CLINICAL STUDY OF CARDIAC MARKERS IN POST MYOCARDIAL INFARCTION PATIENTS ON ANTIHYPERTENSIVE DRUG THERAPY

A Dissertation submitted to

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

Chennai-600032

In partial fulfillment of the requirements for the award of degree of

MASTER OF PHARMACY

IN

PHARMACY PRACTICE

Submitted by

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DECLARATION

I do hereby declare that the dissertation entitled "**CLINICAL STUDY OF CARDIAC MARKERS IN POST MYOCARDIAL INFARCTION PATIENTS ON ANTIHYPERTENSIVE DRUG THERAPY"** submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai, is a record of independent work carried out in the Department of Pharmacy Practice, Swamy Vivekanandha College of Pharmacy, Tiruchengode in partial fulfillment for the degree of Master of Pharmacy Under the guidance of **Mr. S. ANANDKUMAR, M. Pharm.,** Swamy Vivekanandha College of Pharmacy, Tiruchengode. This work is original and has not been submitted earlier for the award of any other degree or diploma of this or any other university.

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"The act of thanks giving does not exhibit ones sense of gratitude, but the true tendency of leading a helping hand during emergency and the fact that every work has thousands of hands behind"

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Abbreviations

ABBREVIATIONS

ACS	Acute Coronary Syndrome
ANG I	Angiotensin I
ANG II	Angiotensin II
BP	Blood Pressure
CABG	Coronary Artery Bypass Grafting
CAD	Coronary Artery Disease
CK	Creatine Kinase
CK-MB	Creatine Kinase Myoglobin Binding
CTn	Cardiac Troponin
ECG	Electrocardiogram
HDL	High Density Lipid
LBBB	Left Bundle Branch Block
LDL	Low Density Lipid
MI	Myocardial Infarction
NSAIDS	Non-Steroidal Anti- Inflammatory Drugs
PILUAQ	Patient information leaflet usefulness assessment questionnaire
RAAS	Renin Angiotensin Aldosterone System
STEMI	St- Elevated Myocardial Infarction
T- I	Troponin – I
T-T	Troponin – T
URL	Upper Reference Limit
VLDL	Very Low Density Lipid

Abstract

ABSTRACT

Clinical study of Cardiac Markers in post myocardial Infarction Patients on Antihypertensive Drug Therapy

Aim and objective:

To assess the level of cardiac markers during anti-hypertensive drug therapy in post myocardial infarction patients.

Materials and methods:

A prospective – observational study was carried out in post myocardial infarction patients with history on antihypertensive therapy. Patient's demographic details, previous medical history of MI and duration on antihypertensive treatment were collected and the effectiveness of antihypertensive drug therapy on cardiac workload was evaluated with the help of cardiac markers by using one way ANOVA followed by Tukey- Kramer multiple comparison test. Patient information leaflet was prepared and assessed.

Results:

The study result showed that Ramipril has a greater control on troponin – I and CK-MB profile of the patients ($P < 0.01$) when compared to Nicorandil. After Ramipril, Amlodipine showed a significant control ($P < 0.05$) when compared to Nicorandil on Troponin – I profile.

Duration of antihypertensive drug treatment revealed that Ramipril decreases the incidence of second MI symptoms for longer duration than other drugs.

Conclusion:

Our study revealed that Ramipril has significant control on troponin-I and CK-MB level in post MI While amlodipine showed a significant control only on troponin-I.

Duration of antihypertensive drug treatment among the study population revealed that Ramipril decreases the incidence of second MI symptoms for longer duration and decrease the release of cardiac markers compared to other drugs. It may due to decrease in workload of heart by ACE inhibitors.

Patient information leaflet was prepared and distributed through cardiology department to improve patients understanding of disease management and the developed leaflet was found to be very useful by the patients.

Keywords: Cardiac markers, myocardial infarction, Antihypertensive drugs.

Introduction

1. INTRODUCTION

1.1 Myocardial Infarction:

The third universal definition of myocardial infarction is defined as myocardial necrosis in clinical setting consistent with myocardial ischemia. These conditions can be satisfied by a rise of cardiac biomarker values (preferably cardiac troponin cTn) above the 99th percentile upper reference limit with atleast one of the following:

- Symptoms suggestive of ischemia.
- ECG changes indicative of new ischemia (significant ST- segment/T- wave changes or left bundle branch block LBBB).
- Development of pathological Q – waves in the ECG.
- Imaging evidence of new loss of viable myocardium or regional wall motion abnormality.
- Detection of an intracoronary thrombus by angiography or autopsy.`[1]

1.2 Classification of myocardial infarction:

Based on ECG findings, MI is classified into ST elevated MI (STEMI), NON-ST elevated MI (NSTEMI), Q wave MI and NON-Q MI.

Based on pathological, clinical and prognostic differences along with different treatment strategies, they are broadly classified into 5 types:

A). Spontaneous myocardial infarction:

It is referred as atherosclerotic plaque rupture, ulceration, fissuring, erosion or dissection with resulting intraluminal thrombus in one or more of the coronary arteries which lead to decreased myocardial blood flow or distal platelet emboli with myocyte necrosis. The patient may have severe CAD/non-obstructive/no CAD.

B). Myocardial infarction secondary to ischemic imbalance:

It is defined as an imbalance between myocardial oxygen supply and or demand in condition other than CAD, for e.g Coronary endothelial dysfunction, coronary artery spasm, coronary embolism, tachycardia, bradycardia, arrhythmias, anemia, respiratory failure, hypotension and hypertension with or without LVH.

C). Myocardial infarction resulting in death when biomarker values are unavailable:

It refers to Cardiac death with symptoms suggestive of myocardial ischemia and presumed new ischemic changes in ECG or new LBBB but death occurs before blood samples could be obtained or before cardiac biomarker could raise or not collected.

D) 1. Myocardial infarction related to Percutaneous coronary intervention:

It is defined by elevated cardiac troponin values >5 with 99/ ≤ 99 percentile URL or a rise of cardiac troponin values >20% with elevated or stable or falling

baseline values. In addition with either symptoms of myocardial ischemia, ECG changes or new LBBB, loss of function of major coronary artery, new loss of viable myocardium or wall motion abnormality.

D) 2. Myocardial infarction related to stent thrombosis:

It is detected by either coronary angiography or autopsy in myocardial ischemia with a rise and/or fall of cardiac biomarkers values with atleast one above the 99th percentile URL.

E). Myocardial infarction related to coronary artery bypass grafting (CABG):

It is defined by elevation of cardiac biomarker values >10 with normal (99 percentile URL). In addition with either new Q waves/LBBB or new graft or coronary artery occlusion or imaging evidence of new loss of viable myocardium or wall motion abnormality. [2]

1.3 Epidemiology:

Cardiovascular disease is considered as one important priority in healthcare system worldwide and burden of these cardiovascular diseases is increasing in low, moderate and high income countries. In worldwide, mortality rate due to these diseases is 265 per 100,000 populations. In 2015, about 15.9 million people had MI in worldwide and 3million people had a STEMI.

