ventricular Internal Dimension in diastole (LVIDd): Amongst all 100% (n=68) of study patients. Most 72.02% (n=49) of the study patients had Left Ventricular Internal Dimension in Diastole (LVIDd) between 51-60 mm and 41-50 mm Left Ventricular Internal Dimension in Diastole (LVIDd) was found amongst (n=19) patients. (**Table 8) (Figure 8)**

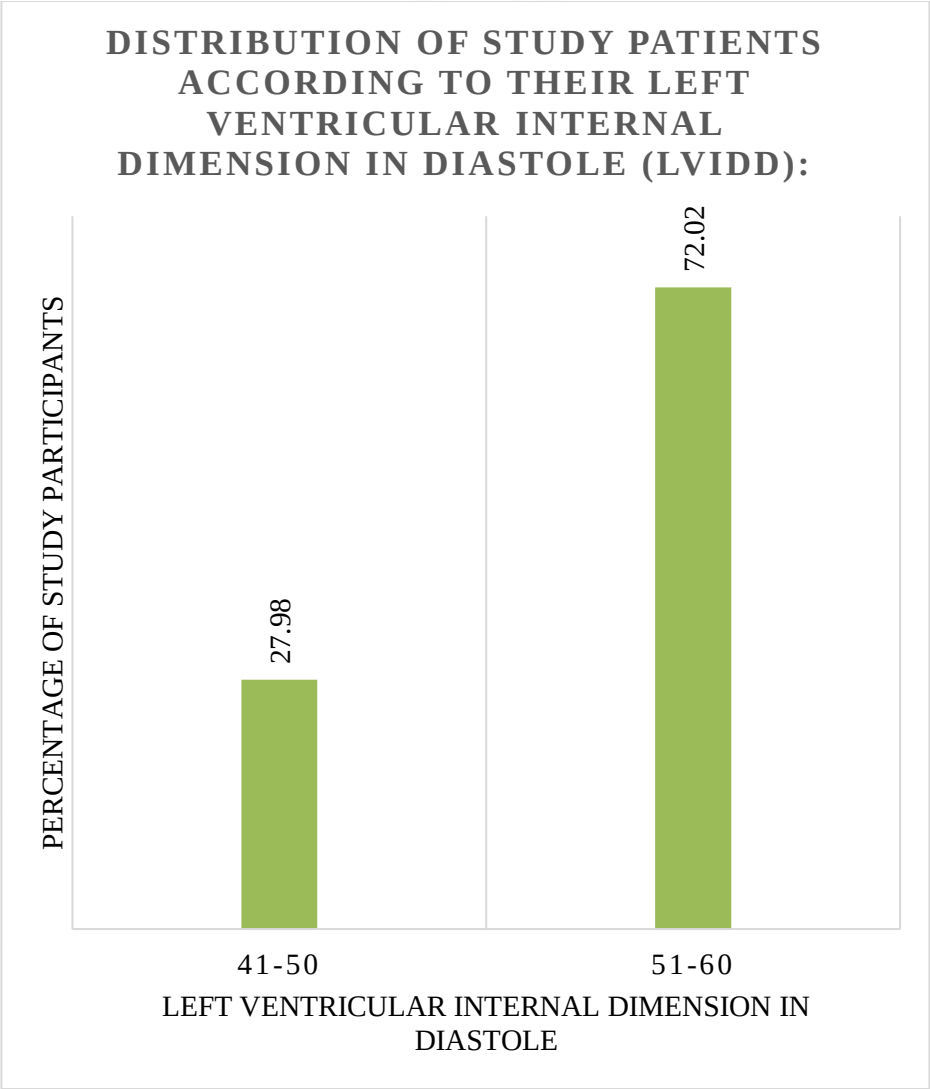

Figure 8 Distribution of study patients according to their Left Ventricular Internal Dimension in diastole (LVIDd).

Table 9 Distribution of study patients according to their Left Ventricular Internal Dimension in systole (LVIDs).

Sr. No.	LVIDS	No. of Patients (n)%	Mean LVIDS	Standard Deviation
1.	31-40	16(23.5)	**44.01%**	**±4.45**
2.	41.50	51(75)		
3.	51-60	1(1.5)		
Total		**68(100)**		

Distribution of study patients according to their Left Ventricular Internal Dimension in systole (LVIDs): Amongst all 100% (n=68) Most 75% (n=51) had LVIDS in between 41-50 mm. 23.5% (n=16) patients had LVIDs in between 31-40 mm. Only a single patient that is 1.5% (n=1) had LVIDs between 51-60 mm (**Table 9) (Figure 9)**

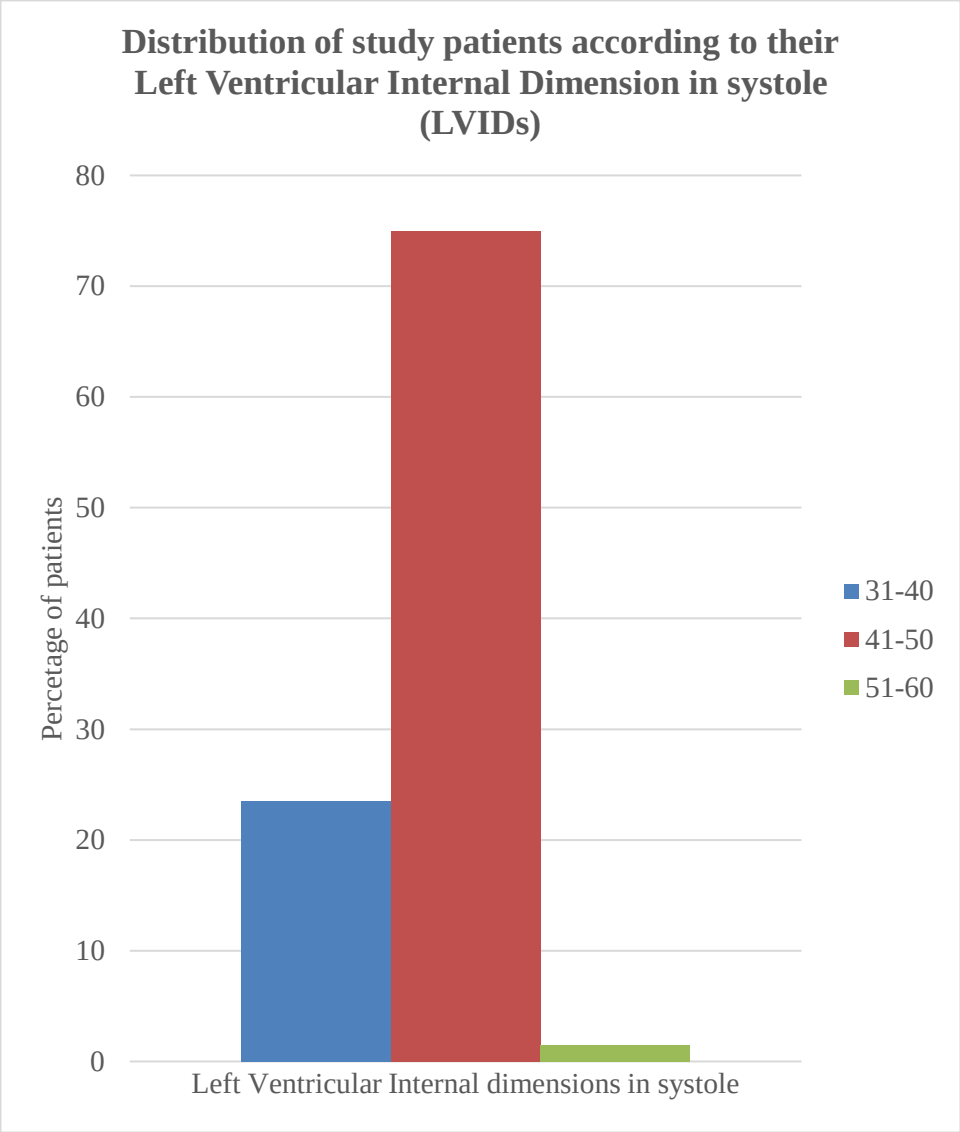

Figure 9 Distribution of study patients according to their Left Ventricular Internal Dimension in systole (LVIDs).

Table 10 Distribution of study patients according to their ventricular function.

Sr. No.	Ventricular Function	No. of Patients n(%)
1	Good Left Ventricular Function	19(27.9)
2	Mild Left Ventricular Dysfunction	6(8.8)
3	Moderate Left Ventricular Dysfunction	18(26.5)
4	Severe Left Ventricular Dysfunction	25(36.8)
Total		**68(100)**

Distribution of study patients according to their ventricular function: Amongst all 100% (n=68) of study patients, 27.9% (n=19) patients had good left ventricular function and 8.8% (n=6), 26.5% (n=18), 36.8% (n=25) patients had mild, moderate and severe left ventricular dysfunction respectively. (**Table 10) (Figure 10)**

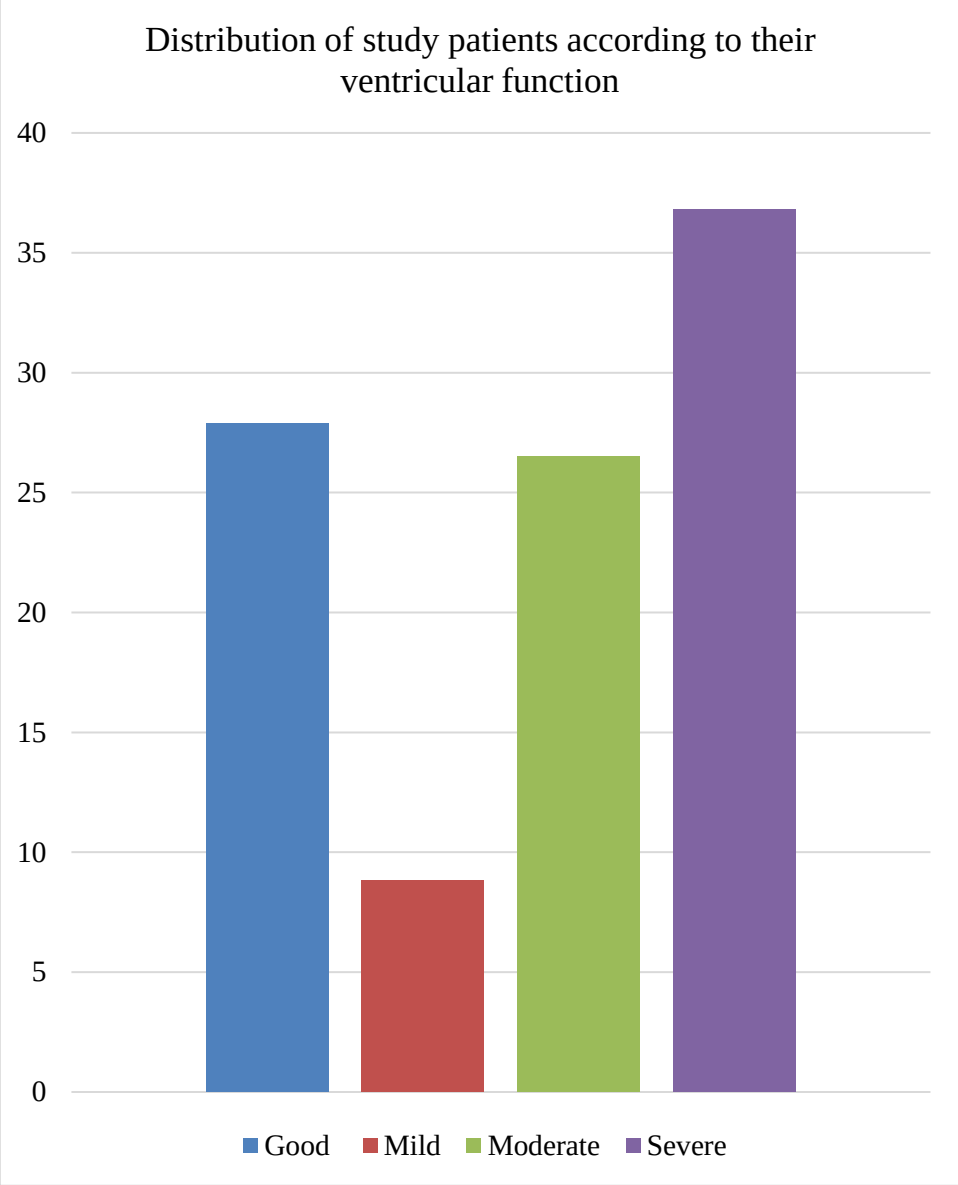

Figure 10 Distribution of study patients according to their ventricular function.

Table 11 Distribution of study patients according to their Regional Wall Motion Abnormality (RWMA).

Sr. No.	RWMA	Pre-Operative	3 Months Follow up	After 1 Year Follow up	At 10 Year Follow up
1	Normal	29(42.6)	42(72.5)	50(86.4)	53(93)
2	Antero-Superior	0	0	1(1.7)	3(5.25)
3	Antero-Lateral	0	2(3.4)	0	0
4	Postero-Inferior	6(8.8)	2(3.4)	1(1.7)	1(1.75)
5	PI/PL	6(8.8)	3(5.2)	2(3.4)	0
6	AS/PI	5(7.4)	2(3.4)	2(3.4)	0
7	AS/PL	6(8.8)	3(5.2)	1(1.7)	0
8	AL/PL	6(8.8)	3(5.2)	1(1.7)	0
9	PI/PL/AL	4(5.9)	0	0	0
10	AS/AL/PL	5(7.4)	1(1.7)	0	0
11	AS/AL/PI	1(1.5)	0	0	0
Total		**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their Regional Wall Motion Abnormality (RWMA): The distribution of study patients according to their Regional Wall Motion Abnormality (RWMA) provides valuable information about the prevalence and location of wall distribution of RWMA in patients at different time points: pre-operative, 3 months follow-up, 1-year follow-up, and 10-year follow-up. The results reveal that the majority of patients had normal wall motion without any abnormalities. Before surgery, 42.6% (n=29) of patients had normal wall motion. This percentage increased to 72.5% (n=42) at the 3-

month follow-up, 86.4% (n=50) at the 1- year follow-up, and 93% (n=53) at the 10-year follow-up. These findings indicate an improvement in wall motion abnormalities over time following cardiac surgery.

Among the specific types of RWMA, Antero-Superior RWMA was observed in 1.7% (n=1) of patients at the 1-year follow-up and increased to 5.25% (n=3) at the 10-year follow-up. Antero-Lateral RWMA was detected in 3.4% (n=2) of patients at the 1-year follow-up examination. Postero-Inferior RWMA was present in 8.8% (n=6) of patients before surgery, and a smaller percentage of patients had PI RWMA at the follow-up examinations: 3.4% (n=2) at 3 months, 1.7% (n=1) at 1 year, and 1.75% (n=1) at 10 years.

Postero-Inferior/Postero-Lateral (PI/PL) RWMA was found in 8.8% (n=6) of patients before surgery, decreasing to 5.2% (n=3) at the 3-month follow-up and 3.4% (n=2) at the 1-year follow-up. Antero-Superior/Postero-Inferior (AS/PI) RWMA was observed in 7.4% (n=5) of patients before surgery, with a similar percentage detected at the follow-up examinations. Other combinations of RWMA were also present in a smaller proportion of patients, such as Antero-Superior/Antero-Lateral/Postero-Lateral (AS/AL/PL) and Antero-Superior/Antero-Lateral/Postero-Inferior (AS/AL/PI), each accounting for less than 2% of patients. (**Table 11) (Figure 11)**

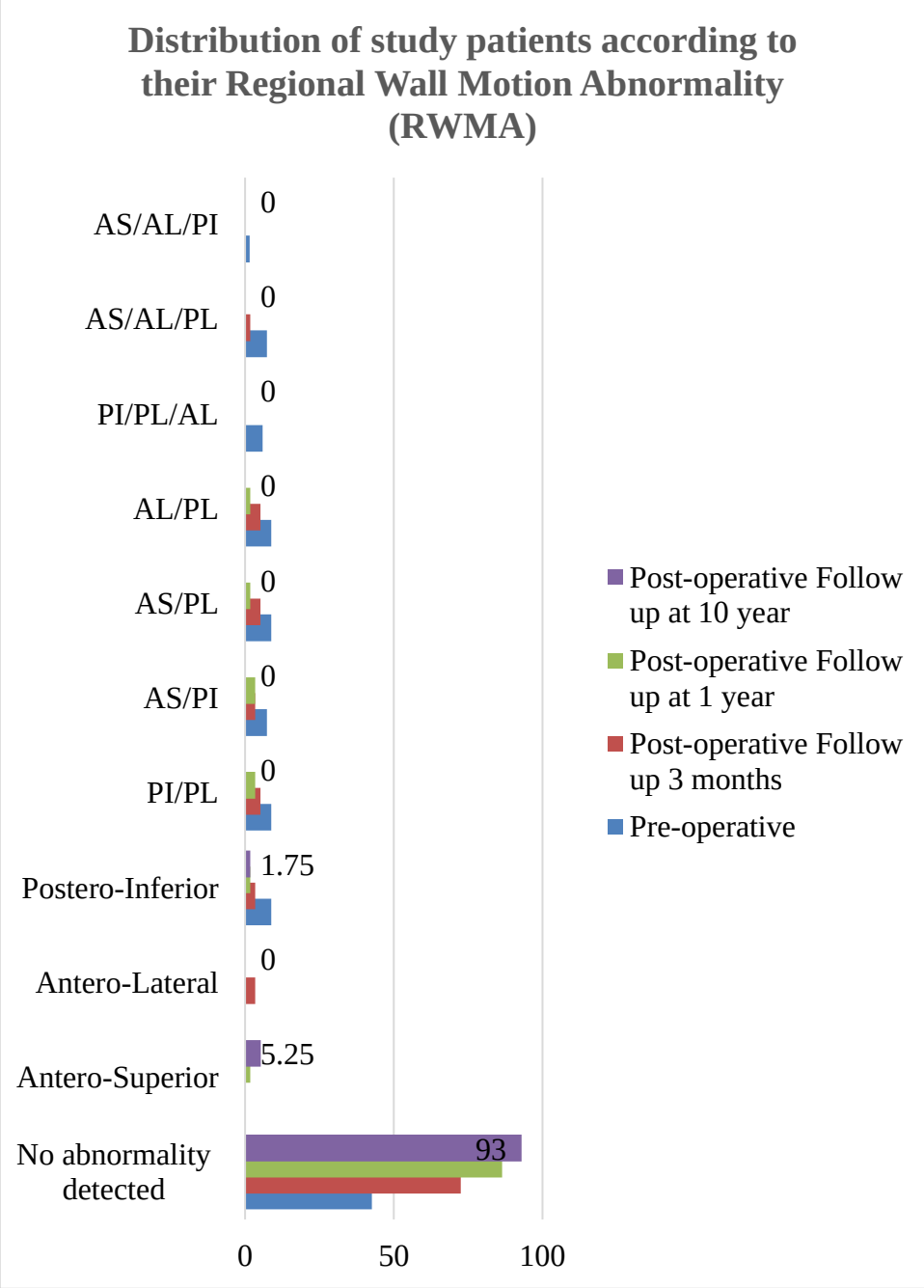

Figure 11 Distribution of study patients according to their Regional Wall Motion Abnormality (RWMA).