By 2020, it is estimated that cardiovascular disease mortalities will increase by 15% in developed countries.[3, 4]

1.4 Pathophysiology:

Due to sudden disruption of an atheromatous plague, platelets adhere and become activated. It releases potent secondary aggregators like (thromboxane A2, adenosine diphosphate and serotonin). Other mediators activate the extrinsic pathway of coagulation, vasospasm (platelet aggregation and mediator release, within minutes the thrombus can evolve to completely occlude the coronary lumen of the coronary vessel. If it's partial known as NSTEMI and totally occlusive coronary vessel is known as STEMI. It leads to myocardial ischemia and necrosis.

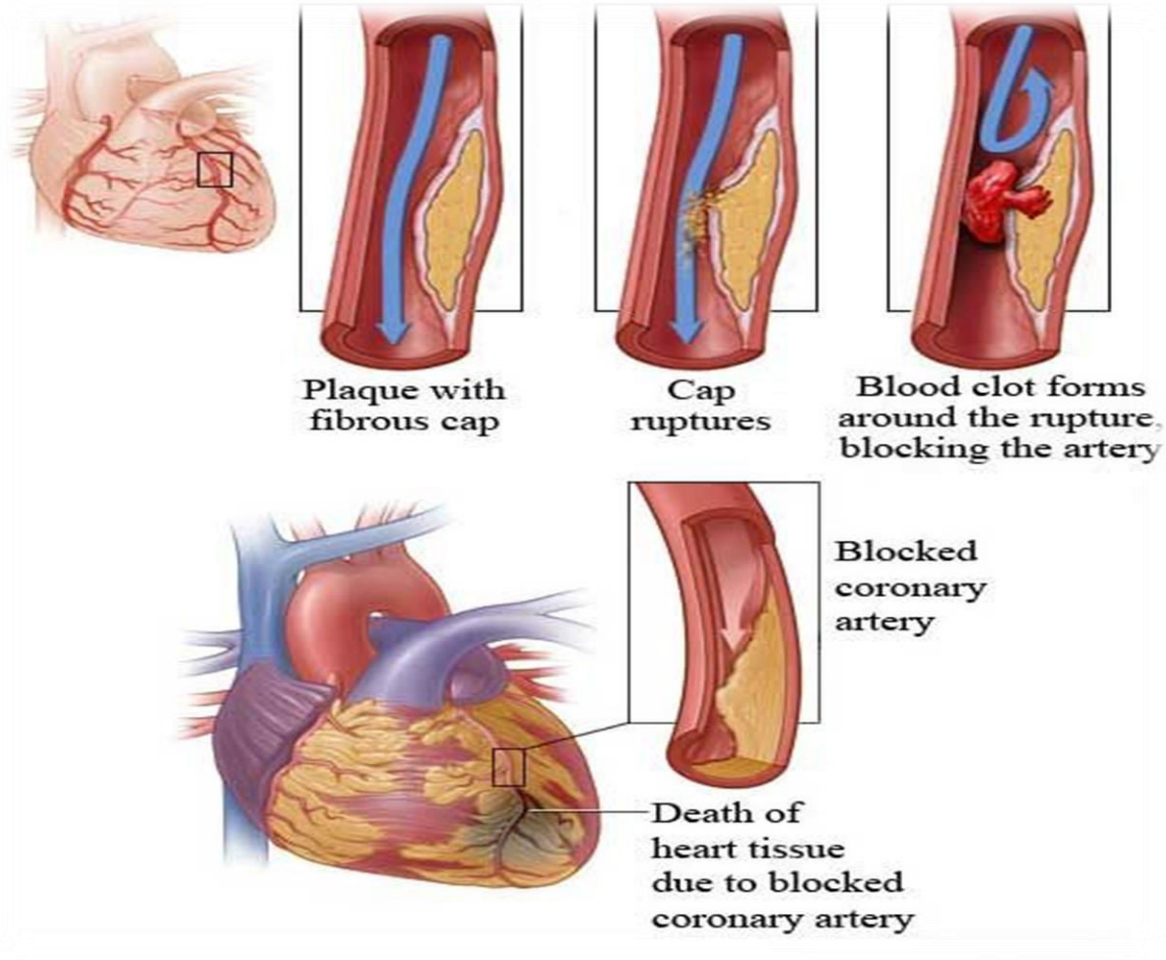


Figure: 1 Pathophysiology of myocardial infarction

1.5 Etiology:

- Atherosclerosis
- Age, Gender
- Family history
- Hypercholesterolemia
- Dyslipidemia
- Diabetes mellitus, hypertension
- Stress, obesity
- Sedentary life style
- Reduced consumption of fruits and vegetables
- Drug use
- Coronary occlusion secondary to vasculitis etc.[5]

1.6 Signs and Symptoms:

- Chest pain
- Radiation of chest pain to jaw, teeth, shoulder, arm and or back
- Dyspnea, shortness of breath
- Epigastric discomfort with or without nausea or vomiting
- Diaphoresis or sweating
- Syncope with or without other cause
- Impairment of cognitive function without other cause.

1.7 Diagnosis:

- ECG
- Echocardiogram
- Chest x-ray
- Coronary catheterization (angiogram)
- Exercise stress test
- Blood test
- Cardiac computerized tomography (CT)
- Magnetic Resonance Imaging (MRI)
- Cardiac markers such as CK, CK-MB, Troponin-I, Troponin-T.

1.8 Treatment:

Non Pharmacological treatment:

- To advice people to eat Mediterranean style diet like more bread, fruits, vegetables, fish, less meat and to replace cheese and butter with products based on plant oils.
- To advice people who drink alcohol to keep weekly consumption within safety limits (not more than 21 units of alcohol per week for men & 14 units for women).
- To undertake regular physical activity.
- To quit smoking.
- Advice patient to maintain healthy weight.

Pharmacological treatment:

1. Anti-platelet agents: Aspirin, Clopidogrel.
2. Nitrates: Nitroglycerin
3. Analgesics: Morphine sulfate
4. β-blockers: Metoprolol, Atenolol, Carvedilol
5. Anti-coagulants: unfractioned heparin, low molecular weight heparin like Dalteparin and Enoxaparin.
6. ACE inhibitors: captopril, Ramipril, Lisinopril, Enalapril.
7. Glycoprotein IIb/IIIa inhibitors: Abciximab, Eptifibatide, Triofiban.
8. Statins: Atorvastatin, Pravastatin.
9. Aldosterone antagonist: Epleronone.

Other treatment options:

- Percutaneous coronary intervention (PCI)
- Surgical Revascularization (CABG)
- Implantable cardiac defibrillators (ICDs).[6]

1.9 Cardiac markers:

Cardiac markers are substances that are released into the blood stream due to injury to the cardiac muscle.

It is used for the diagnosis of acute myocardial infarction or acute coronary syndrome due to myocardial damage.

1.10 Types of markers:

- Cardiac troponin I and T
- Creatine kinase (CK)
- Creatine kinase – myoglobin (CK-MB)
- hs – c – reactive protein (hs – CRP)
- Myeloperoxidase (MPD)
- Ischemic modified albumin (IMA)
- B type natriuretic peptide (BNP).

Cardiac troponin I and T:

Cardiac troponins are regulatory proteins that controls calcium mediated interaction between actin and myosin in cardiac muscle. They are more cardio specific than CK-MB.

Hence they are used mainly to aid in the diagnosis of chest pain patients with non-diagnostic ECG and also used as prognostic indicators of a MI and to identify patients having an increased risk from cardiac events resulting in death.

Troponin level begins to raise in 3 – 4 hours after the onset of ACS and roughly 80% of patients with ACS will have positive value at 3 hours. These levels remain elevated for 7 to 10 days. Normal range: <0.07mg/ml or <5mIU/ml.

Creatine kinase: (CK)

Ck is an enzyme which is present in high concentration in heart muscle, skeletal muscle, Brain and in other tissues. Levels are markedly increased in myocardial infarction, shock, circulatory failure and in muscular dystrophies.

CK begins to rise at 4 – 6 hour after MI, peak at 24 hours and return to normal within 48 to 72 hours.

Normal range: 25 – 200 U/L.

Creatine kinase – myoglobin: (CK-MB)

Cardiac tissue contains more of MB isoenzyme than skeletal muscle. Following a myocardial infarction there is a characteristic increase in serum CK activity. Although, measurement of activity of the MB isoenzyme was used in the past to detect myocardial damage, cardiac troponin measurement is now the preferred biomarker.

It is detected in serum within 2-4 hours after onset of symptoms and peaks at 6- 9 hours. It remains elevated for 72 hours.

Normal range: 5 – 25 IU/L.[12, 13]

1.11 Classification antihypertensive drugs:

Table: 1 classification antihypertensive drugs[8]

S. no	Generic name	Therapeutic dose (mg)	Maximum dose (mg)	Mechanism of action
1.	**ACE inhibitors**			Produce vasodialation effect
	Captopril	12.5mg	450mg	
	Enalapril	5mg	40mg	
	Fosinopril	10mg	80mg	
	Lisinopril	5mg	80mg	
	Perindopril	4mg	16mg	
	Quinapril	5mg	80mg	
	Ramipril	2.5mg	20mg	
	Trandopril	1mg	4mg	
2.	**ARBs**			Inhibit vascular smooth muscle contraction and produce vasodialation effect.
	Candesartan	8mg	32mg	
	Eprosartan	400mg	800mg	
	Irbesartan	150mg	300mg	
	Losartan	50mg	100mg	
	Olmesartan	20mg	40mg	
	Telmisartan	40mg	80mg	
	Valsartan	80mg	320mg	

3.	**Calcium channel blockers**			
	Amlodipine	2.5mg	10mg	Blocks calcium channel and exerts vasodialation
	Felodipine	5mg	10mg	
	Lercanidipine	10mg	30mg	
	Nefidipine	10mg	120mg	
	Diltiazem	180mg	540mg	
	Verapamil	80mg	480mg	
	Clinidipine	5mg	20mg	
4.	**Thiazide diuretics**			Produce diuresis by inhibiting the reobsorption of sodium.
	Hydrochlorthiazide	25mg	50mg	
	Chlorthalidone	12.5mg	100mg	
	Indapamide	1.5mg	5mg	
5.	**β – blockers**			Reduce cardiac output by decreasing arterial blood pressure
	Atenolol	25mg	100mg	
	Carvedilol	12.5mg	50mg	
	Labetolol	100mg	400mg	
	Metoprolol	50mg	450mg	
	Nebivolol	5mg	40mg	
	Oxprenolol	40mg	240mg	
	Pindolol	10mg	60mg	
	Propranolol	40mg	640mg	

6.	**Others** **Potassium sparing diuretic** Amiloride	 2.5mg	 10mg	Reduce potassium and hydrogen secretion and their subsequent secretion
7.	**Centrally acting alpha agonist** Clonidine	 0.1mg	 2.4mg	Reduce sympathetic outflow from the CNS and decreases peripheral resistance, heart rate, BP.
8.	**Vasodialator** Hydralazine Nicorandil	 50mg 10mg	 300mg 30mg	Produce peripheral vasodialating effect.
9.	**Aminoacid decarboxylase inhibitor** Methyldopa Moxonidine	 250mg 200mg	 3mg 0.4mg	Decrease plasma renin activity.
10.	**Quinazoline derivative** Prazosin	 0.5mg	 20mg	Decrease total peripheral resistance.
11.	**Aldosterone antagonist** Spironolactone	 12.5mg	 100mg	Increase the excretion of sodium, water and retains K.

During myocardial infarction, a level of cardiac markers is of crucial importance. In cardiac muscle they are tightly bound to the contractile apparatus and therefore plasma concentrations are extremely low. In myocardial injury, there is release of markers into the serum.

Each markers can risk stratify patients with chest pain but their specificities for myocardial injury, release and clearance characteristics differ. However, treatment of hypertension patients with antihypertensive drugs implicates clinical and circulating improvement. [14, 15]

The use of anti hypertensive drug therapy has been shown to reduce the risk of stroke and CHD in long term randomized controlled trials. It also confirmed that the long-term survival advantages associated with improved adherence to antihypertensive therapy after acute myocardial infarction. [16]

So in this present study we have evaluated the effect of antihypertensive drugs on cardiac workload with the help of cardiac markers in post myocardial infarction patients.

Review of Literature

2. LITERATURE REVIEW

B. Singh *et al.,* 2011 reviewed the usefulness of cardiac biomarkers like T-I, T-T, ck-mb, myoglobin, BNP, hs-CRP, myeloperoxidase, ischemia modified albumin in the diagnosis of ACS or AMI. Troponins are the prognostic indicators of MI and help to identify patients with increased risk. CK-MB assays have greater sensitivity in detecting smaller degree of myocardial damage and also for the diagnosis of reinfarction. Relative index improves specificity of CK-MB elevation for MI. myoglobin is the earliest marker but it lacks cardiac specificity. Hs-CRP, BNP, MPD, IMA is the emerging markers. Hence it is concluded that the cardiac markers are not only used for the diagnosis of AMI but also for risk stratification and prognostification of such patients. [13]

Kamble *et al.,* 2002 studied the effect of antihypertensive drugs on cardiac enzymes in hypertension with myocardial infarction in NIDDM. To determine the effectiveness of antihypertensive drugs, a prospective study was conducted in hypertensive patients who had MI and DM diagnosed by WHO criteria were divided into group I (control), group II (enalapril) and group III (atenolol). Blood samples were collected after the onset of symptoms of MI and compared. It is concluded that the potentiality of enalapril is involved in cellular metabolism & repair process of the heart after MI. Hence CK-MB is considered to have greater predictive diagnostic accuracy than CK.[14]

Kristin newby *et al.,* 2001 evaluated Bedside multimarker testing for risk stratification in chest pain units. This prospective study is designed to compare the ability of quantitative bedside measurement of CK-MB, myogloin & troponin I with different time to positivity characteristics to risk stratify patients with chest pain verses local laboratory results. It is concluded that rapid multi-marker analysis identifies positive patients earlier and provides better risk stratification for mortality than a single marker approach.[15]