Table 12 Distribution of study patients according to their ECG

Sr. No.	MR	Pre-Operative	After 3 months follow up	After 1 year follow up	At 10 years follow up
1	Sinus	68(100)	57(56.5)	58(100)	57(100)
2	AF+CVR	0	1(1.5)	0	0
Total		**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their ECG: Amongst all 100% (n=68) all the patients had sinus in ECG in pre-operative and post- operative follow up. Only a single patient that is 1.5% (n=1) had AF+CVR after 3 months follow up. (**Table 12) (Figure 12)**

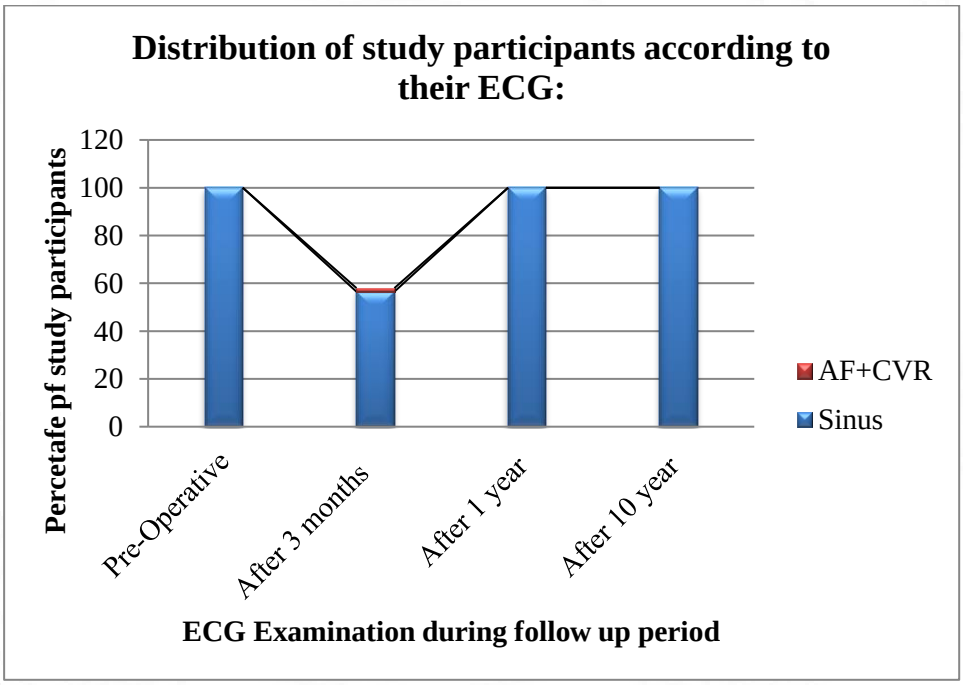

Figure 12 Distribution of study patients according to their ECG

Table 13 Distribution of study patients according to their MR

Sr. No.	MR	Pre-Operative	Intra-operative	Post-operative	After 3 months follow up	After 1 year follow up	At 10 years follow up
1	Nil	0	0	6(9)	7(12)	34(58.5)	51(89.5)
2	1+	3(4.5)	3(4.5)	36(53)	37(64)	20(34.5)	4(7)
3	2+	31(45.5)	33(48.5)	22(32)	13(22.3)	4(7)	2(3.5)
4	3+	17(25)	15(22)	2(3)	0	0	0
5	4+	16(23.5)	16(23.5)	0	0	0	0
Total		**68(100)**	**68(100)**	**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their MR: The distribution of study patients according to their Mitral Regurgitation (MR) provides important information on the severity and changes in MR among patients undergoing cardiac surgery. Table 13 presents the distribution of MR at different time points: pre-operative, intra-operative, immediate post-operative, 3 months follow-up, 1 year follow-up, and 10-year follow-up. The findings reveal that a significant number of patients had 2+ MR, indicating moderate

regurgitation. Pre-operatively, 47% (n=32) of patients exhibited 2+ MR, which remained consistent during the intra-operative examination with 50% (n=34) of patients. The prevalence of 2+ MR decreased to 35% (n=24) immediately after the surgery, 24% (n=14) at the 1-year follow-up, and 7% (n=4) at the 10-year follow-up. These results suggest an improvement in MR severity over time following cardiac surgery.

Moderate MR (1+) was observed in a smaller proportion of patients, with 4.5% (n=3) detected pre-operatively and during the intra-operative examination. The prevalence of 1+ MR increased to 53% (n=36) at the immediate postoperative follow-up, then decreased to 37% (n=64) at the 3-month follow-up, 34.5% (n=20) at the 1-year follow-up, and 7% (n=4) at the 10-year follow-up.

Patients with severe MR (3+ and 4+) were less common in the study cohort. Preoperatively, 25% (n=17) of patients had 3+ MR, while 22% (n=15) had 3+ MR during the intraoperative examination. However, only two patients (3%) had 3+ MR at the 3-month follow-up, and no patients had 3+ or 4+ MR at the 1-year and 10-year follow-ups.

Additionally, 23.5% (n=16) of patients exhibited 4+ MR both pre-operatively and during the intra-operative examination. However, no patients showed 4+ MR at the follow-up assessments.

At the long-term follow-ups, a significant number of patients showed no MR. At the 10-year follow-up, 89.5% (n=51) of patients had no MR, while 58.5% (n=34) and 12% (n=7) had no MR at the 1-year and 3-month follow-ups, respectively. Immediately after the surgery, 9% (n=6) of patients had no MR. (**Table 13) (Figure 13)**

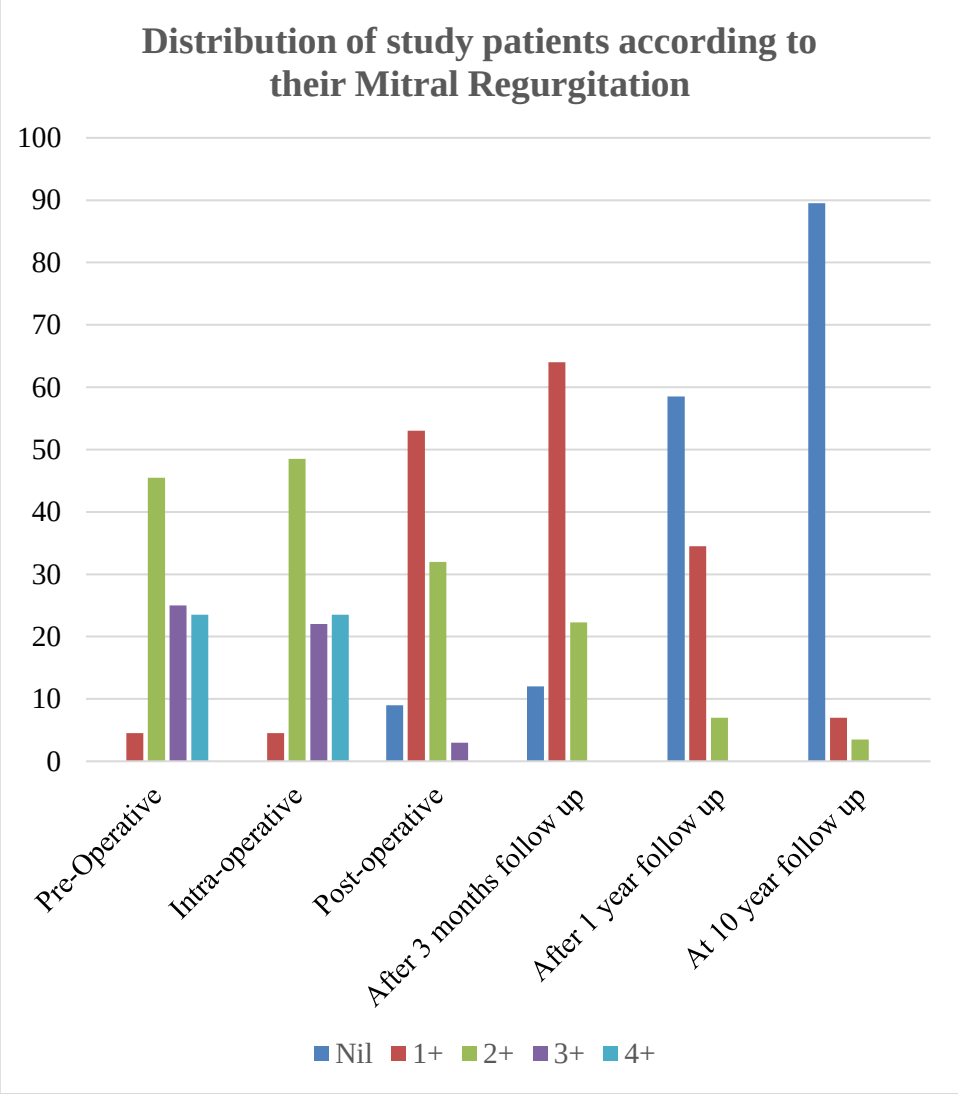

Figure 13 Distribution of study patients according to their Mitral Regurgitation

Table 14 Distribution of study patients according to their total CPB time.

Sr. No.	Total time of CPB	No. of Patients (n)%	Mean CPB	Standard Deviation
1.	90-150	39(57.36)	**143.26**	**±28.935**
2.	160-189	29(42.64)		
Total		**68(100)**		

Distribution of study patients according to their total CPB time: Amongst all 100% (n=68), 57.36% (n=39) of study patients had total CPB time within 90-150 minutes which is 1.5-2.5 hours. 42.24% (n=29) patients had total CPB time within 160-159 minutes which is 2.5-3.15 hours. And the mean CPB time was 143.26 min ±28.93min, with the standard deviation. **(Table 13) (Figure 13)**

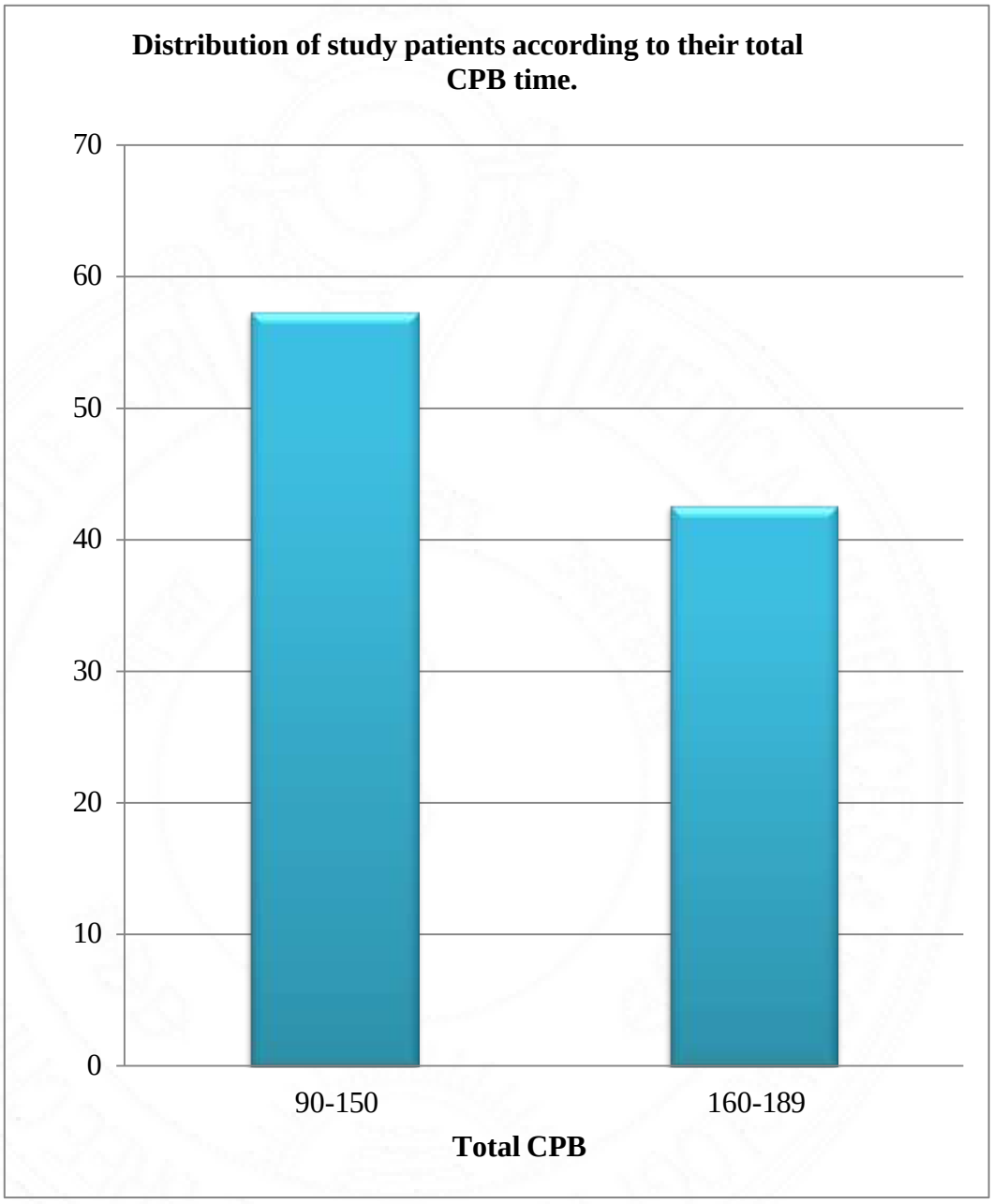

Figure 14 Distribution of study patients according to their total CPB time.

Table 15 Distribution of study patients according to their required number of grafts.

Sr. No.	Number of Grafts	No. of Patients n(%)
1	2 Grafts	13(19.1)
2	3 Grafts	29(42.6)
3	4 Grafts	20(29.5)
4	5 Grafts	6(8.8)
Total		**68(100)**

Distribution of study patients according to their required number of grafts.:

Amongst all 100% (n=68) of patients, 42.6% patients required 3 grafts. 29.5% (n=20) patients required 4 grafts. 19.1% patients required 2 grafts. Few patients 8.8% (n=6) required 5 grafts. (**Table 15) (Figure 15)**

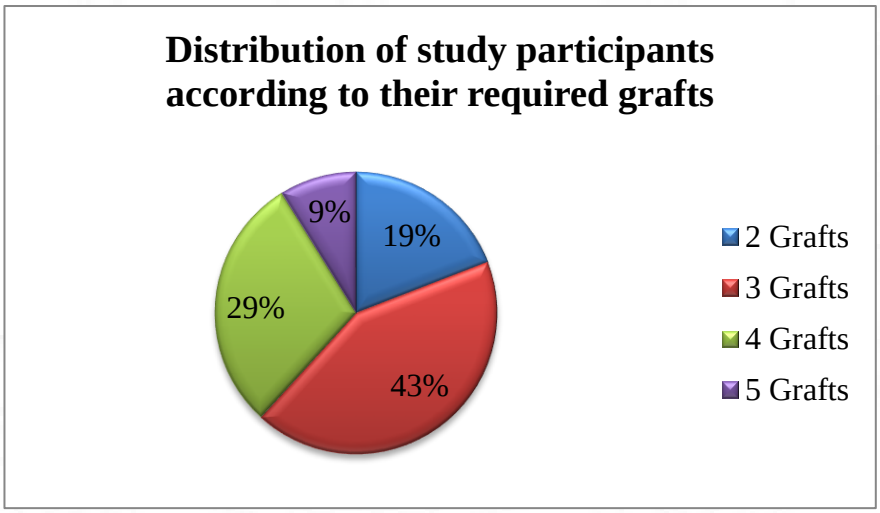

Figure 15 Distribution of study patients according to their required number of grafts.

Table 16 Distribution of study patients according to their type of surgery.

Sr. No.	Symptoms	No. of Patients n(%)
1	Elective	66(97.1)
2	Emergency	2(2.9)
Total		**68(100)**

Distribution of study patients according to their type of surgery. Amongst all 100% (n=68) of the study patients, maximum 97.1 % (n=66) patients underwent surgery in Elective condition and only 2.9% (n=2) patients underwent Emergency surgery. (**Table 16)** **(Figure 16)**

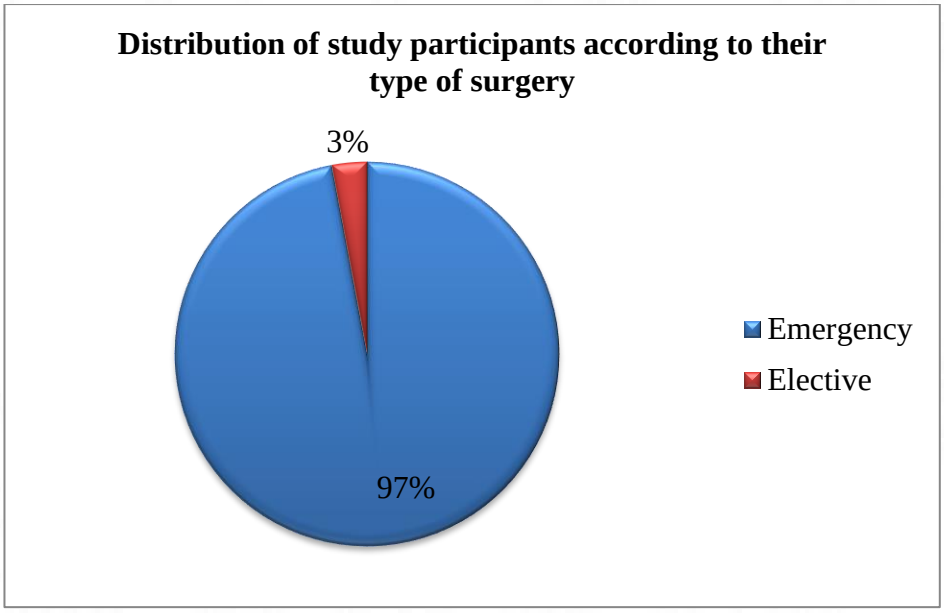

Figure 16 Distribution of study patients according to their type of surgery.

Table 17 Distribution of the study patients according to LMCA disease.

Sr. No.	LMCA disease	Pre-operative	After 3 months follow up	After 1 year follow up	At 10 years follow up
1	No	18(26.5)	58(100)	57(98.3)	57(100)
2	Yes	50(73.5)	0	1(1.7)	0
Total		**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of the study patients according to LMCA disease: Amongst all 100% (n=68) of the study patients, 73.5% (n=50) patients had LMCA disease before the surgery and no one had LMCA disease in 3 months follow up after the surgery. 1 patient developed LMCA disease after 1 year follow up and at 10 year all the patients were free from LMCA disease. (**Table 17) (Figure 17)**

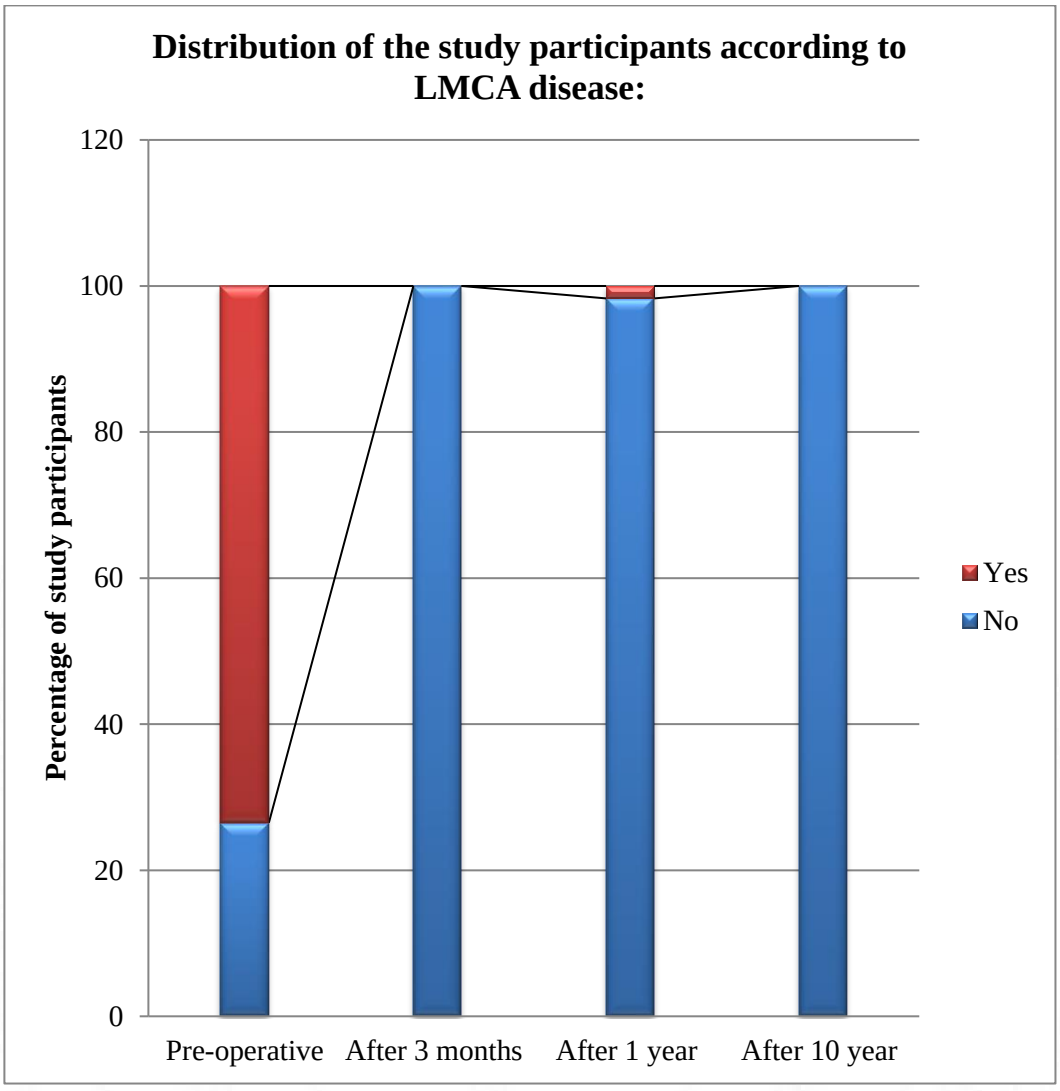

Figure 17 Distribution of the study patients according to LMCA disease.

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Table 18 Distribution of study patients according to their Coronary Artery Bypass Graft (CABG) CABG+MV Repair/ CABG+MV Replacement.

Sr. No.	CABG/ CABG+MV Repl/ CABG+MV Repl	No. of Patients n(%)
1	CABG	34(50)
2	CABG+MV Rep	16(23.5)
3	CABG+MV Repl	18(26.5)
Total		**68(100)**

Distribution of study patients according to their Coronary Artery Bypass Graft (CABG) CABG+MV Repair/ CABG+MV Replacement. Amongst all 100% (n=68) of the study patients, 50% (n=34) of the patients underwent CABG. 23.5% (n=16) patients underwent CABG along with mitral valve repair and 26.5% (n=18) patients underwent CABG with Mitral valve replacement. (**Table 18) (Figure 18)**

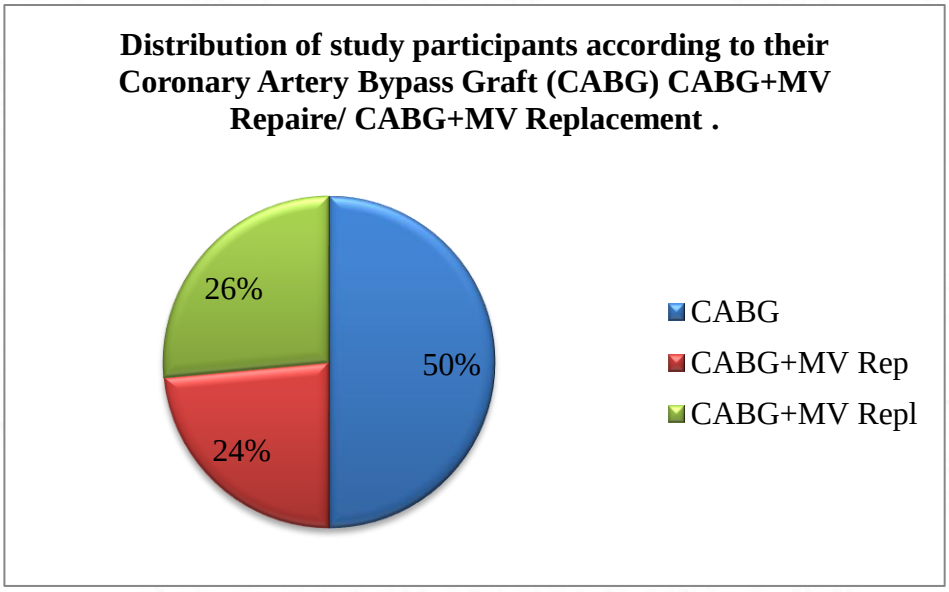

Figure 18 Distribution of study patients according to their Coronary Artery Bypass Graft (CABG) CABG+MV Repair/ CABG+MV Replacement.

Table 19 Distribution of study patients according to their post-operative complications.

Sr. No.	Post-operative Complications	No. of Patients n(%)
1	Second Surgery	0(0)
2	Myocardial Infraction	0(0)
3	Angioplasty/PCI	0(0)
4	Respiratory Failure	12(17.6)
5	Cerebrovascular Event	8(11.8)
6	Renal Failure	10(14.7)
8	Arrhythmias	14(20.6)
Total		**57(100)**

Distribution of study patients according to their post-operative complications: Amongst all alive patients, 20.6% (n=14) patients developed arrhythmias followed them 17.6% (n=12) patients developed respiratory failure, 14.7% (n=10) patients had consequences of renal failure and few patients 11.8% (n=8) patients experienced cerebrovascular event after the surgery. (**Table 19) (Figure 19)**

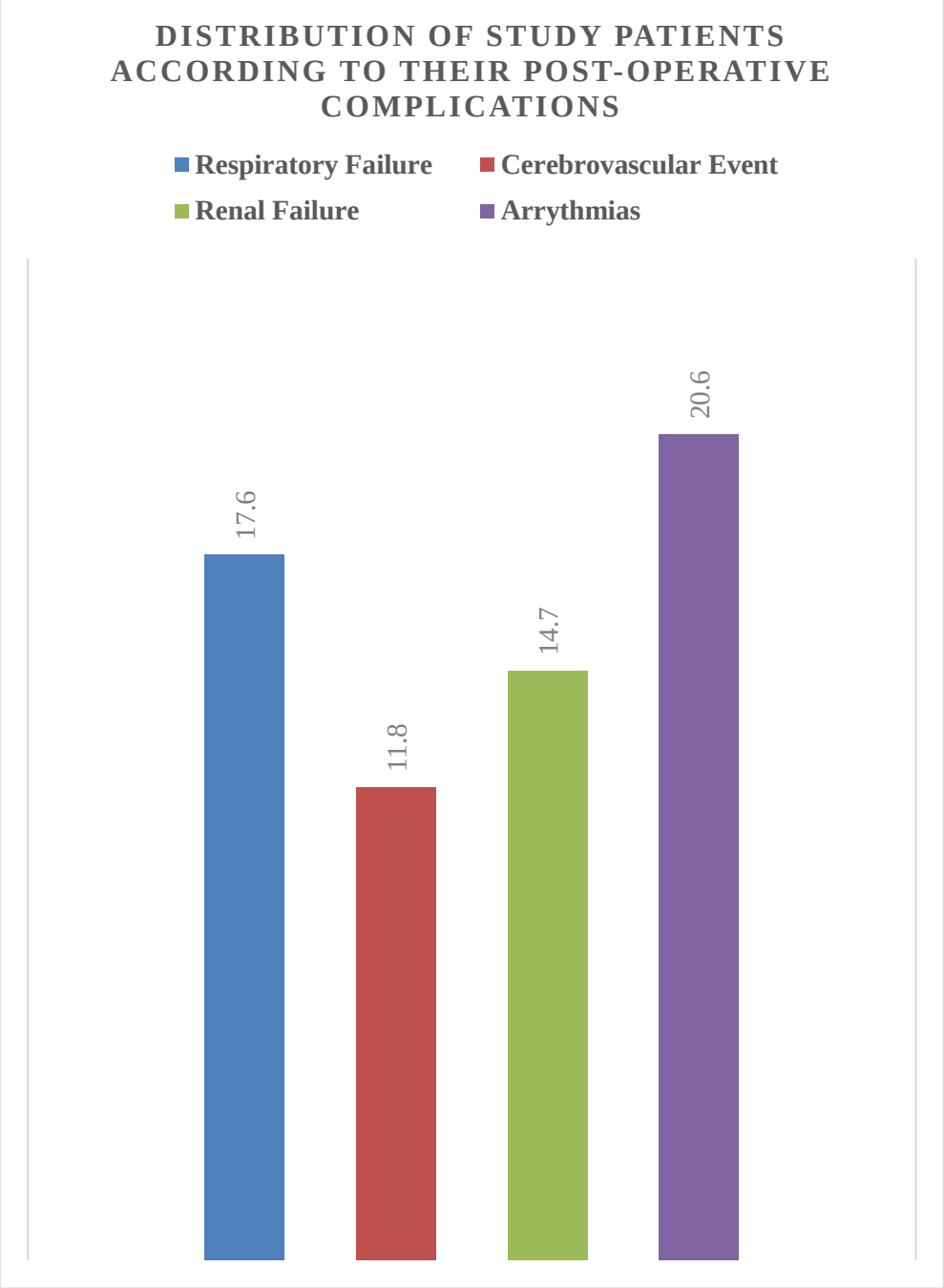

Figure 19 Distribution of study patients according to their post-operative complications.

Table 20 Distribution of study patients according to their hospital stay after the surgery.

Sr. No.	Hospital Stay up to	No. of Patients n(%)	Mean Days	Standard Deviation
1.	1 week	54(79.5)	**8**	**±6**
2.	2 weeks	8(11.76)		
3.	3 weeks	5(7.35)		
4.	1 month	3(4.4)		
Total		**68(100)**		

Distribution of study patients according to their hospital stay after the surgery: Amongst all the patients a maximum number of patients had a hospital stay near about 1 week followed by 11.76% (n=8), 7.35% (n=5) and 4.4% (n=3) patients had a hospital stay of approximately 2 weeks, 3 weeks and 1 month respectively. (**Table 20) (Figure 20)**

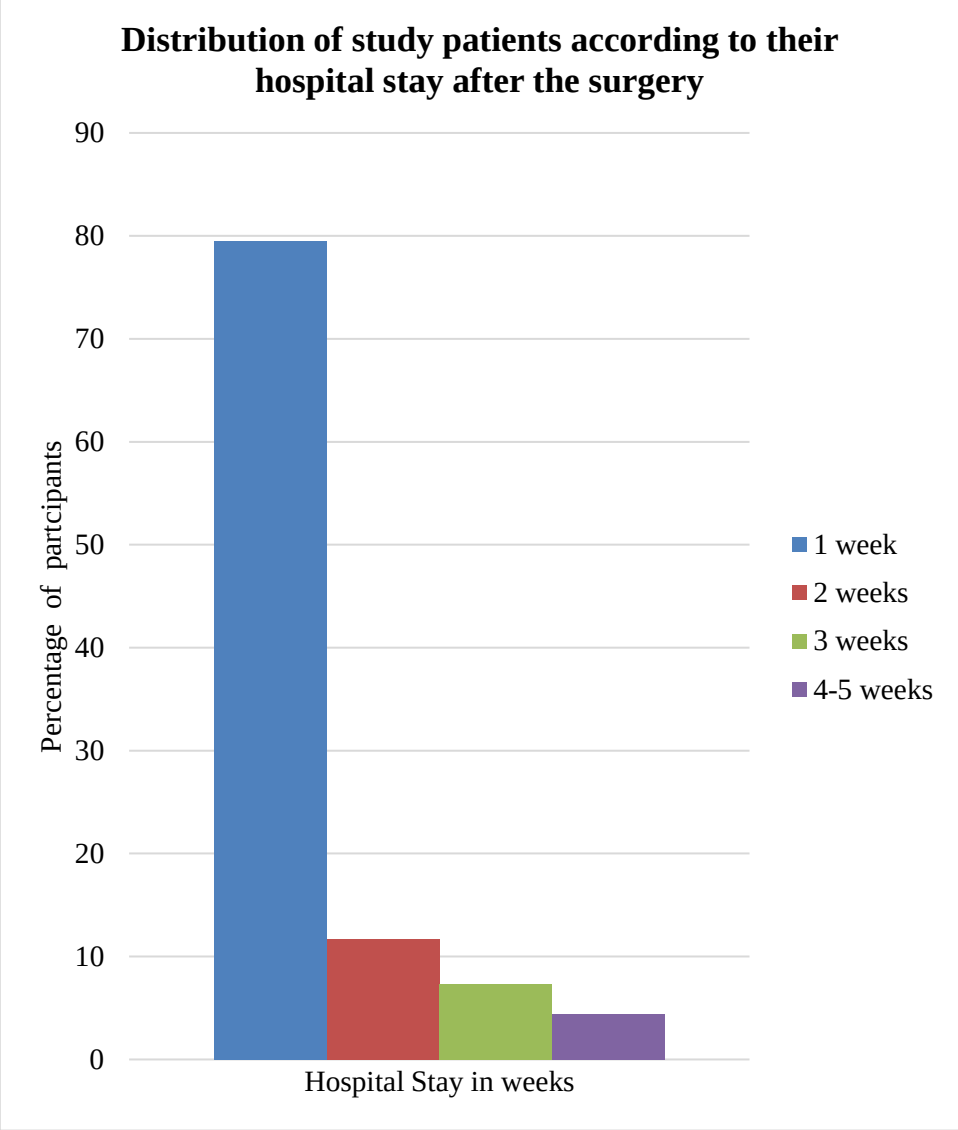

Figure 20 Distribution of study patients according to their hospital stay after the surgery.

Table 21 Distribution of study patients according to their Pulmonary Artery Hypertension.

Sr.No.	Pulmonary Artery Hypertension	After 3 Months Follow up	Ater 1 Year Follow up	At 10 Years Follow up
1.	No	32(55)	40(69)	53(93)
2.	Mild	11(19)	14(24)	3(4)
3.	Mod	15(26)	4(7)	2(3)
Total Patients		**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their Pulmonary Artery Hypertension: Amongst all the patients near about half patients had normal PAH followed by severe PAH in 26% (n=15) of patients and 19 % (n=11) showed mild PAH. After the follow up of 1 year no PAH among 69% (n=40) patients. PAH decreased to mild and moderate in 24% (n=14) and 7% (n=4) patients respectively. **(Table 21) (Figure 21)**

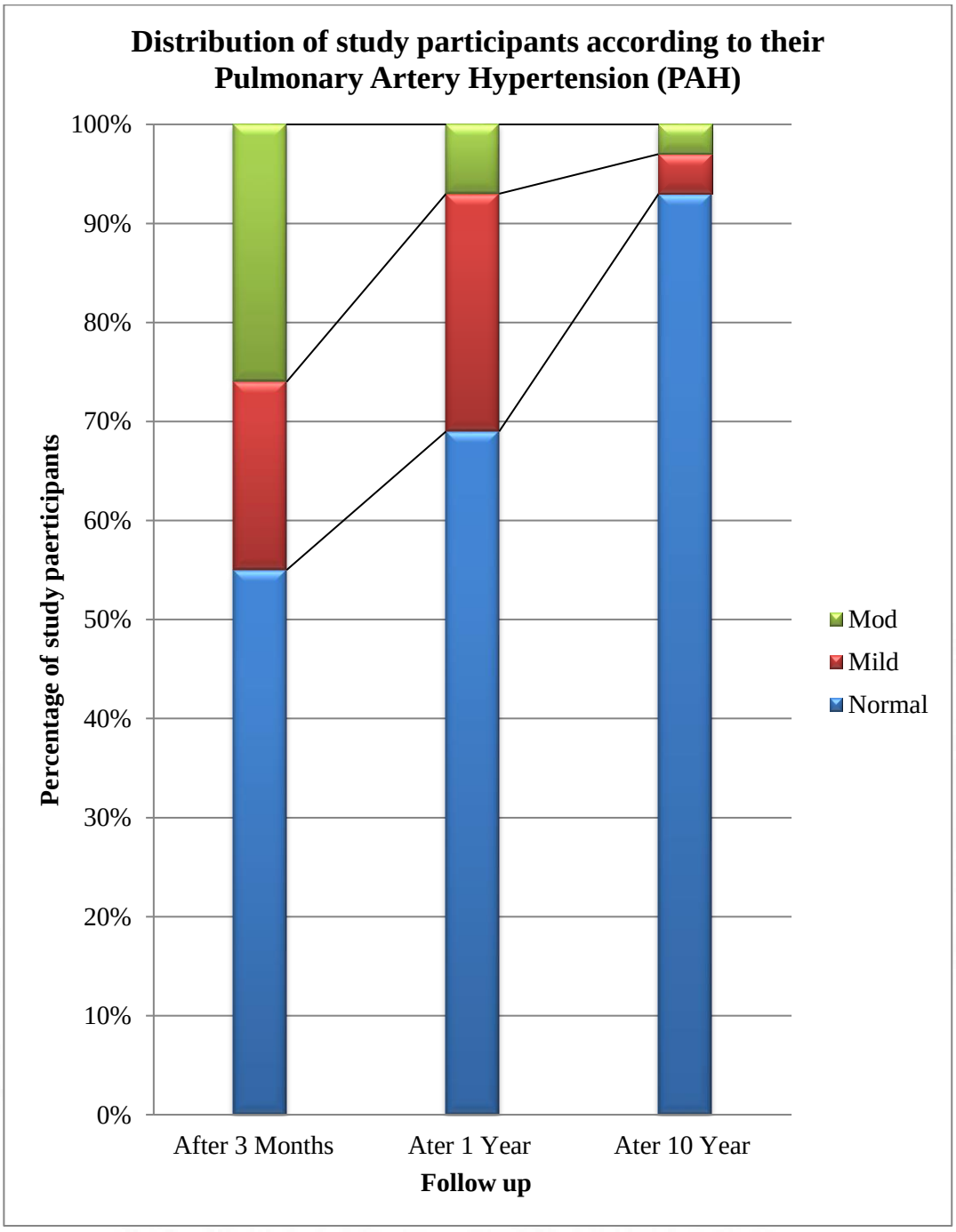

Figure 21 Distribution of study patients according to their Pulmonary Artery Hypertension.

Table 22 Distribution of study patients according to their preformation of re-do-surgery.

Sr.No.	Re-do-surgery	Post-operative	After 3 Months Follow up	After 1 Year Follow up	At 10 Year Follow up
1.	Not performed	57(98.3)	58(100)	58(100)	55(96.5)
2.	Mitral Valve Replacement	1(1.7)	0	0	2(3.5)
Total Patients		**58(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their preformation of re-do-surgery: Amongst all the study patients only 1.7% (n=1) patient required Mitral valve replacement as re-do-surgery immediately after surgery. None patients required re-surgery till 3 months and 1 year follow up and 3.5% (n=2) patients required mitral valve replacement surgery at 10 years follow up. (**Table 22) (Figure 22)**

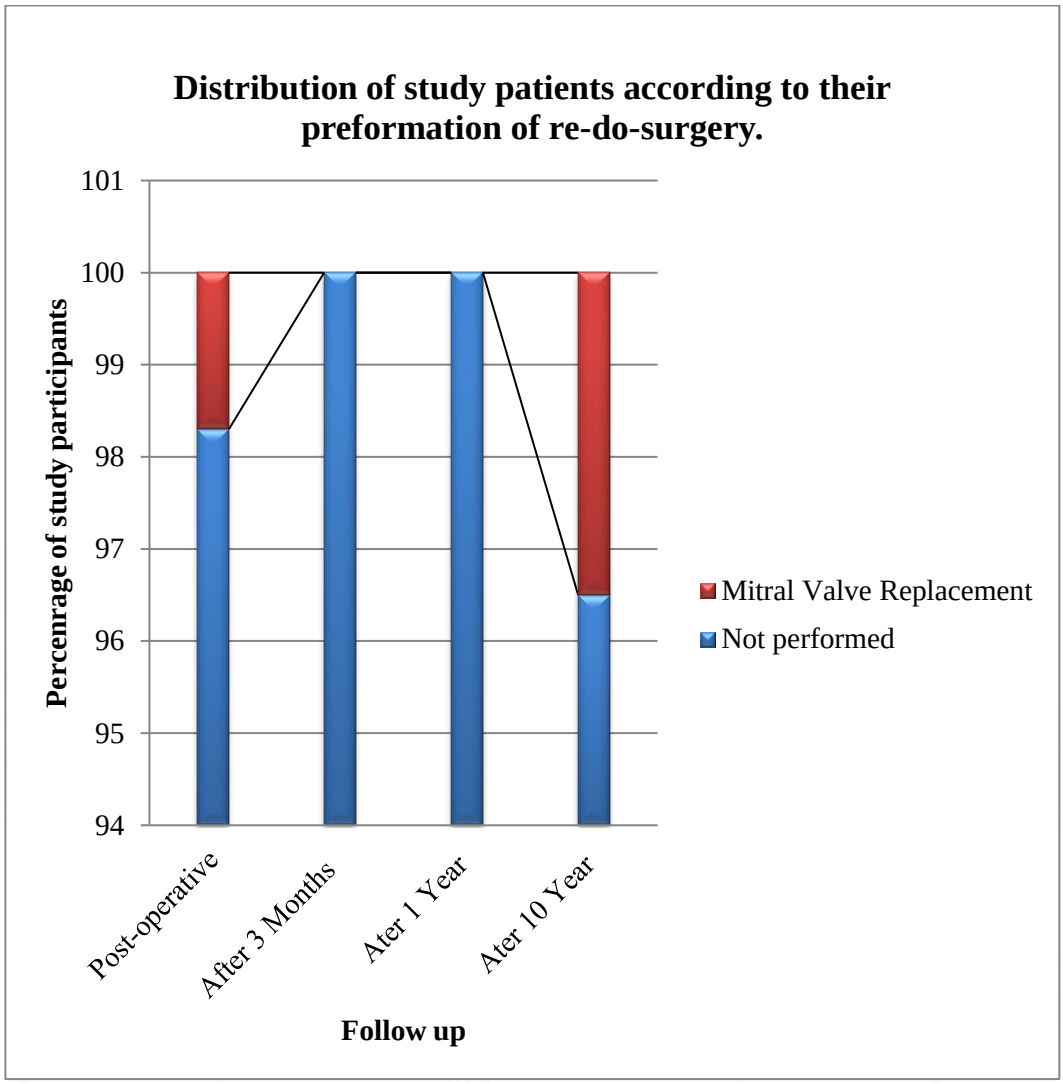

Figure 22 Distribution of study patients according to their Redo surgery.

Table 23 Distribution of study patients according to their survival status.