Giampiero Mazzaglia *et*. *al.,* 2009 studied adherence to antihypertensive medications and cardiovascular morbidity among newly diagnosed hypertensive patients. The study concluded that long-term reduction of acute cardiovascular events associated with high adherence to antihypertensive treatment underscores its importance in assessments of the beneficial effects of evidence-based therapies in the population. An effort focused on early antihypertensive treatment initiation and adherence is likely to provide major benefits.[16]

Minuro Yoshiyama *et al.,* 2005 studied Angiotensin converting enzyme inhibitor prevents left ventricular remodeling after MI in Angiotensin II type I receptor knockout mice. To elucidate the effect of ACE inhibitors that is not mediated by the AT_1 receptor on LV remodeling. A study was conducted on mice in which MI was experimentally induced in WT & KO mice. Both control and test mice were treated with ace inhibitors & 4 weeks after MI, cardiac function was assessed by Doppler echocardiography and northern blot analysis. The study was concluded

that ace inhibitor prevents LV remodeling after MI by mechanisms other than inhibition of Angiotensin AT_1 receptor mediated effects.[17]

Dirk weskrmann *et*. *al.,* 2016 studied diagnosis of myocardial infarction using a high sensitivity troponin I, 1 hour algorithm. A prospective cohort study was conducted on troponin – I assay for the diagnosis of acute myocardial infarction. With application of low troponin I cut off value of 6ng/ml, 1 hr approach was comparable to a 3 hr approach & these two independent cohorts further validated the performance of this algorithm with high negative and positive predictive values. It results that patients with possible AMI can be triaged within 1hr after admission with no loss of safety which enables safe discharge or rapid treatment initiation after 1 hour.[18]

Doson chua *et al.,* 2011 evaluated Angiotensin converting enzyme inhibitors: An ACE in the hole for everyone. It is designed to study the use of ACE inhibitors to treat cardiovascular disorder. The use of ACEI's in heart failure is well established and as proven to reduce mortality and morbidity. It is now routinely used in MI patients to reduce reinfarction, mortality risk and is combined with a diuretic for a secondary prevention in stroke patients. It also reduces the progression of diabetic nephropathy. It is evident that ACEI's should be considered for all patients with diabetes or a history of cardiovascular diseases, except for those at low risk.[19]

Mehmet Akif cakar *et al.,* 2012 analyzed the effect of admission creatinine levels on one - year mortality in acute myocardial infarction. A prospective study is conducted to find the relationship between admission creatinine level and one year mortality in patients with acute myocardial infarction. In this, patients were divided into 2 groups (normal & elevated groups). According to admission serum creatinine level which is measured within 12 hours of acute myocardial infarction and one year mortality rates were evaluated. This study concluded that the mildly elevated admission serum creatinine levels are markedly increased to one year mortality in patients with acute myocardial infarction.[20]

Vinay rao *et al.,* 2014 evaluated Risk factors for acute myocardial infarction in coastal region of India: A case – control study. A prospective case control study is done to assess the risk factors and their influence for AMI. A total of 100 cases of both age and gender matched controls were taken and their prevalence on risk factors like age, sex, diet, smoking, alcohol consumption, history of hypertension, history of diabetes mellitus & lipid profile were studied. This results that smoking and heavy drinking cessation, treatment of hypertension, reduction in blood glucose, correction of abnormal lipid profile either through use of statins or by dietary modifications may be important in preventing IHD in Asian Indians.[21]

Pieter J de Kam *et al.,* 2004 studied the revised role of ACEI's after MI in the thrombolytic/ primary PCI era. In this, the process of left ventricular dilatation and the effects of ACEI's after MI is studied. It has been generally accepted that

progression of LV dilatation is a major predictor of heart failure and death after MI. Also, attenuation of LV dilatation is the main mechanism by which ACEI's exerts their beneficial effect. Reperfusion is obtained much more frequently and LV dilatation after MI has become less prevalent. Neverthless, ACEI's proved effective in reducing cardiac morbidity and mortality. Therefore mechanisms other than attenuation of LV dilatation such as anti-atherosclerotic effects or plaque stabilization may explain the long term beneficial effects of ACEI's after MI. [22]

Tobias reichlin *et al.,* 2009 studied early diagnosis of myocardial infarction with sensitive cardiac troponin assays. A prospective, international, multicenter study is designed to examine the diagnostic performance of new sensitive cardiac troponin assays for the early diagnosis of acute myocardial infarction in emergency department. Cardiac troponin assays were performed in patients who presented with symptoms suggestive of AMI and their levels were determined in a blinded fashion with the use of 4 sensitive assays (Abbott – architect T-I, Roche high – sensitive T-T, Roche T-I & Siemens T-I ultra) and a standard assay (Roche T-I). The final diagnosis was adjudicated by 2 independent cardiologists. It is concluded that the diagnostic performance of sensitive cardiac troponin assays is excellent and these assays can substantially improve the early diagnosis of AMI, particularly in patients with a resent onset of chest pain.[23]

Asli tanindi *et al.,* 2011 evaluated Troponin elevation in condition other than acute coronary syndrome. This study focuses on causes of troponin elevation other than ACS. Acute coronary syndrome comprise a large spectrum of clinical conditions ranging from unstable angina pectoris to acute ST- elevation MI. chest pain is usually the major symptom of atherosclerotic heart disease. However, it may be challenging to diagnose correctly in a ambiguous way that pain characterized by some patients. Cardiac troponins are sensitive and specific biomarkers used in the diagnosis of MI, they are the cornerstone for the diagnosis and risk assessment of MI. Troponin elevation indicates the presence, not the mechanism of MI. There are many clinical conditions other than MI that cause troponin elevation. Physicians should be aware of the wide spectrum of disease states that may result in elevation of troponin and have a clear understanding of the related pathophysiology to effectively make a differential diagnosis. [24]

Claudio picariello *et al.,* 2011 this study focuses on hypertensive patients with acute coronary syndrome, to elucidate wheather the patients are at higher risk and deserve a tailored approach for management and followup. Arterial chronic hypertension is a well known cardiovascular risk factor or development of atherosclerosis. To explain the relation between hypertension and acute coronary syndrome, risk factors such as genetic risk, insulin resistance, sympathetic hyperactivity and vasoactive substances. Hypertension is associated with the development of atherosclerosis which in turn contributes to progression

of MI. Hence hypertensive patients with acute coronary syndrome are more likely to be older, female, non-white ethnicity and having higher prevalence of co-morbidities data on the prognostic role of a preexisting hypertensive state on ACS patients are so far contrasting. [25]

Swee han lim *et al.,* 2013 evaluated the use of cardiac markers in the diagnosis of acute coronary syndrome. Cardiac troponins are the most sensitive and specific biochemical marker of myocardial damage and an important diagnostic tool in the evaluation of ACS. However, high sensitivity troponins (hstn) have increased accuracy in the diagnosis of acute myocardial infarction and this combination may negate the need for other cardiac markers, but not the relative change. It has lower specificity in comparison with traditional troponin and its level may be elevated even in certain non-ACS settings. Given these pitfalls, the assessment of ACS most still is global, comprising clinical history, electrocardiogram changes, troponin change, and nuclear scan showing new loss of viable myocardium. Identification of patients with unstable patients without MI also remains a challenge, as the sensitivity of cardiac troponin in this area remains moderate to low. However, new cardiac markers such as copeptin, ischemia-modified albumin and heart type acid binding protein are still being studied and provide a window of hope in the diagnosis of unstable angina.[26]