Sr. No.	Mortality	No. of Patients n(%)	After 3 Months follow up	After 1 year follow up	At 10 years follow up
1	Yes	10(14.7)	0	0	1(1.5)
2	No	58(85.3)	58(100)	58(100)	57(100)
Total		**68(100)**	**58(100)**	**58(100)**	**57(100)**

Distribution of study patients according to their survival status: Amongst all, few patients that is 14.7% (n=10) had mortality till the 3 months follow up after the surgery, 1.5% (n=1) patient had mortality after 5 years of surgery. 85.3%(n=58) was the survival rate of patient by the 3months and 1 year follow up after the surgery. (**Table 23) (Figure 23)**

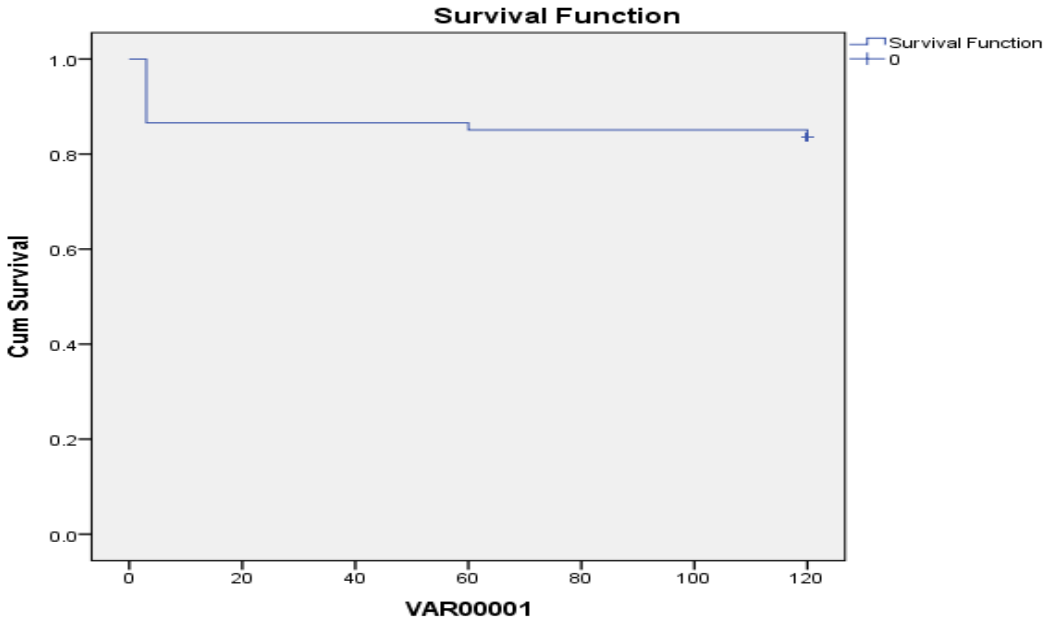

Figure 23 Distribution of study patients according to their survival status.

Table 24 Comparative distribution of study patients according to their MR status in pre- operative examination and post-operative follow-up of 3 months, 1 year and 10 years.

Sr No.	SURGERY	MR status	Pre-op	3Month	1 Year	10 years
1	CABG only	Normal	0 (0)	7 (21.8)	20 (62.5)	29 (90.6)
		plus, one	4 (11.8)	14 (43.8)	10 (31.3)	2 (6.3)
		plus, two	30 (88.2)	11 (34.4)	2 (6.2)	1 (3.1)
		Plus, three	0 (0)	0 (0)	0 (0)	0 (0)
		Plus, four	0 (0)	0 (0)	0 (0)	0 (0)
2	CABG+MVR	Normal	0 (0)	0	5 (45.5)	8 (72.7)
		plus, one	0 (0)	9 (81.8)	4 (36.4)	1 (9.1)
		plus, two	1 (6.3)	2 (18.2)	2 (18.1)	2 (18.2)
		plus, three	14 (87.4)	0 (0)	0 (0)	0 (0)
		plus, four	1 (6.3)	0 (0)	0 (0)	0 (0)
3	CABG+MVr	Normal	0 (0)	0 (0)	9 (60.0)	14 (93.3)
		plus, one	0 (0)	15(100.0)	6 (40.0)	1 (6.7)
		plus, two	0 (0)	0 (0)	0 (0)	0 (0)
		Plus, three	3 (16.7)	0 (0)	0 (0)	0 (0)
		Plus, four	15 (83.3)	0 (0)	0 (0)	0 (0)

Comparative distribution of study patients according to their MR status in pre-operative examination and post-operative follow-up of 3 months, 1 year and 10 years: 90.6% (n=29) of patients that underwent CABG-only surgery had normal MR status after 10 years from the baseline of 0. Of those patients that underwent CABG with Mitral Valve Replacement 72.7%(n=8) of patients had normal MR status than the baseline 0 on the follow-up of 10 years. Those patients who underwent CABG with Mitral valve repair surgery had improved MR status by about 93.30% (n=14) of a patient from the baseline of 0 after the 10-year follow-up. **(Table 24) (Figure 24)**

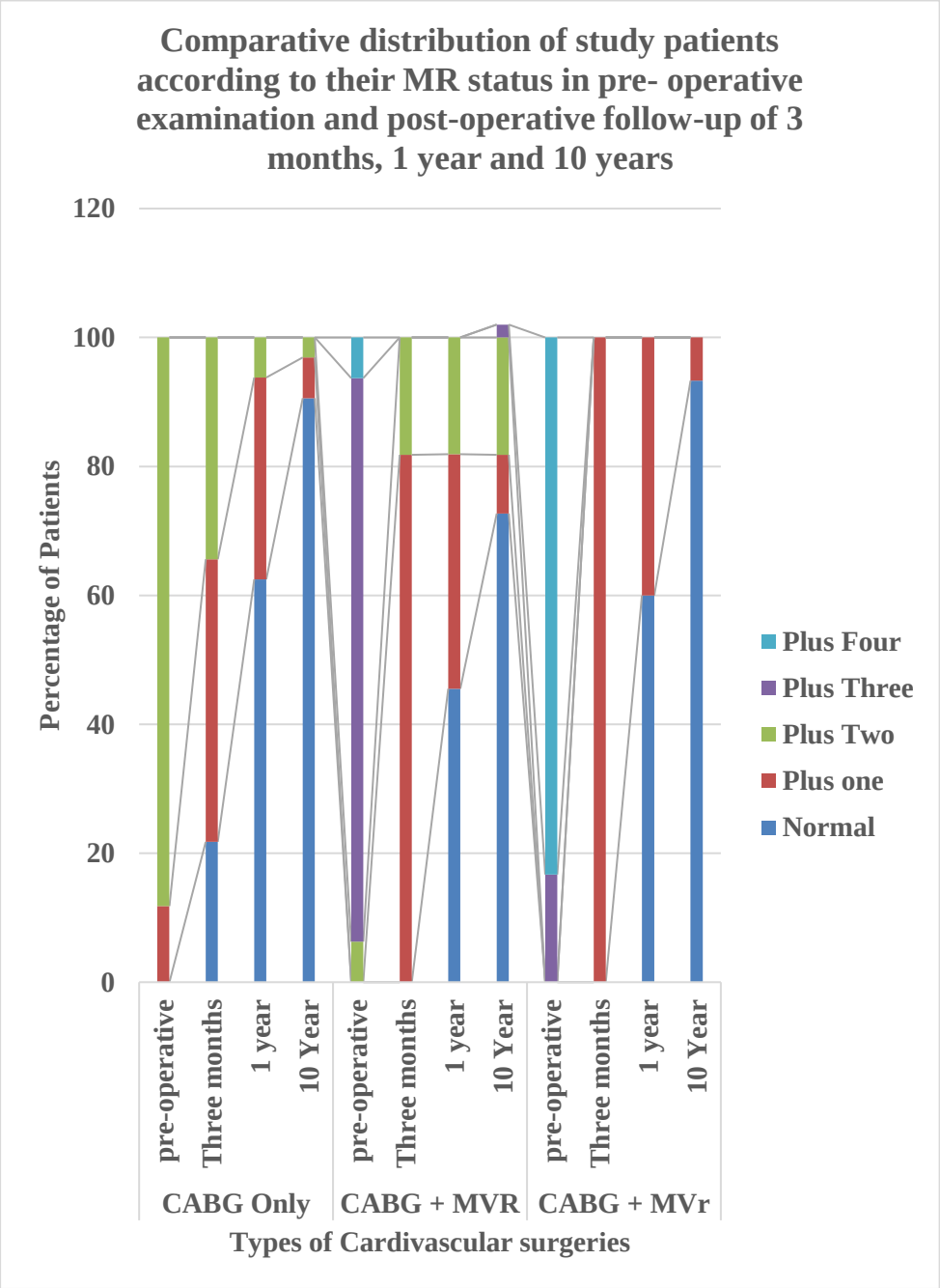

Figure 24 Comparative distribution of study patients according to their MR status in pre- operative examination and post-operative follow-up of 3 months, 1 year and 10 years.

Table 25 Comparative distribution of study patients according to their NYHA functional class in pre-operative examination and post-operative follow up of 3 months, 1 year and 10 years.

Sr No.	SURGERY	MR status	Pre-op	3Month	1 Year	10 years
1	CABG only	Class 1	1 (2.9)	26 (81.3)	29 (90.6)	30 (96.7)
		Class 2	27 (79.4)	6 (18.8)	3 (8.8)	1 (3.3)
		Class 3	5 (14.7)	0 (0)	0 (0)	0 (0)
		Class 4	1 (2.9)	0 (0)	0 (0)	0 (0)
2	CABG+MVR	Class 1	0 (0)	3 (8.8)	7 (63.6)	9 (81.1)
		Class 2	2 (12.5)	8 (23.5)	4 (36.4)	2 (18.2)
		Class 3	14 (62.5)	0 (0)	0 (0)	0 (0)
		Class 4	4 (25)	0 (0)	0 (0)	0 (0)
3	CABG+MVr	Class 1	0(0)	11(73.3)	14 (93.3)	14 (93.3)
		Class 2	1(5.6)	4 (26.7)	1 (6.7)	1 (6.7)
		Class 3	15(83.5)	0 (0)	0 (0)	0 (0)
		Class 4	1 (11.1)	0 (0)	0 (0)	0 (0)

Comparative distribution of study patients according to their NYHA functional class in pre-operative examination and post-operative follow up of 3 months, 1 year and 10 years: 96.7% (n=30) patients that underwent CABG only surgery had improved functional class I after 10 years from the baseline of 2.9% (n=1) Those patients that underwent CABG with Mitral Valve Replacement, 81.1 % (n=9) patients improved functional class I after 10 years from the baseline 0.

Those patients underwent CABG with Mitral valve repair surgery had improved functional class I status and 93.3% (n=14) of a patient from the baseline of 5.6% (n=1) patients. (**Table 25) (Figure 25)**

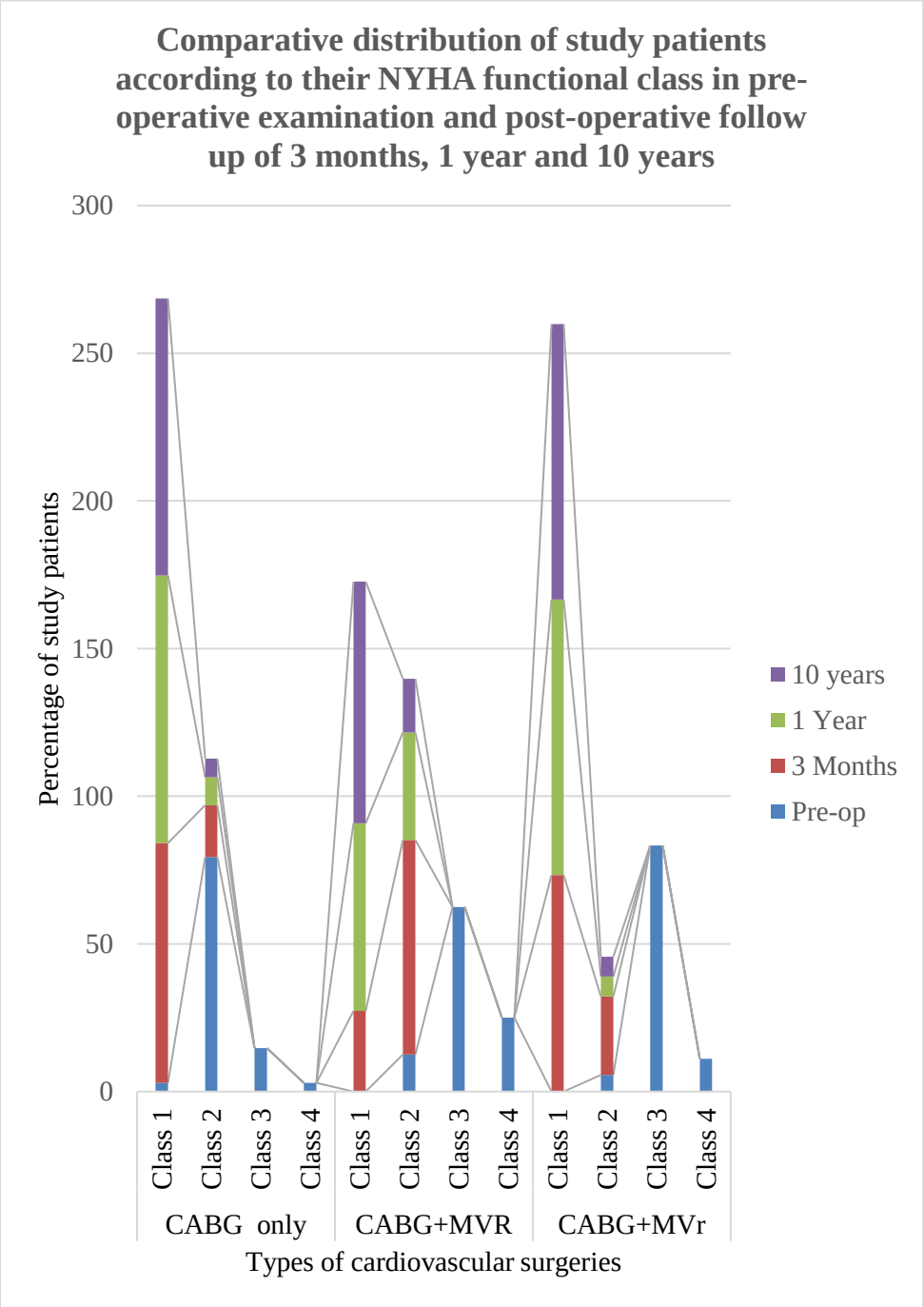

Figure 25 Comparative distribution of study patients according to their NYHA functional class in pre-operative examination and post-operative follow up of 3 months, 1 year and 10 years.

Table 26 Comparative distribution of study patients according to their symptomatic and asymptomatic in pre-operative examination and postoperative follow-up of 3 months, 1 year and 10 years.

Sr No.	SURGERY	Symptoms Status	Pre-op	3Month	1 Year	10 years
1	CABG only	Asymptomatic	25 (73.5)	32 (100.0)	32 (100.0)	31 (100.0)
		Symptomatic	9 (26.5)	0 (0)	0 (0)	0 (0)
2	CABG+MVR	Asymptomatic	1 (6.7)	11 (100.0)	10 (90.9)	11 (100.0)
		Symptomatic	15 (93.8)	0 (0)	1 (9.1)	0 (0)
3	CABG+MVr	Asymptomatic	18 (100.0)	15 (100.0)	15 (100.0)	15 (100.0)
		Symptomatic	0 (0)	0 (0)	0 (0)	0 (0)

Comparative distribution of study patients according to their symptomatic and asymptomatic in pre-operative examination and postoperative follow-up of 3 months, 1 year and 10 years: All 100% of the patients who survived (on pre-operative, 3 months and 1-year examination n=32 and at 1o year n=31) till 10 years after the surgery of CABG only became asymptomatic on the follow-up of 3 months, 1 year and 10-year examination. In CABG Mitral valve replacement surgery all 100% of the patients became asymptomatic after 3 months follow up of where n=11. Only one patient that is 9.1% developed symptoms by the follow-up examination at 1 year.

Later on, an examination of 10-year follow-up that patient became again asymptomatic resulting in all 100% (n=11) patients became asymptomatic after 10 years of follow-up of CABG+MVR. All 100% (n=15) the patients who survived till 10 years after the surgery of CABG with Mitral valve repair became asymptomatic on

the follow-up of 3 months, 1 year and 10-year examinations. **(Table 26) (Figure 26)**

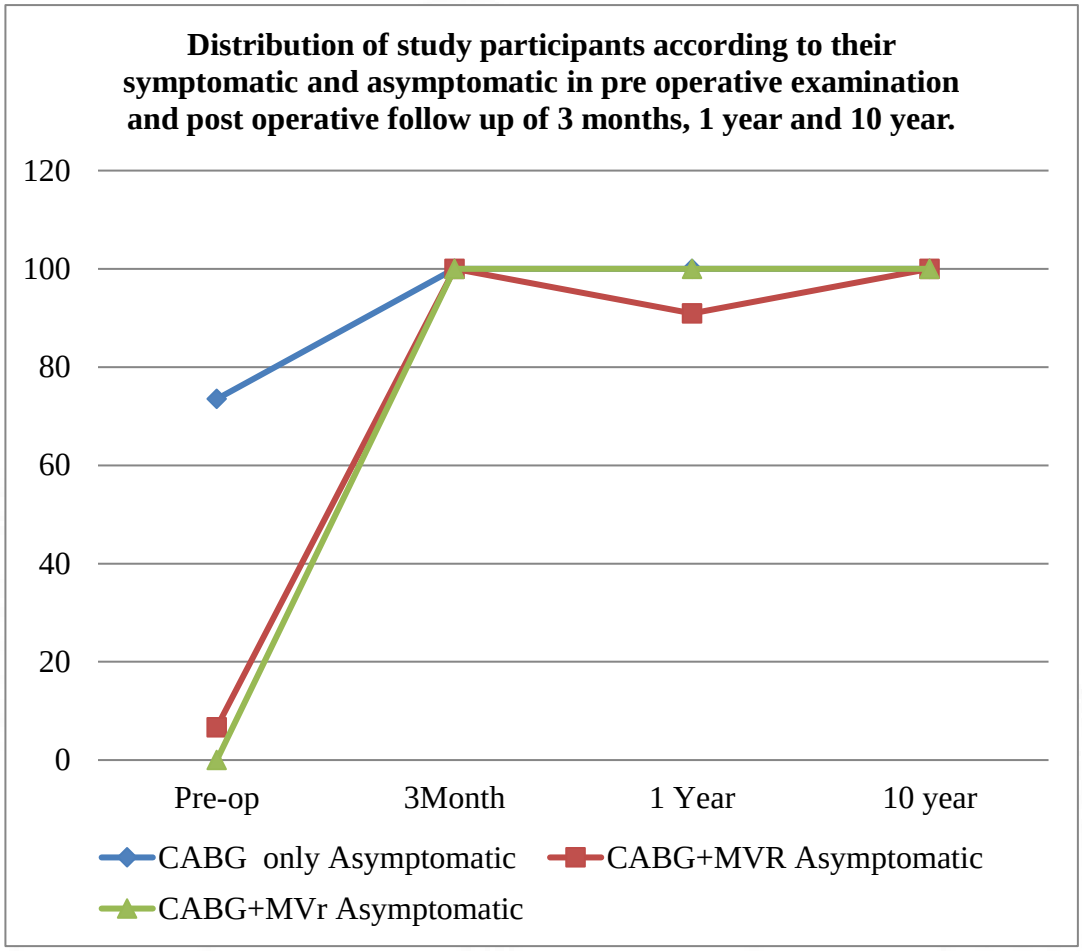

Figure 26 Comparative distribution of study patients according to their symptomatic and asymptomatic in pre-operative examination and postoperative follow-up of 3 months, 1 year and 10 years.

Table 27 Comparative distribution of study patients according to their Re-do-surgery in immediate after surgery examination and post-operative follow up of 3 months, 1 year and 10 years.

Sr No.	SURGERY	Redo Surgery	post op	3Month	1 Year	10 years
1	CABG only	No	32(100)	32 (100.0)	32 (100.0)	31 (100.0)
		Yes	0	0 (0)	0 (0)	0 (0)
2	CABG+MVR	No	11(100)	11 (100.0)	11 (100.0)	11 (100.0)
		Yes	0	0 (0)	0 (0)	0 (0)
3	CABG+MVr	No	14(93.44)	15 (100.0)	15 (100.0)	13 (86.66)
		Yes	1^{R}(6.66)	0 (0)	0 (0)	2^{R} (13.44)
$^{R-}$ Redo surgery for mitral valve replacement						

Comparative distribution of study patients according to their Re-do-surgery in immediate after surgery examination and post-operative follow up of 3 months, 1 year and 10 years: None of the patients who underwent the surgical procedure of CABG only and CABG with mitral valve replacement, required re-do-surgery on all post-operatives follow up examinations.

A single patient that is 6.66% (n=1) underwent CABG Mitral valve replacement re-do-surgery, immediately or before 3 months of CABG +MV repair Surgery. While 13.33% (n=2) underwent CABG+ Mitral valve replacement re-do-surgery, after 1 year or before 10 years of CABG +MV repair Surgery. (**Table 27) (Figure 27)**

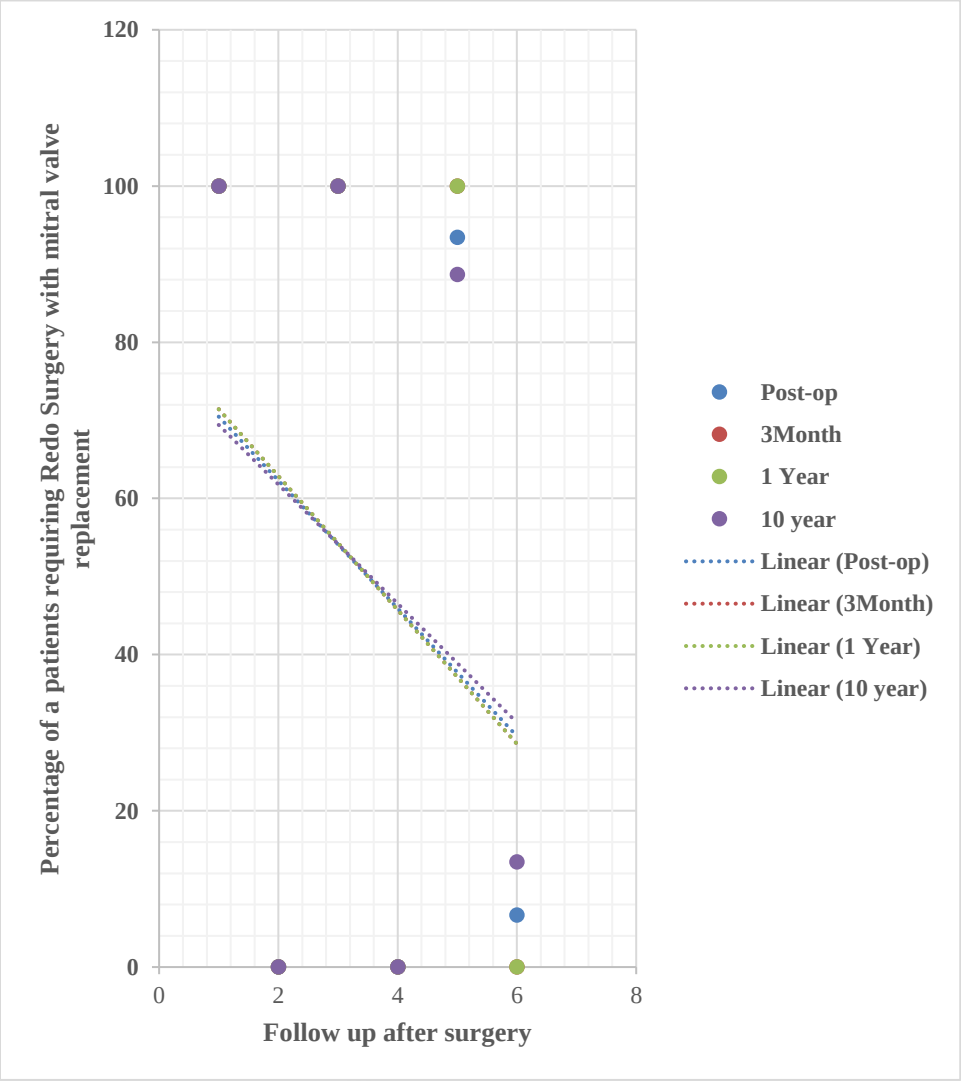

Figure 27 Comparative distribution of study patients according to their Re-do-surgery in immediate after surgery examination and post-operative follow-up of 3 months, 1 year and 10 years

Table 28 Comparative distribution of study patients according to their Complication in immediate after-surgery examination and postoperative follow-up of 3 months, 1 year and 10 years.

Sr No.	SURGERY	Redo Surgery	post op	3Month	1 Year	10 years
1	CABG only	No	32(94.1)	32 (100.0)	32 (100.0)	31 (100.0)
		Yes	2[a](5.9)	0 (0)	0 (0)	1[c] (0)
2	CABG+MVR	No	11(68.7)	11 (100.0)	11 (100.0)	11 (100.0)
		Yes	5[a](31.3)	0 (0)	0 (0)	0 (0)
3	CABG+MVr	No	15(83.3)	14 (93.4)	15 (100.0)	15 (100.0)
		Yes	3[a](18.7)	1[b] (6.6)	0 (0)	0 (0)

[a] LV Failure, b Atrial fibrillation + controlled ventricular rate, [c]CVA- Cerebrovascular Accident.

Comparative distribution of study patients according to their Complication in immediate after-surgery examination and postoperative follow-up of 3 months, 1 year and 10 years: Major postoperative complications occurred immediately after surgery and those all were left ventricle failure. It was observed in 5.9 % (n=2), 31.3% (n=5) and 18.7%(n=3) of the patients in surgery of CABG, CABG+MVR and CABG+MVr respectively. Among those all patients having complications of LV failure did not survive till 3 months follow-up examinations. Only one with the percentage of 3.33 patients who underwent CABG surgery showed a complication of CVA at a 10-year follow-up examination. A patient with 6.6% who underwent CABG+MVr surgery showed complications of AF+CVR on the follow-up after 3 months of examination and that was resolved on the further follow-up examinations of 1 year and 10 years. (**Table 28) (Figure 28).**

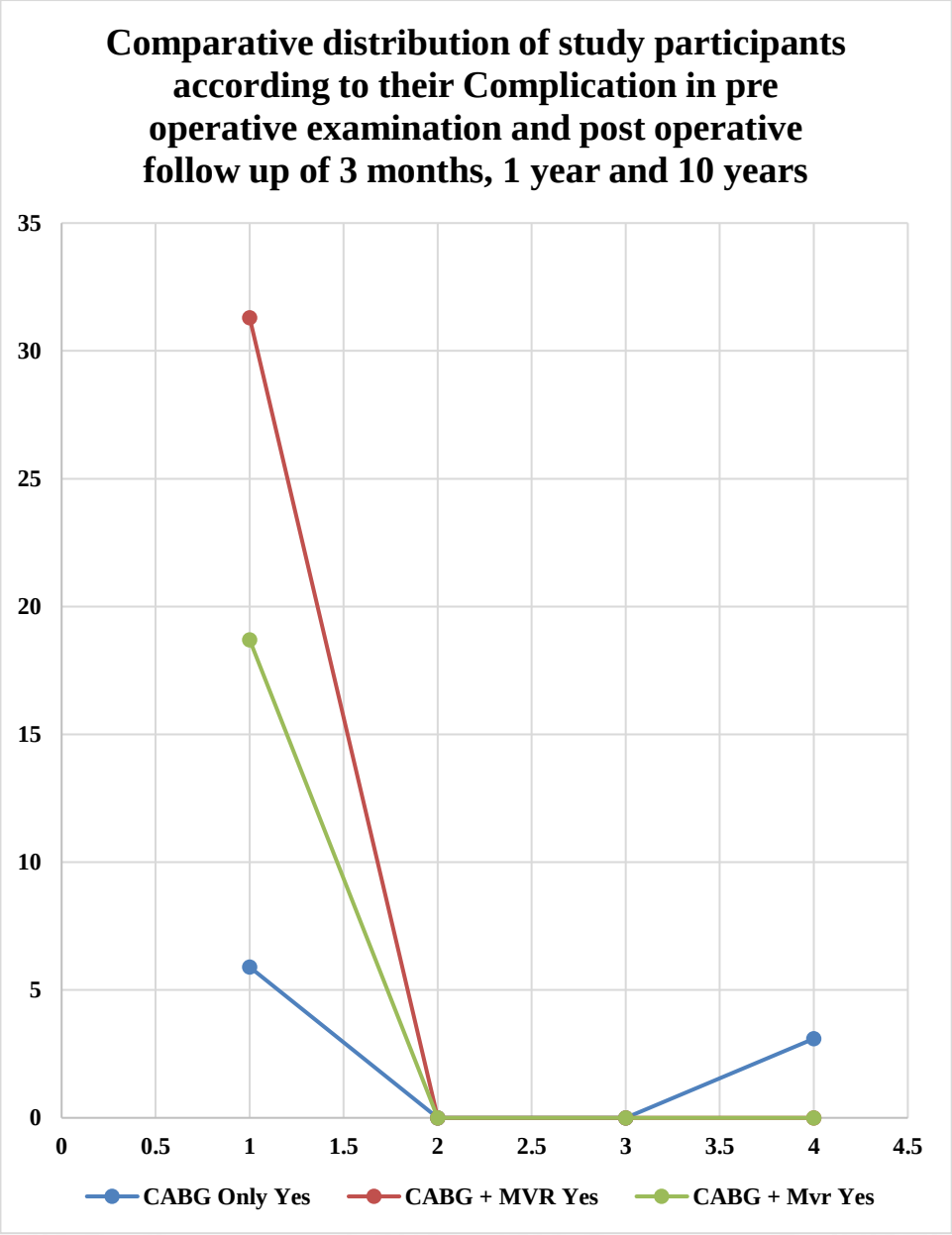

Figure 28 Comparative distribution of study patients according to their Complication in pre operative examination and post operative follow up of 3 months, 1 year and 10 years.

Table 29 Comparative distribution of study patients according to their mortality in immediate after surgery examination and post operative follow up of 3 months, 1 year and 10 years

Sr No.	SURGERY	Mortality	Immediate post op	3Month	1 Year	10 years
1	CABG only	Survive	32(94.1)	32 (100)	32 (100)	31 (96.7)
		Death	2(5.9)	0 (0)	0 (0)	1 (3.3)
2	CABG+MVR	Survive	11(68.7)	11 (100)	11 (100)	11 (100)
		Death	5(31.3)	0 (0)	0 (0)	0 (0)
3	CABG+MVr	Survive	15(83.3)	15 (100)	15 (100.0)	15 (100)
		Death	3(18.7)	0 (0)	0 (0)	0 (0)

Comparative distribution of study patients according to their Mortality in immediate after surgery examination and post-operative follow up of 3 months, 1 year and 10 years: The mortality rate immediately after the surgery or before 3 months follow up after surgery was 5.9% (n=2) for CABG only,31.3% (n=5) for CABG+MVR and 18.7% (n=3) for CABG +MVr .Only3.3% (n=1) patient had mortality observed on 10 years follow up but the actual patient's mortality was after 5 years, following surgery of CABG only. **(Table 29) (Figure 29)**

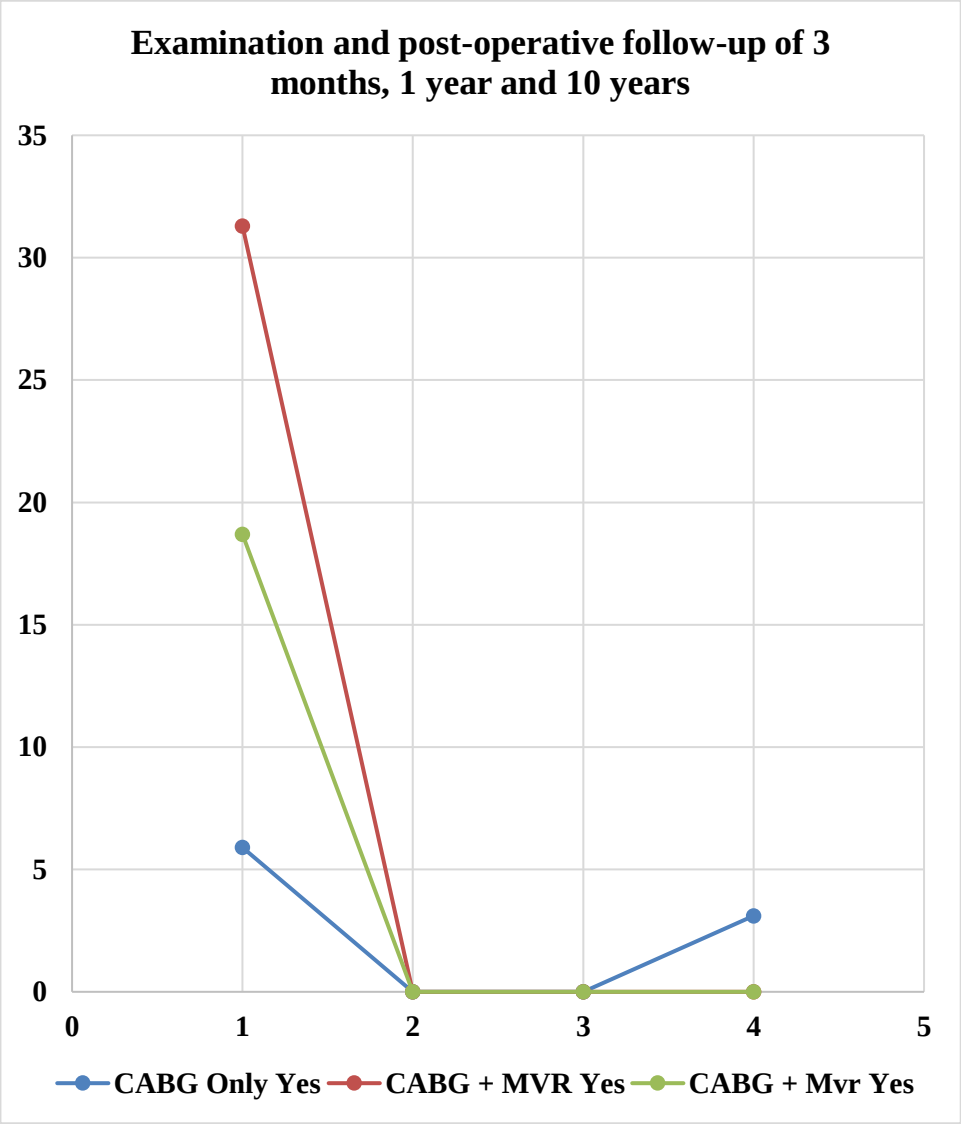

Figure 29 Examination and post-operative follow-up of 3 months, 1 year and 10 years.

Table 30. Comparative distribution of study patients according to their p-value of MR Status, NYHA class, Symptoms, Re-do-surgery, mortality, and complications with total CPB time and CABG only, CABG+MVR and CABG=MVr surgeries.

Sr No.	SURGERY	Variable comparing with CPB	Pre-op	3Month	1 Year	10 years
1	CABG only	MR status	0.752	0.170	0.248	0.002*
	CABG+MVR		0.36	0.367	0.509	0.822
	CABG+MVr		0.064	1.000	0.556	0.016*
2	CABG only	NYHA class	0.10	0.28	0.003	0.16
	CABG+MVR		0.367	0.225	0.489	0.313
	CABG+MVr		0.366	0.541	0.016*	0.016*
3	CABG only	Symptoms	0.067	0.000**	0.000**	0.000**
	CABG+MVR		0.948	0.000**	0.883	0.000**
	CABG+MVr		1.000	0.000**	0.000**	0.000**
(Variable below can't be measured at pre-operative to understand outcome)			Immediate Post-op	3Month	1 Year	10 years
4	CABG only	Re-do-surgery	1.000	1.000	1.000	1.000
	CABG+MVR		1.000	1.000	1.000	1.000
	CABG+MVr		1.000	1.000	1.000	1.000
5	CABG only	Mortality	0.003*	0.170	1.000	1.000
	CABG+MVR		0.508	0.367	1.000	1.000
	CABG+MVr		0.116	1.000	1.000	1.000
9	CABG only	Complications	0.003*	1.000	1.000	0.996
	CABG+MVR		0.58	1.000	1.000	1.000
	CABG+MVr		0.116	1.000	1.000	1.000

Comparative distribution of study patients according to their p-value of MR Status, NYHA class, Symptoms, Re-do-surgery, mortality and complications with total CPB time and CABG only, CABG+MVR and CABG=MVr surgeries.

In table 30. Kruskall Wallis statistical test was performed to understand the effect of patients MR Status, NYHA class, Symptoms, Re-do-surgery, mortality and complications. The p-value <0.05 is considered statistically significant and it was

observed on the following factors that interpret:

-Mitral Regurgitation status is improved after a 10-year follow-up of the patients who underwent CABG only and CABG mitral valve replacement surgery depending on CPB time from the baseline of pre-operative measures. Its p-value is 0.002 and 0.016 respectively.

-NYHA functional class is improved in patients who underwent CABG only and CABG mitral valve repair surgery depending with CPB time from the baseline of pre-operative measures. Its p value is 0.016.

-Patients became asymptomatic those, who underwent CABG only and CABG mitral valve replacement surgery depending on CPB time from the baseline of pre-operative measures. Its p value is 0.000 and that is highly significant.

Mortality and severe complications of LV failure can occur in immediate post-operative period of CABG only and CABG mitral valve replacement surgery depending on CPB time, and the p =0.003. **(Table 30)**

5. DISCUSSION

The present study design was retrospective which was conducted to assess ten-year survival for patients undergoing treatment in patients with Ischemic MR. 68 patients were included in this study that fulfilled our eligibility criteria. All the study patients were taken from the same institute. Ethical clearance was obtained from the respective authority of the same institute. Results were obtained and presented in tabular and figure form.

This study is conducted in only one institute and data on the patient is retrieved from the records of the institutes. Patients were appointed for examination and follow-up on phone calls. According to our eligibility criteria, we got 68 patients for the study. All the patients were from the age between 43 to 89 years old while 56 years is the mean age of the patients. These results contradict the study of ***PK Smith et al*** (Smith et al., 2014) and ***ElBardissi Andrew W et al*** (ElBardissi et al., 2012) which showed a mean age of the study patients as 65 years and that is near about 10 years more than our results, this may be due to racial difference.

There were 88% of males included in this study, in the study of ***Duk-Hyun Kang*** (Kang et al., 2006) also male is more than female and it was 68%. According to the study by ***Jean-François Avierinos et al*** (Avierinos,J et al, 2008) women undergo mitral surgery less often than men and those with severe regurgitation incur excess long-term mortality vs. men. Hence males are higher than females in our study.

There were 13.2% of patients with diabetes associated with hypertension and these results are nearly similar, that is 19% in the study of ***Volha Dziadzko et al*** (Dziadzko, C, et al., 2018). According to ***Andero Rossi et al*** (Rossi et al., 2016) mitral regurgitation is a common pathologic condition in patients with type 2 diabetes (Rossi et al., 2016).

Diabetics whose blood sugar, blood pressure, blood fats (lipids), body mass index (BMI), and kidney function (estimated glomerular filtration rate, EGFR) were within the therapeutic target range had a persistently high risk of hardening in left-sided valves, observed by the Diagnostic and Interventional Cardiology website 2022 (*DAIC*, 2022), in this study most of the patients having diabetes, hypertension and dyslipidemia and only one patient is normal and not having any of above said disease. The outcome of MR severity decreasing is excellent and the rate is 94.8%.

In the study of ***Simon C. Y. Chow et al*** (Chow, W, et al., 2020) the highest 44.4% patient were of NYHA Class III on pre-operative examination and exactly similar results, where we found that 44.1% of our study patients had NYHA Class III on pre-operative examination. 27.23% of study patients had NYHA class II findings (Chow, W, 2020) which is slightly less than our study as we found 44.1%.There were no patients remaining in NYHA Class III and IV in this study on post-operative examination. These findings could be that post-op NYHA class III–IV was the only factor associated with 10-year all-cause mortality. As we had only 7 Patients with NYHA class IV and 10 patients had mortality after the surgery. The outcome of NYHA functional class is very good, and it is 79.3%

The mean value of Left Ventricular ejection fraction were found 45% and nearly somewhat same results were also observed in the study of ***Ryan J. Koene et al*** (Koene et al., 2017) and the mean LVEF is 49±13 before the operative procedure. It is increased up to 50% on post-operative examination in both the study. The assessment of changes in pre- and post-operative LV systolic indices and function after CABG, improved.

The mean value of LVIDd is 52.38±4.48 cm while that of LVIDs is 44.01±4.45. and the agreement of our observations is with the study of ***Ryan J. Koene et al*** (Koene et

al., 2017b) and their values are 5.4±0.8 and 4.0±1.0 for LVIDd and LVIDs respectively. The improved LVEF had a significant reduction in mean LVIDd and mean LVIDs.

There were 42.6% of study patients who had regional wall motion abnormality in either area at the baseline and after the surgery, 92% of patients had normal RWMA after the follow-up examination at 10 years. While in the study of ***Toshiharu Fujii et al*** (Fujii et al., 2013) observed 23% RWMA in anteroseptal area, 22% RWMA in inferior area and 20.1% in lateral area before the surgery.