James A.de Lemos *et al.,* 2006 studied the prevalence and determinants of CTnT elevation in a large, representative sample of the general population. The

dallas heart study is a population-based, multiethnic, probability sample of residents of dallas country, designed to study subclinical cardiovascular disease. In the general population, CTnT elevation is rare in subjects without CHF, LVH, CKD or DM suggesting that the upper limit of normal for the immunoassay should be <0.01µg/l. even minimally increased cardiac troponin T may represent subclinical cardiac injury and have important clinical implications, a hypothesis that should be tested in longitudinal outcome studies.[27]

Andrea Milde hrn *et al.,* 2016 evaluated the association between pain sensitivity and recognition of myocardial infarction. A cross – sectional study is conducted in participants who underwent the cold pressor test (a common experimental pain assay) and ECG. Participants with unrecognized myocardial infarction endured the cold pressor test significantly longer than participants with recognized myocardial infarction. The association between unrecognized MI and lower pain sensitivity was stronger in women than in men and statistically significant in women only, but interaction testing was not statistically significant (P = 0.14). It is concluded that persons who experience unrecognized MI have reduced pain sensitivity compared with persons who experience unrecognized MI have reduced pain sensitivity compared with persons who experience recognized MI. This may partially explain the lack of symptoms associated with unrecognized MI.[28]

Robert A. Byrne *et al.,* 2016 a retrospective cohort study is conducted to assess the prognostic value of hs-cTnT and the influence of sex in patients with stable coronary artery disease undergoing elective percutaneous coronary intervention. Primary endpoint was all-cause mortality. Unadjusted hazard ratio (HR) in overall and sex – specific population and multivariable adjusted HR were calculated by using COX proportional hazard models. In elevated hs-CTnT levels, 99 percentile URL were observed at baseline, mortality is increased in patients with the sex – specific 99th percentile URL compound to those with normal hs-CTnT. It was concluded that in patients with stable coronary artery disease undergoing elective percutaneous coronary intervention, pre-procedural hsCTnT was a strong predictor of mortality in both men and women.[29]

Sabesan mythili *et al.,* 2015 studied the Diagnostic markers of acute myocardial infarction. This review is done to determine the various cardiac biomarkers released during the event of an AMI. AMI is a major cause of morbidity and mortality worldwide. The highest risk of fatality occurs within the initial hours of onset of AMI. Thus, early diagnosis of cardiac ischemia is critical for the effective management of patients with AMI. Improper diagnosis leads to inappropriate admission of patients without AMI and vice versa. In addition to clinical history, physical examination, accurate electrocardiogram finding & assessment of cardiac biomarkers have an important role in the early diagnosis o acute ischemia. It is concluded that cardiac biomarkers has become the frontline diagnostic tools for AMI and has greatly enabled the clinicians in the rapid

diagnosis and prompt treatment planning, thereby reducing the mortality rate to a great extent. [30]

Hafidh A. Al – Hadi *et al.,* 2009 reviewed Cardiac markers in the early diagnosis and management of patients with acute coronary syndrome. This review is based on available markers of myocardial damage such as CK, CK-MB, CK-MB isoforms, heart type fatty acid-binding protein, myoglobin, CTnT, CTnI. Chest pain is the most frequent reason for patients seeking urgent medical attention. The current diagnostic and triage system based on clinical history & electrocardiograms are insufficient, this may results in misdiagnosis and delayed treatment. Hence this study concluded that the triage and management of patients with chest pain can be considerably improved by implementation of serial cardiac markers testing that identifies ACS in the very early stage of presentation.[31]

Pedrinelli R *et al.,* 2012 evaluated Hypertension and acute myocardial infarction: an overview. This review focuses on the hypertension which is a frequent finding in patients with acute myocardial infarction and its recurring association with female, DM, older age, less frequent smoking and more frequent vascular co-morbidities. Antecedent hypertension associates with higher rates of death and morbid events both during the early and long term course of AMI, particularly if complicated by left ventricular dysfunction and CHF. ACE inhibition and aldosterone antagonism exerts particular benefits in that higher risk

hypertensive subgroup. Higher systolic pressure at the onset of chest pain associates with lower mortality with in 1year from coronary occlusion whereas after hemodynamic stabilization, there is an inconsistent relationship with recurring coronary events in the long-term follow up. Hence antihypertensive treatment in post MI prevents ischemic relapses is uncertain. Excessive drop of diastolic pressure may jeopardize to new acute coronary events, to know about the underlying mechanisms it needs further evaluation. [32]

Alharbi F F. ***et al.,*** **2017 s**tudied the risk of acute MI after discontinuation of anti-hypertensive agents. A case control study. A nested case control cohort study is done to assess the association between discontinuation of different antihypertensive agents and the risk of AMI. In this study, patients who were hospitalized or their first AMI is considered as cases and controls were not hospitalized for AMI. Patients were divided into antihypertensive users and discontinuers as recent (≤ 90 days), intermediate term (91-180), long term (≥ 180 days). The risk of AMI is significantly increased in discontinuers regardless of time compared to current users of drugs like β-blockers, CCBs, diuretics, ACEIs. This study concluded that the discontinuation of antihypertensive drugs increases the risk of AMI after >90 days of discontinuations. Hence it implies the importance of antihypertensive drug therapy to reduce the risk of AMI in patients with hypertension.[33]

Giovanni corrao *et al.,* 2011 assessed whether antihypertensive Monotherapy or a combination antihypertensive therapy provides a greater CV protection in daily clinical practice. A case control study is carried out in patients aged 40 to 79 years who were newly treated with antihypertensive drug. Cases were patients who experienced hospitalization for CV disease and controls were randomly selected. Logistic regression was used to model the CV risk associated with starting on and or continuing with combination therapy. It results that patients with combination therapy had 11% CV risk reduction with those starting on Monotherapy. Hence this study concluded that in daily life practice, a combination of antihypertensive drug is associated with great reduction of CV risk.[34]

Garry tavern *et al.,* 2016 assessed the effect of antihypertensive pharmacotherapy in preventing sudden cardiac death, non-fatal MI & fatal MI among hypertensive individuals, a randomized trial is done to select the patients. Comparison include one or more antihypertensive drug verses placebo or no treatment. The search methods include Cochrane register of studies online, Ovid MEDLINE, Ovid EMBASE, clinical trial.gov. This study concluded that antihypertensive drugs reduce incidence of fatal and non-fatal MI but they didn't reduce the incidence of sudden death. Continued research is needed to determine the causes of sudden cardiac death.[35]

James J Dinicolantonia *et al.,* 2015 studied β – blockers in hypertension, diabetes, heart failure, and acute myocardial infarction. This review focuses on β – blocker which is an essential class of cardiovascular medications for reducing morbidity and mortality in heart failure patients. This review discusses the cornerstone clinical trials that have tested β - blockers in the settings of HTN, DM, and stable CHD. This study mainly tested on the non-vasodialating β1 selective blockers like atenolol, metoprolol and vasodialating β – blockers like carvidilol, nebivolol to determine the advantages over the other. This study concluded that carvidilol may have an advantage over the first generation β – blockers in patients with heart failure and acute myocardial infarction.[36]