The mean value of CPB Time is 143.26 ±28.93 minutes while 158.7±28.3 minutes in the study ***of Meng-Lin Lee et al*** (Lee et al., 2018) and in the study of ***Simon C. Y. Chow et al*** (Chow, W, et al., 2020) it is 101.8±35.5 minutes.

In the study of ***Weitie Wang et al (Wang et al., 2019)*** 3 grafts were used in 98% of patients and in our study 42.6% of patients required 3 grafts.

Simon C. Y. Chow et al(Chow, W al., 2020) showed 77.8% of the patient underwent elective surgery while in this study 97.1% patients underwent elective surgery and the remaining patients underwent emergency surgery that was 2.9%. In the study of ***Sheeren Khaled et al*** (Khaled et al., 2019), only 2% of patients underwent elective surgery.

73.5% of the study patients had Left Main Coronary Artery (LMCA) disease at the baseline that is before surgery and all the patients were free from LMCA disease after the surgery. Only 1 patient had relapsed LMCA disease on the examination of 1-year follow-up, in the study, ***Sheeren Khaled et al*** (Khaled et al., 2019) showed, 14% of patients had the LMCA disease prior to the surgery.

21% of the study patients had done CABG with Mitral Valve repair and 79% of patients underwent only CABG. None of the patients required CABG +Mitral valve replacement

procedure as mentioned in the study by ***Sheeren Khaled et al*** (Khaled et al., 2019) 60.1% of the study patients had done CABG with Mitral Valve repair and 39.9% of patients underwent only CABG. None of the patients required CABG + mitral valve replacement procedure as mentioned in the study ***of Michel Pompeu B.O et al.*** (Sá et al., 2013) In our study 50% of patients underwent CABG only, 23.5% of study patients had CABG with MVR and 26.5% of patients required CABG with Mitral Valve replacement.

The highest 79.5% of study patients required 8±6 days, of hospital stay after the surgery. In the study by ***Weitie Wang et al*** *(Wang et al., 2019)* there are 11.32 ±1.48 days, of hospital stay required after the surgery.

Mild Pulmonary Arterial Hypertension was observed in 26% of the study patients and 19% of the study patients had moderate PAH and near about half per cent which is 55% doesn't have PAH and 93% of study patients not having PAH after the surgery. 27% doesn't have PAH while 34% of patients had mild PAH while 24.83% of study patients had a moderate type of PAH in the study of ***Rasha Al-Bawardy et al***.(Al-Bawardy et al., 2020), the outcome of PAH status is very good and it is 82.8%.

Post-operative complications such as Respiratory failure, cerebrovascular events, renal failure and arrhythmias are observed in 17.6%, 11.8%, 14.7% and 20.6% of the study patients. In the study of ***Ryan J. Koene et al*** (Koene et al., 2017a) postoperative complications of cerebrovascular events, renal failure and arrhythmias were observed among 28%, 25% and 11% of the patients in the study of ***Simon C. Y. Chow et al*** (Chow, W et al., 2020). 14.3% patient had postoperative renal failure, 1.83% of patients had post-operative respiratory failure observed in the research of ***Simon C. Y. Chow et al*** (Chow, W et al, 2020).

Total 11 patients had mortality among 68 patients and 57 patients survived at 10-year follow-up examination. 83.6% survival rate observed in our study of 10-year follow-update. 63.9% was found in ***Simon C. Y. Chow et al*** (Chow, W et al., 2020) 93.2% survival rate was observed in the study ***Sheeren Khaled et al*** (Khaled et al., 2019).

Limitations:

- Retrospective study hence there may be information bias.
- The sample size is relatively small, which may limit the generalizability of the findings.
- Study is conducted in only one institute the outcome rate will be different in different populations and races.

6. SUMMARY AND CONCLUSION

SUMMARY

Mitral regurgitation (MR) is a prevalent form of valvular heart disease, affecting millions worldwide. It can be classified into primary MR, caused by mitral valve dysfunction, and secondary MR, due to left ventricle remodeling. Current guidelines for the treatment of moderate to severe ischemic MR recommend various surgical approaches, including coronary artery bypass grafting (CABG) with or without mitral valve repair or replacement. However, there is limited clarity on which procedure is the optimal choice under specific conditions.

To address this knowledge gap, this thesis aimed to investigate the long-term outcomes of patients with ischemic MR after undergoing different coronary surgeries. The retrospective, observational study involved 68 eligible patients with coronary artery disease and IMR who underwent surgical management between 2001 and 2010. The mean age of the patients was 56.87 years, and the majority were male.

The study revealed that the majority of patients had moderate MR (2+), which decreased in prevalence during post-operative and long-term follow-up assessments. Patients who underwent coronary artery bypass surgery with mitral valve repair required redo surgery less frequently compared to other groups. However, post-operative complications, such as left ventricle failure, respiratory failure, cerebrovascular events, renal failure, and arrhythmias, were observed in some patients, leading to mortality in a few cases.

The surgical interventions, including CABG with or without mitral valve replacement or repair, demonstrated positive outcomes in improving mitral regurgitation status and functional class. Most patients achieved favorable long-term outcomes without the need for additional surgical interventions.

The findings contribute to the understanding of managing ischemic MR and provide evidence for the effectiveness of surgical interventions in improving long-term survival and reducing re-operation rates. However, the study has limitations, including its retrospective nature and relatively small sample size, which may affect the generalizability of the results. Moreover, the study was conducted in a single institute, and outcomes may vary in different populations and races.

In conclusion, this thesis sheds light on the management of ischemic MR and highlights the importance of surgical interventions in improving long-term outcomes. Comprehensive care and follow-up are crucial in addressing post-operative complications following cardiac surgeries. Nevertheless, further research is necessary to validate these findings and explore other factors influencing mortality in this patient population.

CONCLUSION

There has been a shifting trend in recent years regarding the discussion for the pathophysiology and treatment of Ischemic Mitral Regurgitation. As surgical techniques are perfected and becoming standardized across the different Cardiac Surgery centers, stronger evidence arises from randomized clinical trials and echo-cardiographic studies.

The distribution of RWMA in patients undergoing cardiac surgery demonstrates an improvement in wall motion abnormalities over time. Most patients had normal wall motion, while specific patterns of RWMA were observed in a subset of patients. These findings contribute to the knowledge of RWMA prevalence and patterns in the context of cardiac surgery and can guide clinical management.

The distribution of MR among patients undergoing cardiac surgery demonstrates a decrease in MR severity over time. Most patients presented with moderate MR (2+), which decreased in prevalence during the post-operative and long-term follow-up assessments. Patients with mild MR (1+) also exhibited improvements, while severe MR (3+ and 4+) was relatively rare in this cohort. These findings contribute to our understanding of MR management and outcomes within the context of cardiac surgery.

It is a great challenge to manage IMR. The evaluation of IMR can be accurate by perioperative surgical revascularization alone with CABG is sufficient in patients with mild MR, but in the case of severe IMR, CABG along with valve repair can improve functional capacity, LV reverse remodeling, MR severity and BNP levels.

The comparative distribution of study patients according to their NYHA functional class in pre-operative examination and post-operative follow-up provides valuable insights into the long-term outcomes of different surgical interventions for patients with cardiovascular conditions. The results highlight the significant improvements in functional class over time for patients who underwent CABG alone, CABG with MVR, and CABG with mitral valve repair. These findings contribute to the existing body of knowledge on the effectiveness of surgical interventions in improving functional outcomes and enhancing the quality of life for individuals with cardiovascular diseases.

Low rate of re-do surgery in patients who underwent CABG with or without mitral valve replacement or repair. The majority of patients achieved favourable outcomes without the need for additional surgical interventions.

Complications highlight the occurrence of major adversities, particularly LV failure, following cardiac surgeries. Although a small percentage of patients

experienced complications, close monitoring and appropriate management are crucial to ensure favourable outcomes. These findings contribute to the existing literature on the potential risks and challenges associated with cardiac surgeries and emphasize the importance of comprehensive care and follow-up to address post-operative complications.

The low mortality rates observed after the initial post-operative period highlight the effectiveness of these surgical interventions in improving long-term survival. However, further research is necessary to validate these findings and explore other factors influencing mortality in this patient population. The survival rate is good for CABG surgery. Complications may occur even after surgery in some patients. These complications may be cardiovascular events, respiratory failure and in some patients redo surgery is required.

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ANNEXURES

CV of PRINCIPAL INVESTIGATOR

Format for CV of the Investigators

Vajpeyi	**Anshuman**	
Date of Birth (dd/mm/yy) 03/07/1989		Sex: Male
Study Site Affiliation (e.g. Principal Investigator, Co-Investigator, Coordinator) Co-investigator: principal investigator		
Professional Mailing Address (Include Institution name)		Study Site Address (Include Institution name)
Dr Anshuman Vajpeyi Dept of CVTS SCTIMST Trivandrum		Dr Anshuman Vajpeyi Senior Resident , Dept of CVTS SCTIMST Trivandrum
Telephone (Office): -		Mobile Number: 7389914567
Telephone (Residence):-		Email: vajpeyi.anshuman@gmail.com

Academic Qualifications (Most recent qualification first)		
Degree/Certificate	Year	Institution, Country
MBBS	2014	JNMC, (DMIMSU)Wardha , Maharashtra
MS General. Surgery	2017	SAMC & PGI Indore,Madhya Pradesh Medical Science University, Jabalpur, MP

Details of professional registration : (MCI/State Registration/Bar Council/DCI/etc including Registration Number and Year of Registration: 91303		
Month and Year	Title	Institution/Company, Country
2021	SENIOR RESIDENT	SCTIMST.
Brief summary of relevant research experience:		
Current project/s at hand:		

Dr Anshuman Vajpeyi Dr .Anshuman Vajpeyi	Date: 01/07/2021 Place:Trivandrum

CV of Guide

Format for CV of the Investigators

Last Name :Panicker	First Name: Varghese	Middle Name:T
Date of Birth (dd/mm/yy) :25/02/1976		Sex: Male
Study Site Affiliation (e.g. Principal Investigator, Co-Investigator, Coordinator)		
Professional Mailing Address (Include Institution name)		Study Site Address (Include Institution name)
Professor Dept:of CVTS SCTIMST Trivandrum, 695011		Professor Dept:of CVTS SCTIMST Trivandrum, 695011
Telephone (Office): 0471-2524551		Mobile Number:9387801642
Telephone (Residence):0471-2443261		Email :vtp@sctimst.ac.in

Academic Qualifications (Most recent qualification first)

Degree/Certificate	Year	Institution, Country
MCh -CVTS	2008	SCTIMST
MS –General Surgery	2004	Medical College,Trivandrum
MBBS	1997	Medical College,Trivandrum

Details of professional registration : (MCI/State Registration/Bar Council/DCI/etc including Registration Number and Year of Registration : TCMC 27238 ,1999

Current and previous positions (most recent position first)

Month and Year	Title	Institution/Company, Country
2019- till date	Professor	SCTIMST
2015 -2019	Additional Professor ,CVTS	SCTIMST
2012-2015	Associate Professor ,CVTS	SCTIMST
2009-2012	Assistant Professor ,CVTS	SCTIMST
2009	Consultant ,CVTS	SCTIMST

Brief summary of relevant research experience:

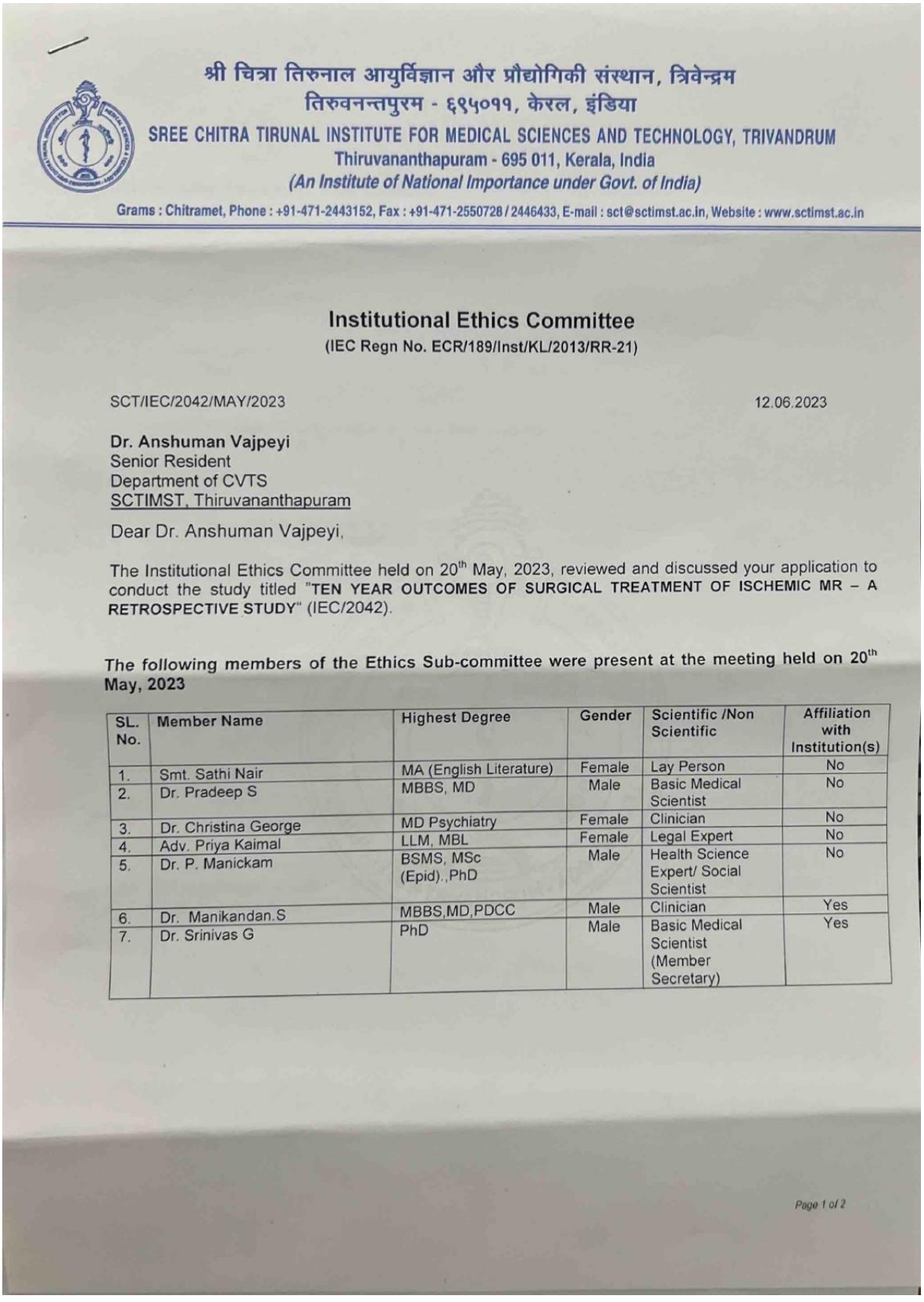
Mitral Annuloplasty in Calcified Annulus

Current project/s at hand:

Signature:Varghese T Panicker	21-01-2019 Trivandrum

APPENDIX – APPROVALS & PERMISSIONS

Institutional Ethics Committee (IEC) Approval Letter



श्री चित्रा तिरुनाल आयुर्विज्ञान और प्रौद्योगिकी संस्थान, त्रिवेन्द्रम
तिरुवनन्तपुरम - ६९५०११, केरल, इंडिया
SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES AND TECHNOLOGY, TRIVANDRUM
Thiruvananthapuram - 695 011, Kerala, India
(An Institute of National Importance under Govt. of India)
Grams : Chitramet, Phone : +91-471-2443152, Fax : +91-471-2550728 / 2446433, E-mail : sct@sctimst.ac.in, Website : www.sctimst.ac.in

Institutional Ethics Committee

(IEC Regn No. ECR/189/Inst/KL/2013/RR-21)

SCT/IEC/2042/MAY/2023 12.06.2023

Dr. Anshuman Vajpeyi
Senior Resident
Department of CVTS
SCTIMST, Thiruvananthapuram

Dear Dr. Anshuman Vajpeyi,

The Institutional Ethics Committee held on 20th May, 2023, reviewed and discussed your application to conduct the study titled "**TEN YEAR OUTCOMES OF SURGICAL TREATMENT OF ISCHEMIC MR – A RETROSPECTIVE STUDY**" (IEC/2042).

The following members of the Ethics Sub-committee were present at the meeting held on 20th May, 2023

SL. No.	Member Name	Highest Degree	Gender	Scientific /Non Scientific	Affiliation with Institution(s)
1.	Smt. Sathi Nair	MA (English Literature)	Female	Lay Person	No
2.	Dr. Pradeep S	MBBS, MD	Male	Basic Medical Scientist	No
3.	Dr. Christina George	MD Psychiatry	Female	Clinician	No
4.	Adv. Priya Kaimal	LLM, MBL	Female	Legal Expert	No
5.	Dr. P. Manickam	BSMS, MSc (Epid).,PhD	Male	Health Science Expert/ Social Scientist	No
6.	Dr. Manikandan.S	MBBS,MD,PDCC	Male	Clinician	Yes
7.	Dr. Srinivas G	PhD	Male	Basic Medical Scientist (Member Secretary)	Yes

Page 1 of 2

The following documents were reviewed:

Original submission

1. *Covering letter addressed to the Chairperson, IEC, SCTIMST*
2. *IEC Application Form*
3. *Telephone script in Malayalam*
4. *Study Proposal*
5. *Proforma*
6. *CV of PI and Co-PIs*
7. *Declaration Form*
8. *Proforma*
9. *Checklist Form*
10. *Responses/Amendments made based on the Reviewer's Comments*
11. *SRC Recommendation Letter*

Revised submission

1. *Covering letter addressed to the Member Secretary, IEC, SCTIMST dated 07.06.2023*
2. *Covering letter addressed to the Chairperson, IEC, SCTIMST dated 20.12.2022*
3. *IEC Application Form*
4. *Telephone script in Malayalam and English*
5. *Study Proposal*
6. *Proforma*
7. *CV of PI and Co-PIs*
8. *Declaration Form*
9. *Proforma*
10. *Checklist Form*
11. *Responses/Amendments made based on the Reviewer's Comments*

IEC Decision

The IEC approved the conduct of the study in the present form.

Remarks:
The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information/informed consent and asks to be provided a copy of the final report.

There was no member of the study team who participated in voting / decision making process. The ethics committee is organized and operated according to the requirements of Good Clinical Practice and the requirements of the Indian Council of Medical Research (ICMR).