Muhammed firdaus *et al.,* 2008 studied the prevention of cardiovascular events by treating hypertension in older adults. An evidence – based approach. A systematic pubmed search was conducted to look for evidence showing benefits of lowering BP in older hypertension adults. Lowering BP in these individuals will significantly reduce the risk of CAD, stroke and all cause mortality. From the trial evidence, it is found that a low dose diuretic should be considered as initial therapy for most hypertensive older adults. To prevent cardiovascular mortality and morbidity, therapy with >1 medication is often necessary to reduce BP in these patients.[37]

Csaba farsang *et al.,* 2011 evaluated the Indication and utilization of angiotensin receptor II blockers in patients at high cardiovascular risk. This review focuses on

ARBs which reduces the risk of cardiovascular events partly beyond that of blood pressure lowering effect. It has been shown ARBs are cardiovascularly protective and well tolerated. Although the eight available ARBs are all indicated for the treatment of hypertension, they have partly different pharmacology, pharmacokinetic and pharmacodynamic properties. Due to ARBs trials for the reduction of cardiovascular risk classification of differences in patients have led to their indications in different populations. It results that for patients at high cardiovascular risk, telmisartan is indicated. For patients with hypertension and specific risk factors losartan and irbesartan is effective. At highest cardiovascular risk with heart failure and left ventricular dysfunction candesartan, losartan and valsartan is indicated.[38]

Giovanni corrao *et al.,* 2017 evaluated the protective effects of antihypertensive treatment in patients aged 85 years or older. To assess whether in individuals aged 85years or older adherence to antihypertensive drugs reduces the risk of cardiovascular events. A case control study is done on patients aged 85 years or older who were newly treated with antihypertensive drugs. Cases were who experienced death/hospital discharge for stroke, MI or heart failure. Upto 5 controls were randomly selected for each case. It concluded that the risk of CV morbidity in patients aged 85 years or more were reduced in adherence with antihypertensive drug therapy.[39]

Neil poulter *et al.,* 2010 studied the effect of ARBs in reducing the CV risk. Evidence shows that ARBs are better tolerated compared to the other major drug classes in the treatment of hypertension patients. Overall, CV protective effects are similar between ACE inhibitor and ARBs but compared to other agents ARBs may offer better stroke protection. There is no robust evidence that ARBs are associated with significantly increased CV events, including MI compared to other anti-hypertensive agents.[40]

Scott D. solomon *et al.,* 2007 studied the Effect of antecedent hypertension and follow- up blood pressure on outcomes after high risk myocardial infarction. To assess the relationship between antecedent hypertension and outcomes and the association between elevated systolic BP >140mm Hg or low BP <100mm Hg in 2 or 3 follow up visits during the first 6 months and subsequent CV events over a median 24.7 months of followup. Antecedent hypertension independently increased the risk of MI, HF, stroke, CV death or cardiac arrest. While low BP in the post MI period was associated with increased risk of adverse events. Patients with elevated BP were at significantly increasing the risk of stroke and combined cardiovascular events. Six months after a high-risk MI, elevated systolic BP a potentially modifiable risk factor is associated with an increased risk of subsequent stroke and CV events.[41]

Noah jarari *et al.,* 2016 studied a review on prescribing patterns of antihypertensive drugs. This review focuses on the antihypertensive medication

utilization, cost factors, adherence and guidelines in prescribing medications in different settings. It has been estimated that by 2025, 1.56 billion individuals will have hypertension. Due to the increase in cost and prevalence influences the prescribing patterns among physician and compliance to the treatment by the patient. The recent guidelines by the JNC8 recommended both CCB as well as ACE inhibitors as first line drugs. Combinations are generally used for effective long-term management and to treat co-morbid conditions. It concluded that in India, more systematic studies are required on the evaluations of prescribing patterns and guidelines based antihypertensive medication which can be tailored to suit the patient's requirements.[42]

Saad shafquat *et al.,* 2007 evaluated Drug compliance after stroke and myocardial infarction: A comparative study. To assess whether compliance with prescribed medication after stroke or MI is similar in these 2 populations, a retrospective study is done on patients who had first-ever stroke or MI and compliance were assessed through telephonic survey. It results that compliance is highest with anti-hypertensive drugs followed by anti-platlet drugs and anti-lipid agents. It is concluded that compliance with prescribed regimens is appreciably lower after stroke than after MI.[43]

Lori M. Dickerson *et al.,* 2005 studied Management of hypertension in older persons. Antihypertensive therapy has been shown to reduce morbidity and mortality in older patients with elevated systolic or diastolic BP. This benefit

appears to persist in patients older than 80 years, but less than one-third of the older patients have adequate blood pressure control. Systolic BP is the most important predictor of CVD. Low dose thiazide diuretics remain first line therapy or older patients. β – Blockers, ACE inhibitors, ARB's and CCB's are the second line medications that should be selected based on co-morbidities and risk factors.[44]

Shahid akbar *et al.,* 2014 studied the current status of β – blockers use in the management of hypertension. This review focuses on the evolutionary changes of clinical uses of β – blockers in hypertension and advantages of newer additions to the group. β – Blockers are one of the most extensively used therapeutic drugs in both cardiac and non-cardiac ailments. Current uses of β – blockers in cardiovascular disease include ischemic heart diseases, hypertension, cardiac arrhythmias and heart failure. Other non- cardiac uses include glaucoma, migraine, situational anxiety, benign essential tremors and cardiac symptoms of thyrotoxicosis.[45]

Robert J. Henning *et al.,* 2015 reviewed recent advances in the diagnosis and treatment of myocardial infarction. The third universal definition of MI requires cardiac myocyte necrosis with an increased or decreased in CTn measurement during symptoms o myocardial ischemia, ECG ST-segment /T wave changes/left bundle branch block, development of pathological ECG Q waves, regional wall motion abnormality identified by an imaging technique, identification of

intracoronary thrombus by angiography. There have been significantly advances in adjunctive pharmacotherapy, procedural techniques and stent technology in the treatment of patients with MI. The routine use of antiplatelet agents and PCI reduces patient's morbidity and mortality. Human bone marrow mononuclear cells have more advantages. These studies established that the intramyocardial/intracoronary administration of stent cells is safe. Additional clinical studies with cardiac stem cells are in progress.[46]

Jennifer frank *et al.,* 2008 studied the Management of hypertension using combination therapy. Most patients with hypertension require more than a single antihypertensive agent, particularly if they have co-morbid conditions. A JNC guideline recommends diuretic therapy as initial treatment for patients with hypertension. For patients with hypertension and diabetes mellitus β-blockers, ACE inhibitors and or CCBs and diuretic is recommended. For hypertension with coronary disease Diuretic, β-blockers, ACE inhibitors and or CCBs is recommended. For post MI, ACE inhibitors, β-blockers, aldosterone antagonist is recommended. ACE inhibitors and ARBs are recommended for patients with hypertension and CKD. Diuretic and ACE inhibitors are recommended for recurrent stroke prevention in patients with hypertension.[47]

Bryam Williams *et al.,* 2005 studied recent hypertension trials – implications and controversies. These studies have provided definitive evidence of a treatment benefit and the weight and consistency of the clinical evidence has led

to uniformity in many aspects of treatment recommendations worldwide. However, controversies remain-in particular wheather specific class of drugs offer benefits for CVD prevention. Clinical trials are of short duration and there are more marked drug specific differences in intermediate cardiovascular structure, functions and metabolic end points. Although, blood pressure lowering is undoubtedly beneficial, the most effective way to go beyond BP is to add a statins.[48]

Chantal bourgaut *et al.,* 2001 studied Antihypertensives and MI risk: the modifying effect of history of drug use. A case – control study is done to examine the controversy around MI risk in relation to antihypertensive agents by considering past drug history both as a confounder and as an effect modifier. In this, patients who had received ACEIs, CCBs / β-blockers and MI cases were identified and included in this study. Controls were matched to each case to account for duration and timing of follow up. It results that the use of CCBs & ACEIs Vs β-blockers increased the risk of MI. However, the risk for CCB use disappeared in patients who had already used these agents in the past. Hence this study concluded that past drug history can be both a confounder and an effect modifier.[49]

Myron L. weisfeldt *et al.,* 2007 studied advances in the prevention and treatment of CVD. Over the past 35years, usage adjusted mortality from CVD decline 50%. This marked reduction reflects advances in the prevention,

diagnosis and treatment of common CV conditions. They played a major role in the prevention of atherosclerosis and its consequences: heart attack, stroke and heart failure. Additionally, novel device-based therapies contribute to the decline in cardiac morbidity and mortality. It is hoped life style changes, early risk-factor screening and more efficacious drugs will strikingly reduce CVD in the future.[50]

Norm R.C Campbell *et al.,* 2009 the association between the changes in antihypertensive therapy with changes in hospitalization and death from major HTN related CVD in Canada. Using various databases**,** Canadian standardized yearly mortality and hospitalization rates per 1000 for stroke, HF and AMI were calculated for individuals aged ≥20 years and regressed against anti-hypertensive prescription rates and changes were examined in a time series analysis. It results in significant reduction in rate of death and hospitalization rate with an increase in anti-hypertension prescriptions and that it coincides with the introduction of the Canadian hypertension education programme.[51]

Mathias Abiodun Emolepae *et al.,* 2017 evaluated CK-MB activity in uncomplicated hypertension and to determine whether sex difference exist in the activity of the enzyme. A prospective case controlled study is done on Nigerians with hypertension. Serum CK-MB, T-I and lipid profile were assayed using selectra pros chemistry analyser. The control groups of normotensive subjects were included. It results that serum CK-MB activity was higher in female than male hypertensive subjects. There was low or no difference in CK-MB and T-I

activity in normotensive subjects. Hence cardiac markers should e routinely done in the evaluation of hypertension subjects and sex specific consideration may be recognized in the management of the patients. [52]

Dorairaj Prabhakaran *et al.,* 2016 studied cardiovascular diseases in India. A quarter of all mortality is attributable to CVD. IHD and stroke are the predominant causes for 80% of CVD deaths. In India, it is estimated that age standardized CVD death rate of 272 per 10 0000 population is higher than the global average of 235 per 100000 population. It is concluded that to address the socioeconomic and healthcare needs of the Indians, more resources need to be directed toward applying the excisting knowledge base to tackle the CVD epidemic in policy, programs, capacity building and research arenas.[53]

Aim and Objectives

3. AIM AND OBJECTIVES

Aim

To assess the level of cardiac markers during anti-hypertensive drug therapy in post myocardial infarction patients.

Objectives

- To evaluate the effect of anti-hypertensive drugs on cardiac workload in post myocardial infarction patients.
- To assess changes in the level of cardiac markers in post - MI.

Plan of Work

4. PLAN OF WORK

The proposed study entitled “CLINICAL STUDY OF CARDIAC MARKERS IN POST MYOCARDIAL INFARCTION PATIENTS ON ANTIHYPERTENSIVE DRUG THERAPY” was planned and carried out in a tertiary care hospital as given below.

Phase I

- Identification of research problem and scope of the study
- Literature survey
- Preparation of study protocol
- Obtaining approval from ethical committee

Phase II

- Design of structured proforma
- Patient selection
- Obtaining patient consent
- Data retrieval from cardiology and medical record department

Phase III

- Data analysis
- Report submission

Methodology

5. METHODOLOGY

5.1 STUDY DESIGN

The study was a Prospective – Observational study.

5.2 STUDY SITE

The study was carried out in the department of cardiology at Vivekanandha Medical Care Hospital (VMCH), Elayampalayam, Tiruchengode.

5.3 DURATION OF THE STUDY

The study was conducted from July 2016 to June 2017 in the department of cardiology.

5.4 INCLUSION CRITERIA

- ✓ Age > 40 years
- ✓ Gender – both male and female
- ✓ Patients with post myocardial infarction
- ✓ Patients with previous history on anti-hypertensive drug therapy.

5.5 EXCLUSION CRITERIA

- ✓ Pregnancy
- ✓ Patients with multi-antihypertensive drug therapy
- ✓ Patients with chronic renal failure
- ✓ Hypothyroidism.

5.6 STUDY APPROVAL

The study was approved (Ref.No:SVCP/IEC/JAN/2016/14) by institutional ethical committee of Vivekanandha Medical Care Hospital (Annexure – 1)

5.7 STUDY POPULATION

The study was conducted in Vivekanandha Medical Care Hospital, total 250 patients who are having post MI and on antihypertensive drug therapy were screened and 108 patients was selected based on the following inclusion and exclusion criteria for further study.

5.8 DATA SOURCE

Data was collected from patient record, interviewing patient/ caretakers and from medical record department.

5.9 STUDY METHOD

Patients with post myocardial infarction with history on antihypertensive therapy were selected for the study. Patient demographic details, previous medical history of MI and duration on antihypertensive treatment were collected from medical record department and the effectiveness of antihypertensive drug therapy on cardiac workload was evaluated with the help of cardiac markers. Patients were provided with information leaflet to improve understanding of disease management.

5.10 DATA ENTRY FORM

A specially designed data entry form was used in this study. It consists of following details name, age, sex, IP No, reason for admission, past medical history, past medication history, family history, social history, laboratory investigations, diagnosis and therapeutic chart was noted. (Annexure – 4)

5.11 STATISTICAL ANALYSIS

Statistical analysis was done using graph pad Instat software, version 3.01. Results were expressed as Mean ± SD. One way ANOVA followed by Tukey – Kramer multiple comparison test were used to analyze the statistical different of various groups. $P < 0.05$ was considered significant.

5.12 PATIENT INFORMATION LEAFLET

Patient information leaflet was prepared and distributed through cardiology department and its usefulness was assessed by using patient information leaflet usefulness assessment questionnaire (PILUAQ).