Sincerely,

Dr. G. Srinivas
Member Secretary, IEC

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE (IEC)
SCTIMST, THIRUVANANTHAPURAM

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY
INSTITUTIONAL ETHICS COMMITTEE (IEC)
SCTIMST
THIRUVANANTHAPURAM

APPENDIX – SUPPLEMENTARY TABLES

MASTER CHART (DATA ENTRY)

Sr No	Age In Years	Gender	Co-morbidity	NYHA Functional Class	SYMPTOM	Imaging						
		Female=1 Male=0	None=0 Hypertension=1 Diabetes=2 PeriArterialD=3 Dyslipidemia=4 COPD=5 ThyroidDys=6 ChrKidneyD=7	ClassI=1 ClassII=2 ClassIII=3 ClassIV=4	Symptomatic/ Asymtomatic	LVEF	LVIDd	LVIDs	RWMA	Ventricular Function	MR	ECG PRE-op RYTHEM
1	49	0	1,4	2	Sympt.	58%	56mm	48mm	AS/PI	Gd LVF	2+	Sinus
2	78	0	1,2,4	4	sympt.	30%	57mm	50mm	PI/AS	Sev LVD	3+	Sinus
3	48	0	1	3	sympt	50%	50mm	45mm	no	mild LVD	2+	Sinus
4	50	0	1,2,4	2	asympt	60%	50mm	41mm	no	Gd LVF	1+	Sinus
5	53	1	1,4	3	sympt	38%	52mm	43mm	PI	Mod. LVD	3+	Sinus
6	65	1	1	2	asympt.	40%	51mm	44mm	AL/ PL	Mod LVD	2+	Sinus
7	72	0	1,2,3	3	sympt	40%	50mm	41mm	AS/AL/PI	Mod LVD	2+	Sinus
8	47	0	1	2	asympt	66%	44mm	40mm	nil	Gd LVF	1+	Sinus
9	58	1	1,2,4	3	sympt	40%	56mm	49mm	PI/PL	mod LVD	4+	Sinus
10	59	0	1,2,4	2	asympt	55%	55mm	40mm	AS/PL	Gd LVF	2+	Sinus
11	89	1	1,2,4,	4	sympt.	28%	56mm	48mm	AS/AL/PL	Sev LVD	4+	Sinus
12	68	0	1,4	3	sympt	37%	55mm	50mm	PI/PL	Mod LVD	3+	Sinus
13	68	1	1,2,4	3	sympt	40%	55mm	48mm	PI	Mod LVD	4+	Sinus
14	78	0	1	3	sympt	37%	56 mm	49mm	PL/PI	Mod LVD	3+	Sinus
15	57	0	1,2	2	asympt	57%	47mm	47mm	no	Gd LVF	2+	Sinus
16	61	0	1,2	3	asympt	38%	44mm	40 mm	AS/PI	Mod LVD	1+	Sinus
17	68	0	1	1	asympt	50%	44 mm	34 mm	no	Mild LVD	2+	Sinus

18	42	0	1,4	3	sympt	30%	55mm	48mm	PI/PL	Mod LVD	3+	Sinus
19	60	0	1,4	3	sympt	28%	55mm	48mm	AS/PI	Sev LVD	3+	Sinus
20	68	0	1,4	3	sympt	40%	56mm	49mm	PI	Mod LVD	4+	Sinus
21	62	0	1,2,4	2	asympt	50%	44mm	41mm	no	mild LVD	2+	Sinus
22	60	0	1,2	2	asympt	55%	48mm	40mm	no	Gd LVF	2+	Sinus
23	57	1	1,4	2	asympt	60%	44mm	40mm	no	Gd LVF	2+	Sinus
24	44	0	1,2,4	3	sympt	50%	55mm	49mm	AS/PI	mild LVD	4+	Sinus
25	55	0	1,4	2	asympt.	51%	44 mm	38mm	no	mild LVD	2+	Sinus
26	68	0	1,2,4	2	asympt	61%	43 mm	38 mm	no	GD LVF	2+	Sinus
27	60	0	1,2,4	2	asympt	40%	44 mm	38 mm	PI	Mod LVD	2+	Sinus
28	54	0	1,2	2	asympt	51%	48 mm	40 mm	no	Mild LVD	2+	Sinus
29	57	0	1,2	3	sympt	38%	52mm	46 mm	AL/PL	Mod LVD	4+	Sinus
30	63	0	1,2,4	3	sympt	51%	54mm	47mm	no	mild LVD	3+	Sinus
31	79	0	1,2,4	2	asympt	51%	44 mm	38mmm	no	mild LVD	2+	Sinus
32	72	0	1	2	asympt.	52%	48mm	36mm	no	mild LVD	2+	Sinus
33	63	0	1,2,4	4	sympt	30%	52mm	48mm	AL/PL/PI	mod LVD	4+	Sinus
34	52	1	1,4	4	sympt	40%	52mm	45mm	AL/PL	mod LVD	3+	Sinus
35	55	0	1,4	4	sympt	30%	58mm	48mm	PL/PI	mod LVD	4+	Sinus
36	54	0	1,2,4	3	sympt	48%	56 mm	44mm	AS/PL	mild LVD	4+	Sinus
37	56	0	1,2	2	asympt	52%	51mm	41mm	no	Gd LVF	2+	Sinus
38	50	0	1,4	3	sympt	50%	51mm	46mm	no	mild LVD	3+	Sinus
39	52	0	1,2,4	3	sympt	38%	56mm	48mm	AS/PL	mod LVD	3+	Sinus
40	68	0	1,4	3	sympt	66%	58mm 47mm		PL	Gd LVF	4+	Sinus
41	67	0	1	2	sympt	66%	56mm	48mm	PI/PL	Gd LVF	3+	Sinus
42	63	0	1,2	2	asympt	38%	55mm	44mm	AS/PL	Mod LVD	3+	Sinus
43	71	0	1,2,4	4	sympt	30%	58mm	47mm	AS/AL/PL	Mod LVD	3+	Sinus

44	64	0	1,2	3	sympt	50%	51mm	42mm	no	Mild LVD	2+	Sinus
45	47	0	1	2	asympt	52%	51mm	42mm	no	Gd LVF	2+	Sinus
46	52	0	1,4	3	sympt	42%	55mm	45mm	AS/PL	Mild LVD	4+	Sinus
47	50	0	1	2	asympt	52%	51mm	42 mm	no	Gd LVF	2+	Sinus
48	52	0	1,4	3	sympt	48%	56mm	46mm	no	Mild LVD	3+	Sinus
49	54	0	1,2,4	2	sympt	45%	51mm	40mm	no	Mild LVD	2+	Sinus
50	67	0	1,4	3	sympt	40%	58mm	45mm	AS/PL	mod LVD	4+	Sinus
51	59	0	1,2,4	2	asympt	52%	51mm	41mm	no	Gd LVF	2+	Sinus
52	68	0	1,4	3	sympt	48%	56mm	44mm	AL/PL	Mild LVD	3+	Sinus
53	64	0	1,4	3	sympt	52%	57mm	48mm	no	Gd LVF	3+	Sinus
54	60	0	1, 2,4	2	sympt	38%	52mm	41mm	PL/PI	Mod LVD	2+	Sinus
55	52	0	1,4	2	asympt	57%	51mm	41mm	no	Gd LVF	2+	Sinus
56	63	0	1,4	2	sympt	54%	50mm	38mm	no	Gd LVF	2+	Sinus
57	63	0	1,4	2	sympt	38%	56mm	49mm	AL/PL/PI	Mod LVD	4+	Sinus
58	58	0	1,4	3	sympt	36%	58mm	50mm	AL/PL/PI	Mod LVD	4+	Sinus
59	60	1	1,4	3	sympt	37%	58mm	48mm	AL/PL	Mod LVD	4+	Sinus
60	68	0	1,2,4	3	sympt	28%	56mm	43mm	AL/AS/PL	Sev LVD	3+	Sinus
61	70	0	1,2,4	4	sympt	26%	56mm	46mm	AL/PL/PI	Sev LVD	2+	Sinus
62	42	0	1,4	2	asympt	56%	47mm	38mm	no	Gd LVF	2+	Sinus
63	46	0	1,2	2	asympt	58%	49mm	39mm	no	Gd LVF	2+	Sinus
64	69	0	1,2,4	3	sympt	36%	51mm	41mm	AS/AL/PL	Mod LVD	2+	Sinus
65	61	0	1,2,4	3	sympt	28%	57mm	47mm	AS/PL/AL	Sev LVD	2+	Sinus
66	53	0	1,4	3	sympt	30%	57mm	59mm	AL/PL	mod LVD	4+	Sinus
67	54	0	1,2,4	2	asympt	46%	56mm	41mm	no	mild LVD	2+	Sinus
68	55	0	1,4	2	asympt	50%	56mm	41mm	no	mild LVD	2+	Sinus

Intra-operative Parameters								
Sr. No.	**On pump/Off Pump**	**Total CPB Time**	**MR**	**Ventricular Function**	**Number of grafts**	**Emergency elective surgery**	**LMCA disease**	**CABG/CABG+MV rep/CABG+MV Repl.**
1	on pump	130 min	2+	58%	3 grafts	elective	no	CABG
2	on pump	170 min	3+	30%	4 grafts	elective	yes	CABG+MV rep
3	on pump	160 min	2+	50%	4 grafts	elective	no	CABG+ MV rep
4	on pump	120 min	1+	60%	3 grafts	elective	no	CABG
5	on pump	180 min	2+	38%	5 grafts	elective	no	CABG+ MV rep
6	on pump	135min	2+	40%	3grafts	elective	no	CABG
7	on pump	150 min	2+	40%	5 grafts	elective	yes	CABG
8	on pump	110 min	1+	66%	2 grafts	elective	no	CABG
9	on pump	185min	4+	40%	4 grafts	elective	yes	CABG+MV Repl
10	on pump	130min	2+	55%	3 grafts	elective	yes	CABG
11	on pump	188min	4+	28%	4 grafts	elective	yes	CABG+MVRepl
12	onpump	170min	3+	37%	4 grafts	elective	yes	CABG+MV rep
13	on pump	165 min	4+	40%	3 grafts	elective	yes	CABG+MV Repl
14	on pump	189min	3+	37%	4 grafts	elective	yes	CABG+MV Repl
15	on pump	120 min	2+	57%	4 grafts	elective	yes	CABG
16	on pump	130 min	1+	38%	4 grafts	elective	yes	CABG
17	on pump	90 min	2+	50%	2 grafts	elective	yes	CABG
18	on pump	187 min	3+	30%	5 grafts	elective	yes	CABG+MV rep
19	on pump	179 min	3+	28%	4 grafts	elective	yes	CABG+MV rep
20	on pump	150 min	4+	40%	3 grafts	elective	yes	CABG+MV Repl
21	on pump	110 min	2+	50%	3 grafts	elective	yes	CABG

22	on pump	120 MIN	2+	55%	4 grafts	elective	yes	CABG
23	on pump	126 min	2+	60%	3 grafts	elective	yes	CABG
24	on pump	160 min	4+	50%	3 grafts	elective	yes	CABG+MV Repl
25	on pump	90 min	2+	51%	2 grafts	elective	no	CABG
26	on pump	100 min	2+	61%	2 grafts	elective	no	CABG
27	on pump	120 min	2+	40%	4 grafts	elective	no	CABG
28	on pump	120 min	2+	51%	3 grafts	elective	no	CABG
29	on pump	170 min	4+	38%	4 grafts	elective	yes	CABG+MV Repl
30	on pump	150 min	3+	51%	2 grafts	elective	yes	CABG+MV Repl
31	on pump	120 min	2+	51%	3 grafta	elective	yes	CABG
32	on pump	120 min	2+	52%	2 grafts	elective	yes	CABG
33	on pump	170 min	4+	30%	4 grafts	emergency	yes	CABG+MV Repl
34	on pump	180 min	3+	40%	3 grafts	elective	yes	CABG+ MV rep
35	on pump	170 min	4+	30%	4 grats	emergency	yes	CABG+MV Repl
36	on pump	160 min	4+	48%	3 grafts	elective	yes	CABG+MV Repl
37	on pump	120 min	2+	52%	3 grafts	elective	yes	CABG
38	on pump	180 min	3+	50%	2 grafts	elective	yes	CABG+ MV rep
39	on pump	170 min	3+	38%	3 grafts	elective	yes	CABG+MV rep
40	on pump	160 min	4+	66%	3 grafts	elective	yes	CABG+MV Repl
41	on pump	175min	3+	66%	3 grafts	elective	yes	CABG+ MV rep
42	on pump	180 min	3+	38%	4 grafts	elective	yes	CABG+MV rep
43	on pump	173 min	3+	30%	4 grafts	elective	yes	CABG+MV rep
44	on pump	120 min	2+	50%	3 grafts	elective	yes	CABG
45	on pump	110 min	2+	52%	3 grafts	elective	no	CABG
46	on pump	150 min	4+	42%	3 grafts	elective	yes	CABG+MV Repl
47	on pump	110 min	2+	52%	2 grafts	elective	no	CABG
48	on pump	170 min	3+	48%	3 grafts	elective	no	CABG+ MV rep

49	on pump	120 min	2+	45%	3 grafts	elective	no	CABG
50	on pump	160 mins	4+	40%	4 grafts	elective	no	CABG+MV Repl
51	on pump	100 mins	2+	52%	2 grafts	elective	no	CABG
52	on pump	170 min	3+	48%	3 grafts	elective	yes	CABG+ MV rep
53	on pump	110 min	3+	52%	3 grafts	elective	yes	CABG+MV Repl
54	on pump	130 min	2+	38%	4 grafts	elective	yes	CABG
55	on pump	110 min	2+	57%	2 grafts	elective	no	CABG
56	on pump	110 min	2+	54%	2 grafts	elective	no	CABG
57	on pump	160 min	4+	38%	3 grafts	elective	yes	CABG+MV Repl
58	on pump	170min	4+	36%	4 grafts	elective	yes	CABG+MV Repl
59	on pump	150 min	4+	37%	3 grafts	elective	yes	CABG+MV Repl
60	on pump	180 min	2+	28%	5 grafts	elective	yes	CABG+ MV rep
61	on pump	150 min	2+	26%	5 grafts	elective	yes	CABG
62	on pump	100 min	2+	56%	2 grafts	elective	yes	CABG
63	on pump	90 min	2+	58%	2 grafts	elective	yes	CABG
64	on pump	150 min	2+	36%	4 grafts	elective	yes	CABG
65	on pump	130 min	2+	28%	5 grafts	elective	yes	CABG
66	on pump	160 min	4+	30%	3 grafts	elective	yes	CABG+MV Repl
67	on pump	130 min	2+	46%	3 grafts	elective	yes	CABG
68	on pump	120 min	2+	50%	3 grafts	elective	yes	CABG

Post-operative Follow Up Immediate												
Sr No	**Mortality**	**Cause of death**	**MR**	**Myocardial Infarction**	**Second Surgery**	**Angioplasty/ PCI**	**Respiratory Failure**	**Cerebrovascular event**	**Renal Failure**	**Anticoagulation regimen**	**Hospital Stay**	**Arrythmias**
1	No		1-2+	no	No	no	no	no	no	no	6 days	no
2	25/05/01	LV Failure	1-2+	no	No	no	yes	yes	no	yes	12 days	yes
3	No	nil	1+	no	No	no	no	no	no	yes	7 days	yes
4	No	nil	1+	no	No	no	no	no	no	no	5 days	no
5	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
6	No	nil	2+	no	No	no	no	no	no	no	5 days	no
7	No	nil	2+	no	No	no	yes	no	no	no	13 days	yes
8	No	nil	1+	no	No	no	no	no	no	no	5 days	no
9	No	nil	1+	no	no	no	no	yes	no	yes	21 days	yes
10	No	nil	2+	no	No	no	no	no	no	no	5 days	no
11	24/03/2003	LV Failure	2+	no	No	no	yes	no	yes	yes	7 days	yes
12	No	nil	2+	no	No	no	no	no	no	yes	7 days	no
13	No	nil	1+	no	No	no	no	no	no	yes	8 days	no
14	21/01/2004	LV Failure	2+	no	No	no	yes	no	yes	yes	10 days	yes
15	No	nil	1+	no	No	no	no	no	no	no	5 days	no
16	No	nil	1+	no	No	no	no	no	no	no	5 days	no
17	No	nil	no	no	No	no	no	no	no	no	5 Days	no
18	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
19	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
20	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
21	No	nil	no	no	No	no	no	no	no	no	5 days	no
22	No	nil	no	no	No	no	no	no	no	no	5 days	no

23	No	nil	no	no	No	no	no	no	no	no	5 days	no
24	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
25	No	nil	1+	no	No	no	no	no	no	no	5 days	no
26	No	nil	no	no	No	no	no	no	no	no	5 days	no
27	No	nil	no	no	No	no	no	no	no	no	5 days	no
28	No	nil	1+	no	No	no	no	no	no	no	5 Days	no
29	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
30	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
31	No	nil	1+	no	No	no	no	no	no	no	5 days	no
32	No	nil	1+	no	No	no	no	no	no	no	5 days	no
33	01/01 /2006	LV failure	2+	no	No	no	yes	yes	yes	yes	17 days	yes
34	13/04 /2006	LV Failure	2+	no	No	no	yes	no	yes	yes	8 days	no
35	17/09 /2006	LV failure	2+	no	No	no	yes	yes	yes	yes	14 days	yes
36	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
37	No	nil	1+	no	No	no	no	no	no	no	5 days	no
38	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
39	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
40	No	nil	1+	no	No	no	no	no	no	yes	10 days	yes
41	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
42	No	nil	1+	no	No	no	no	yes	no	yes	21 days	yes
43	19/01 /2007	LV failure	2+	no	No	no	yes	yes	yes	yes	30 days	yes
44	No	nil	2+	no	No	no	no	no	no	no	5 days	no
45	No	nil	2+	no	No	no	no	no	no	no	5 days	no
46	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
47	No	nil	1+	no	No	no	no	no	no	no	5 days	no

48	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
49	No	nil	2+	no	No	no	no	no	no	no	5 days	no
50	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
51	No	nil	2+	no	No	no	no	no	no	no	5 days	no
52	No	nil	2+	no	MV Repl	no	yes	no	yes	yes	17 days	yes
53	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
54	No	nil	1+	no	No	no	no	no	no	no	5 days	no
55	No	nil	2+	no	No	no	no	no	no	no	5 days	no
56	No	nil	2+	no	No	no	no	no	no	no	5 days	no
57	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
58	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
59	No	nil	1+	no	No	no	no	no	no	yes	7 days	no
60	23/04 /2008	LV Failure	1+	no	No	no	yes	yes	yes	yes	28 days	yes
61	18/05 /2009	LV Failure	1+	no	No	no	yes	no	yes	no	17 days	yes
62	No	nil	2+	no	No	no	no	no	no	no	5 days	no
63	No	nil	2+	no	No	no	no	no	no	no	5 days	no
64	12/12 /2009	LV failure	2+	no	No	no	yes	no	yes	no	15 days	no
65	No	nil	2+	no	no	no	no	yes	no	no	30 days	no
66	No	nil	1+	no	no	no	no	no	no	yes	7 days	no
67	No	nil	2+	no	no	no	no	no	no	no	5 Days	no
68	No	nil	1+	no	no	no	no	no	no	no	5 Days	no

Post-operative Follow Up at 3 Months													
Sr. No.	**LVEF**	**RWMA**	**PAH**	**MR**	**Symptom**	**PCI**	**Re-surgery**	**Mortality**	**Cause of death**	**FC**	**CXR**	**ECG**	**Other Vascular Events**
1	60%	no	no	1-2+	no	no	no	no	nil	2	WNL	Sinus	nil
2	--	--	--	--	--	--	--	--	--	--	--	--	--
3	52%	no	no	1+	no	no	no	no	nil	2	wnl	sinus	nil
4	60%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
5	42%	PI	no	1+	no	no	no	no	nil	2	wnl	sinus	nil
6	44%	AL/PL	no	2+	no	no	no	no	nil	2	wnl	sinus	nil
7	42%	AS/PI	mild	2+	no	no	no	no	nil	2	wnl	sinus	nil
8	66%	nil	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
9	48%	no	mod	1+	no	no	no	no	nil	2	wnl	sinus	nil
10	58%	no	no	2+	no	no	no	no	nil	2	wnl	sinus	nil
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	42%	PL/PI	mod	2+	no	no	no	no	nil	2	wnl	sinus	nil
13	48%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
14	--	--	--	--	--	--	--	--	--	--	--	--	--
15	60%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
16	46%	no	no	!+	no	no	no	no	nil	1	wnl	sinus	nil
17	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
18	40%	PI/PL	mod	1+	no	no	no	no	nil	2	wnl	Sinus	nil
19	42%	AS/PI	mod	2+	no	no	no	no	nil	2	wnl	sinus	nil
20	44%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
21	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
22	55%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
23	60%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
24	52%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil

25	51%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
26	61%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
27	46%	PI	no	no	no	no	no	no	nil	1	wnl	sinus	nil
28	54%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
29	48%	AL	mod	1+	no	no	no	no	nil	1	wnl	sinus	nil
30	52%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	mil
31	51%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
32	52%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
33	--	--	--	--	--	--	--	--	--	--	--	--	--
34	--	--	--	--	--	--	--	--	--	--	--	--	--
35	--	--	--	--	--	--	--	--	--	--	--	--	--
36	52%	AS/PL	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
37	52%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
38	50%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
39	42%	AS/PL	mod	1+	no	no	no	no	nil	2	wnl	sinus	nil
40	66%	PL/PI	mod	1+	no	no	no	No	nil	1	wnl	sinus	nil
41	68%	no	mild	!+	no	no	no	No	nil	1	wnl	sinus	nil
42	42%	AS/PL	mod	1+	no	no	no	No	nil	1	wnl	sinus	nil
43	--	--	--	--	--	--	--	--	--	--	--	--	--
44	52%	no	no	2+	no	no	no	No	nil	1	wnl	sinus	nil
45	53%	no	no	!+	no	no	no	No	nil	1	wnl	sinus	nil
46	48%	no	mild	1+	no	no	no	No	nil	1	wnl	sinus	nil
47	52%	no	no	!+	no	no	no	No	nil	1	wnl	sinus	nil
48	50%	no	mod	1+	no	no	no	No	nil	2	wnl	sinus	nil
49	50%	no	no	2+	no	no	no	No	nil	2	wnl	sinus	nil
50	50%	no	mod	!+	no	no	no	No	nil	2	wnl	sinus	nil
51	52%	no	no	2+	no	no	no	No	nil	1	wnl	sinus	nil

52	52%	AL	mod	1+	no	no	no	No	nil	2	wnl	AF+CVR	nil
53	52%	no	mild	!+	no	no	no	No	nil	1	wnl	sinus	nil
54	42%	no	no	2+	no	no	no	No	nil	1	wnl	sinus	nil
55	57%	no	no	2+	no	no	no	No	nil	1	wnl	sinus	nil
56	54%	no	no	2+	no	no	no	No	nil	1	wnl	sinus	nil
57	46%	no	mod	1+	no	no	no	No	nil	1	wnl	sinus	nil
58	40%	no	mod	1+	no	no	no	No	nil	2	wnl	sinus	nil
59	42%	AL/PL	mod	1+	no	no	no	No	nil	2	wnl	sinus	nil
60	--	--	--	--	--	--	--	--	--	--	--	--	--
61	--	--	--	--	--	--	--	--	--	--	--	--	--
62	56%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
63	58%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
64	--	--	--	--	--	--	--	--	--	--	--	--	--
65	32%	AS/PL/AL	mild	2+	no	no	no	no	nil	2	wnl	sinus	nil
66	38%	AL/PL	mod	1+	no	no	no	no	nil	1	wnl	sinus	nil
67	50%	no	no	2+	no	no	no	no	nil	1	wnl	sinus	nil
68	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil

FOLLOW UP (After 1 year)													
Sr no.	**LVEF**	**RWMA**	**PAH**	**MR**	**Symptoms**	**PCI**	**Re Surgery**	**Mortality**	**Cause of Death**	**FC**	**CXR**	**ECG**	**Other vascular events**
1	60%	no	no	1+	no	no	no	no	nil	1	wnl	Sinus	nil
2	--	--	--	--	--	--	--	--	--	--	--	--	--
3	52%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
4	60%	no	no	nil	no	no	no	no	nil	1	wnl	sinus	nil
5	42%	PI	no	!+	no	no	no	no	nil	2	wnl	sinus	nil
6	44%	AL/PL	no	2+	no	no	no	no	nil	2	wnl	sinus	nil
7	42%	AS/PI	mild	1+	no	no	no	no	nil	2	wnl	sinus	nil
8	66%	nil	no	nil	no	no	no	no	nil	1	wnl	sinus	nil
9	48%	no	mod	1+	no	no	no	no	nil	2	wnl	Sinus	nil
10	58%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	42%	PL/PI	mod	2+	yes	no	no	no	nil	2	wnl	sinus	nil
13	48%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
14	--	--	--	--	--	--	--	--	--	--	--	--	--
15	60%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
16	48%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
17	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
18	42%	PI/PL	mod	1+	no	no	no	no	nil	2	wnl	sinus	nil
19	42%	AS/PI	mod	2+	no	no	no	no	nil	2	wnl	sinus	nil
20	48%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
21	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
22	55%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
23	60%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil

24	52%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
25	51%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
26	61%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
27	46%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
28	54%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
29	48%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
30	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
31	51%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
32	52%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
33	--	--	--	--	--	--	--	--	--	--	--	--	--
34	--	--	--	--	--	--	--	--	--	--	--	--	--
35	--	--	--	--	--	--	--	--	--	--	--	--	--
36	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
37	58%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
38	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
39	42%	AS/PL	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
40	66%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
41	68%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
42	46%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
43	--	--	--	--	--	--	--	--	--	--	--	--	--
44	52%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
45	56%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
46	48%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
47	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
48	50%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
49	52%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
50	50%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil

51	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
52	54%	no	mild	no	no	no	no	no	nil	1	wnl	sinus	nil
53	58%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
54	42%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
55	57%	no	no	no	no	no	no	no	no	1	wnl	sinus	nil
56	54%	no	no	2+	no	no	no	no	nil	1	wnl	sinus	nil
57	49%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
58	48%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
59	46%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
60	--	--	--	--	--	--	--	--	--	--	--	--	--
61	--	--	--	--	--	--	--	--	--	--	--	--	--
62	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
63	58%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
64	--	--	--	--	--	--	--	--	--	--	--	--	--
65	36%	AS	no	no	no	no	no	no	nil	2	wnl	sinus	nil
66	42%	no	mild	1+	no	no	no	no	nil	1	wnl	sinus	nil
67	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
68	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil

OST-OPERATIVE FOLLOW UP (10 years/ latest i.e within 10 years)													
Sr. No.	**LVEF**	**RWMA**	**PAH**	**MR**	**Symptoms**	**PCI**	**Re- Surgery**	**Mortality**	**Cause of death**	**FC**	**CXR**	**ECG**	**Other vascular events**
1	60%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
2	--	--	--	--	--	--	--	--	--	--	--	--	--
3	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
4	60%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
5	44%	PI	no	2+	no	no	no	no	nil	2	wnl	sinus	nil
6	48%	no	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
7	46%	AAS/PI	mod	2+	no	no	no	12/04/2008	CVA	2	wnl	sinus	CVA
8	66%	nil	no	no	no	no	no	no	nil	1	wnl	sinus	nil
9	50%	nil	mild	1+	no	no	no	no	nil	2	wnl	sinus	nil
10	58%	nil	no	1+	no	no	no	no	nil	1	wnl	sinus	nil
11	--	--	--	--	--	--	--	--	--	--	--	--	--
12	48%	no	mod	2+	no	no	MV REPL (2010)	no	nil	1	wnl	sinus	nil
13	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
14	--	--	--	--	--	--	--	--	--	--	--	--	--
15	60%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
16	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
17	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
18	44%	no	mild	no	no	no	no	no	nil	2	wnl	sinus	nil
19	44%	AS	mild	no	no	no	MV REPL (2012)	no	nil	1	wnl	sinus	nil
20	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
21	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil

22	55%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
23	60%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
24	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
25	51%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
26	61%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
27	48%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
28	54%	no	no	no	no	no	no	no	nil	1	wnll	sinus	nil
29	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
30	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
31	54%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
32	58%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
33	--	--	--	--	--	--	--	--	--	--	--	--	--
34	--	--	--	--	--	--	--	--	--	--	--	--	--
35	--	--	--	--	--	--	--	--	--	--	--	--	--
36	58%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
37	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
38	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
39	46%	AS	no	!+	no	no	no	no	nil	1	wnl	sinus	nil
40	66%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
41	68%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
42	46%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
43	--	--	--	--	--	--	--	--	--	--	--	--	--
44	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
45	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
46	52%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
47	56%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil
48	50%	no	no	no	no	no	no	no	nil	1	wnl	sinus	nil

49	52%	no	No	No	no	no	no	no	nil	1	wnl	sinus	nil
50	52%	no	No	No	no	no	no	no	nil	1	wnl	sinus	nil
51	56%	no	No	No	no	no	no	no	nil	1	wnl	sinud	nil
52	54%	no	No	No	no	no	no	no	nil	1	wnl	sinus	nil
53	58%	no	No	No	no	no	No	no	nil	1	wnl	sinus	nil
54	46%	no	No	No	no	no	No	no	nil	1	wnl	sinus	nil
55	57%	no	No	No	no	no	No	no	nil	1	wnl	sinus	nil
56	54%	no	No	No	no	no	No	no	nil	1	wnl	sinus	nil
57	50%	no	No	No	no	no	No	no	nil	1	wnl	sinus	nil
58	48%	no	No	No	no	no	No	no	nil	1	wnl	sinus	nil
59	48%	No	No	No	no	no	No	no	nil	1	wnl	sinus	nil
60	--	--	--	--	--	--	--	--	--	--	--	--	--
61	--	--	--	--	--	--	--	--	--	--	--	--	--
62	56%	No	No	No	no	no	No	no	nil	1	wnl	sinus	nil
63	58%	No	No	No	no	no	No	no	nil	1	wnl	sinus	nil
64	--	--	--	--	--	--	--	--	--	--	--	--	--
65	38%	AS	No	No	no	no	No	no	nil	2	wnl	sinus	nil
66	42%	No	No	No	no	no	No	no	nil	1	wnl	sinus	nil
67	50%	No	No	No	no	no	No	no	nil	1	wnl	sinus	nil
68	50%	No	No	No	no	no	No	No	nil	1	wnl	sinus	nil

APPENDIX – Plagiarism Check Report

Document Information

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Sources included in the report

SA	**Run3_Aben_i6228101_C%26L_BG3_Protocol.pdf** Document Run3_Aben_i6228101_C%26L_BG3_Protocol.pdf (D162919048)	1
W	URL: https://www.annals.in/article.asp?issn=0971-9784;year=2017;volume=20;issue=4;spage=432;epage=4... Fetched: 2022-05-19 08:40:32	4
W	URL: https://research.rug.nl/files/31587811/Complete_thesis.pdf Fetched: 2021-05-17 11:21:15	3
W	URL: https://www.science.gov/topicpages/m/mitral+regurgitation+imr.html Fetched: 2021-11-08 07:25:05	1
SA	**Sree Chitra Tirunal Institute, Thiruvananthapuram / Dr Rahul Thesis.pdf** Document Dr Rahul Thesis.pdf (D158578069) Submitted by: dash@sctimst.ac.in Receiver: sadh.sctims@analysis.urkund.com	2
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Entire Document

INTRODUCTION

It is common to use the words secondary, functional, and ischemic mitral regurgitation (MR) interchangeably to refer to distinguish from primary or degenerative MR, which is described as regurgitation brought on by mitral valve dysfunction valve leaflets (MV) and/or chordae that support them. The MV leaflets and chords are themselves in pure secondary MR. normal; However, structural and functional defects of the left ventricle prevent leaflet coaptation.(1) MR with ischemia is a subset of secondary MR where coronary artery disease is the underlying cause of left ventricular dysfunction and related ischemia and infarction of the myocardium.(2)

APPENDIX- Other
PROFORMA

PATIENT INFORMATION

SUBJECT CODE NO:

AGE:

GENDER:

PRE-OPERATIVE PARAMETERS:

RISK FACTORS / COMORBIDITIES:

Hypertension
Diabetes
Peripheral Arterial disease
Dyslipidemias
Chronic obstructive lung disease
Thyroid dysfunction
Chronic Kidney disease
NYHA Functional Class

IMAGING

ECHOCARDIOGRAPHY
- LVEF
- LVIDd / LVIDs
- MR
- RWMA
- VENTRICULAR FUNCTION

ECG-Pre op Rhythm

INTRA OPERATIVE PARAMETERS

On Pump/Off Pump
Total cardiopulmonary bypass time
Duration of surgery
Ventricular function
Number of grafts
Emergency /elective surgery
LMCA disease

APPENDIX- Other
PROFORMA

POST OPERATIVE PARAMETERS

Mortality
Myocardial infarction / Respiratory failure /Renal failure/ Arrythmias/ CVA
Second surgery /Angioplasty
Anticoagulation regimen
Arterial /venous conduits
Hospital Stay

FOLLOW UP

- If patient is deceased / alive (if deceased date and cause of death)
- ECG
- ECHO:
  1. Ejection fraction
  2. RWMA
  3. Left ventricle function
  4. PAH
  5. Status of MR

- Chest Xray
- Functional status assessment Post operative quality of life
- Symptoms (Fatigue, Exertional dyspnea, Palpitations, Features of heart failure)
- Second surgery (valve repair, replacement, revascularization i.e., surgical, Percutaneous)
- Any cerebrovascular events, or other systemic adverse cardiovascular events.

APPENDIX – Other

CONSENT FORM IN MALYLAM

(Local Language)

ഈഷ്മിക് എം ആർ ശസ്ത്രക്രിയാ ചികിത്സയ്ക്ക് ശേഷമുള്ള പത്ത് വർഷക്കാലത്തെ നേട്ടങ്ങൾ

ടെലിഫോൺ വഴി പങ്കാളികളെ ഉൾപ്പടുത്താനും അഭിമുഖത്തിനുമുള്ള കുറിപ്പ്

ഹലോ, എന്റെ പേര് ഡോ. അംശുമാൻ വാജ്പയ് എന്നാണ്. ശ്രീചിത്ര തിരുനാൾ ഇൻസ്റ്റിറ്റ്യൂട്ട് ഫോർ മെഡിക്കൽ സയൻസസ് ആന്റ് ടെക്നോളജിയിൽ നിന്നും ഒരു ഗവേഷണപഠനത്തിനായി വിളിക്കുകയാണ്. എനിക്ക് ..... (പഠനത്തിലുൾപ്പെടുത്താനദ്ദേശിക്കുന്നയാളുടെ പേര്) ആയോ അല്ലെങ്കിൽ അവരുടെ രക്ഷിതാക്കളുമായോ സംസാരിക്കാനാകുമോ?

ഇല്ലെങ്കിൽ പങ്കെടുപ്പിക്കാനുദ്ദേശിക്കുന്നയാൾ ഫോണെടുക്കുന്നതുവരെ കാക്കുക, അല്ലെങ്കിൽ വീണ്ടും വിളിക്കാൻ പറ്റിയ സമയം ചോദിക്കുക

ആണെങ്കിൽ:

ആശുപത്രി രേഖകളിൽനിന്നാണ് എനിക്ക് താങ്കളുടെ ഫോൺ നമ്പർ കിട്ടിയത്. ഇത് സംസാരിക്കാൻ പറ്റിയ സമയമാണോ.

അനുയോജ്യമെങ്കിൽ, മറ്റൊരു സമയത്ത് വിളിക്കാൻ ഏർപ്പാടുചെയ്യുക.

ഈഷ്മിക് എം ആർ ശസ്ത്രക്രിയാ ചികിത്സയ്ക്ക് ശേഷമുള്ള പത്ത് വർഷക്കാലത്തെ നേട്ടങ്ങൾ **എന്ന** ഒരു ഗവേഷണ പഠനത്തിനായാണ് ഞാൻ വിളിക്കുന്നത്. താങ്കളുടെ ദീർഘകാല നേട്ടങ്ങളെപ്പറ്റിയും ഇപ്പോഴത്തെ അവസ്ഥയെപ്പറ്റിയും അറിയുക എന്നതാണ് ഈ ഗവേഷണ പഠനത്തിന്റെ ഉദ്ദേശം. ഗവേഷണന പഠനത്തിൽ പങ്കെടുക്കുന്നത് പൂർണ്ണമായും സ്വമേധയായാണ്. താങ്കളോ /താങ്കളുടെ കുടുംബാംഗമോ പഠനത്തിൽ പങ്കെടുക്കാൻ താത്പര്യപ്പെടുന്നുണ്ടോ എന്നറിയാൻ, പഠനത്തിന്റെ അടിസ്ഥാന ആശയം വിശദീകരിക്കാൻ ഞാൻ 2-3 മിനിട്ട് എടുക്കുന്നതിൽ കുഴപ്പമില്ലല്ലോ.

താങ്കൾ പങ്കെടുക്കുവാൻ സമ്മതിക്കുകയാണെങ്കിൽ ക്ലിനിക്കിലേയ്ക്ക് വരുവാൻ ആവശ്യപ്പെടുകയും താങ്കളോട് പഠനത്തിന്റെ കൂടുതൽവിശദാംശങ്ങൾ ചർച്ചചെയ്യുകയും, പങ്കെടുക്കണോ വേണ്ടയോ എന്ന് താങ്കൾക്ക് തീരുമാനിക്കാനാവുകയും ചെയ്യും. പഠനത്തിൽ പങ്കെടുക്കുന്നതുകൊണ്ട് അപായമൊന്നുമുണ്ടാകില്ല. പ്രത്യേകിച്ച് ഇടപെടലുകളൊന്നും നടത്തില്ല. പങ്കാളികളുടെ പ്രവർത്തന തകരാറുകളുടെ ഹൃദയസംബന്ധമായ കാരണങ്ങൾ വിശദമായി വിലയിരുത്തും. മോശം നേട്ടങ്ങളുടെയും പ്രവർത്തനപരമായ തകരാറുകളുടെയും അപായഘടകങ്ങൾ കണ്ടെത്താൻ തുടർ പരിശോധനയും വിലയിരുത്തലും നടത്തുന്നത് സഹായകരമാകും. ഇത് പതിവ് വിലയിരുത്തലിന്റെ ഭാഗവുമാണ്.

താങ്കളുടെ വ്യക്തിവിവരങ്ങൾ രേഖപ്പെടുത്താതെ രേഖകൾ പാസ്വേർഡിനാൽ സംരക്ഷിക്കപ്പെട്ട കമ്പൂട്ടറിൽ സൂക്ഷിച്ച് താങ്കളെപ്പറ്റിയുള്ള വിവരങ്ങൾ രഹസ്യമാക്കിവയ്ക്കാൻ ഞങ്ങൾ പരമാവധി പരിശ്രമിക്കും. പിഴയൊന്നും കൂടാതെ താങ്കൾക്ക് ഏതുസമയത്തും പങ്കാളിത്തം അവസാനിപ്പിക്കാം. പഠനത്തെപ്പറ്റി ചോദ്യങ്ങളുണ്ടെങ്കിൽ താങ്കൾക്ക് എന്നെ ..... എന്ന നമ്പറിൽ ബന്ധപ്പെടാം. ഗവേഷണപങ്കാളിയെന്നനിലയിലുള്ള താങ്കളുടെ അവകാശങ്ങളെപ്പറ്റിയുള്ള ചോദ്യ

ങ്ങൾക്കോ, സാങ്കേതിക വിശദീകരണങ്ങൾക്കോ താങ്കൾക്ക് ബന്ധപ്പെടാം ഡോ. ശ്രീനിവാസ് ജി മെമ്പർ സെക്രട്ടറി, IEC, SCTIMST,. ഫോൺ നമ്പർ 0471-2524689, ഇമെയിൽ iec.mem.sec@sctimst.ac.in

സമ്മതിക്കുന്നെങ്കിൽ, അനയോജ്യമാണെങ്കിൽ യോഗ്യത രേഖപ്പെടുത്തുക,

രോഗി മരിക്കുകയും ബന്ധു "അദ്ദഹം മരിച്ചു" എന്നു മറുപടി നൽകിയാൽ

അദ്ദേഹത്തിന്റെ മരണത്തിൽ ഞാൻ അനുശോചിക്കുന്നു. താങ്കൾക്ക് മരണമടഞ്ഞ സമയം പറയാനാകുമോ, മരണകാരണത്തിന്റെ വിശദാംശങ്ങൾ നൽകാനാകുമോ?

താങ്കൾ സമ്മതിക്കുമെങ്കിൽ ഈ വ്യക്തിയുടെ ആശുപത്രി രേഖകൾ പരിശോധിക്കാമോ.സമ്മതമെങ്കിൽ. നന്ദി. മറ്റുള്ളവരിൽ സമാനമായ സങ്കീണ്ണതകൾ തടയാൻ വിശദാംശങ്ങൾ സഹായിച്ചേക്കാം. താങ്കളുടെ സമയത്തിന് നന്ദി.

വേണ്ടായെങ്കിൽ. അത് മനസ്സിലാക്കാനാകും. താങ്കളുടെ സമയത്തിന് നന്ദി.

APPENDIX – Other
CONSENT FORM (English Language)

TELEPHONE RECRUITMENT AND INTERVIEW SCRIPT

Study Title: The outcomes of Ischemic M R Surgery after 10 years

Hello, my name is Dr. Ansuman Vajpeyi. I'm calling from Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST) about a research study. Am I speaking to _____(name of recruit) or his/ her relative?

If "no," wait for recruit to pick up, leave a message, or ask for a time to call back. If "yes":

I got your phone number from the hospital records. Is this a good time to talk?

Arrange to call at another time, if appropriate.

I'm calling about a research study of the outcomes of Ischemic M R Surgery after 10 years. The purpose of this research study is to learn more about the long-term outcome and present condition of you. Joining a research study is completely voluntary. If it's alright with you I'd like to take about some time to explain the basic idea of the study and to see if you would be interested in you/your family member taking part. If you agree to participate, we will ask you to come to the clinic and explain more about the details of the study so that you can decide whether to participate in the study or not. There will be no risks for the participants because of participation in the study. No specific intervention will be done. The participants dysfunctions related to heart will be analyzed in detail. A follow up examination and evaluation may be helpful for finding the low benefits and risk factors of functional deficiencies of the heart and this follow up will be a routine assessment.

We will do our best to keep your information confidential by not mentioning your identity and keeping the records on a password-protected computer. If you do not want to give permission to analyze your medical records at any point of time you can choose to stop at any time without penalty. If you have questions about the

study, you can call me at …….. If you have questions about your rights as a research subject or technical clarifications, you can call Dr. G. Srinivas, Member Secretary, IEC, SCTIMST (Email: iec.mem.sec@sctimst.ac.in, Phone no. 0471-2524689)

If accepting: Document eligibility response and make appointment, if appropriate. If the patient has expired and relative replies that "He/ She is no more/ has expired"

I'm sorry to hear about his/her demise. Can you tell me the time of death and the details about the cause of death? If you are agreeable, can we go through the hospital records of this person?

If yes: Thank you. The details might be helpful in preventing similar complications in other people. Thank you for your time.

If *no*: That's perfectly understandable. Thank you for your time.

SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES

AND TECHNOLOGY, TRIVANDRUM

An Institution of National Importance established by an Act of the Indian

Parliament (Act No.52 of 1980)

Dept. of Science and Technology,
Govt. of India

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