Results

6. RESULTS

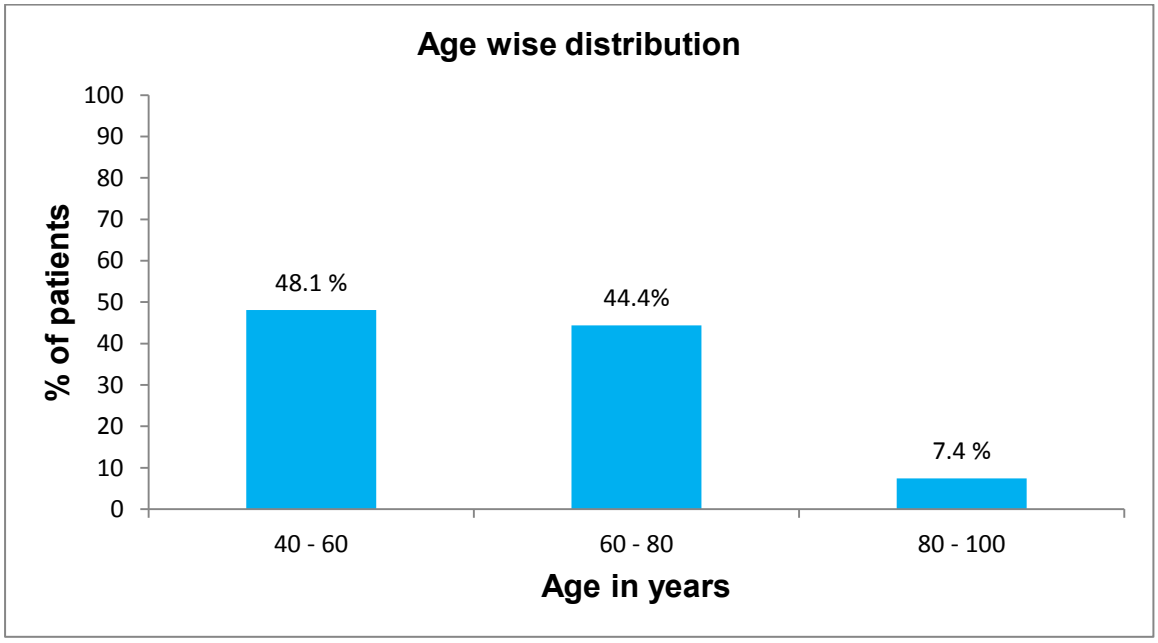
6.1. Age distribution of myocardial infarction patients

Among the 108 MI patients 52 (48.1%) were in the age group of 40 – 60, 62 (57.4%) were in the age group of 60 – 80 and 8 (7.4%) were in the age group of 80 -100. The age distribution showed that the age more than 60 are more prone to myocardial infarction.

Table: 2 Age distribution of myocardial infarction patients

S.no	Age in years	Number of patients	Percentage (%)
1.	40 - 60	52	48.1
2.	60 -80	48	44.4
3	80 - 100	8	7.4

Figure: 2 Age distribution of myocardial infarction patients



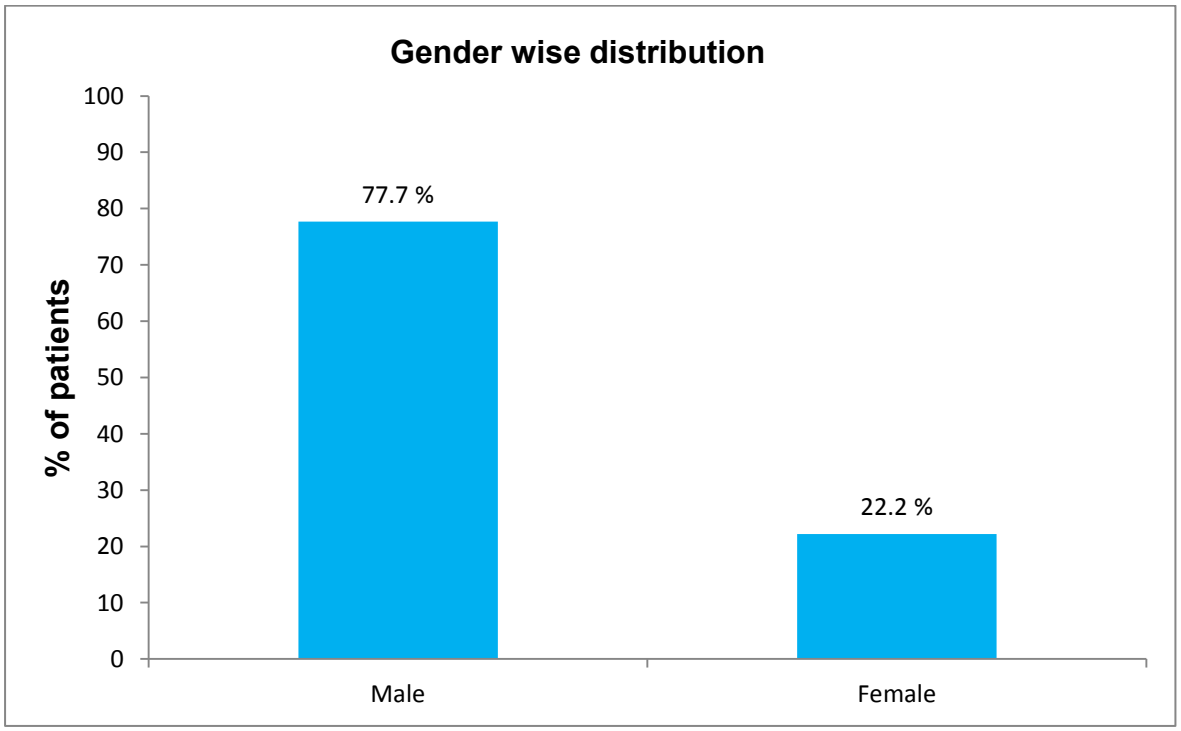
6.2. Gender distribution of myocardial infarction patients

Among the 108 myocardial infarction patients 84 (77.7%) were males and 24 (22.2 %) were females. The gender distribution showed that males are prone to myocardial infarction.

Table: 3 Gender distribution of myocardial infarction patients

S.no	Gender	Number of patients	Percentage (%)
1.	Male	84	77.7%
2.	Female	24	22.2%

Figure: 3 Gender distribution of myocardial infarction patients



6.3. BMI profile of myocardial infarction patients

Among the 108 myocardial infarction patients of our study all patients were normal and above normal. BMI (18.5 – 24.9).

Table: 4 BMI profiles of myocardial infarction patients

S.no	Groups	Sample size	BMI (kg/m^2) Mean ± SD
1.	Ramipril	12	23.85 ± 2.97
2.	Nebivolol	12	24.23 ± 3.26
3.	Nicorandil	12	22.85 ± 2.5
4.	Amlodipine	12	23.1 ± 4.91
5.	Atenolol	12	23.27± 2.39
6.	Carvedilol	12	24.65 ± 5.37
7.	Clinidipine	12	24.43 ± 2.54
8.	Metoprolol	12	25.41 ± 3.07
9.	Telmisartan	12	23.6 ± 3.66

6.4. Social habits:

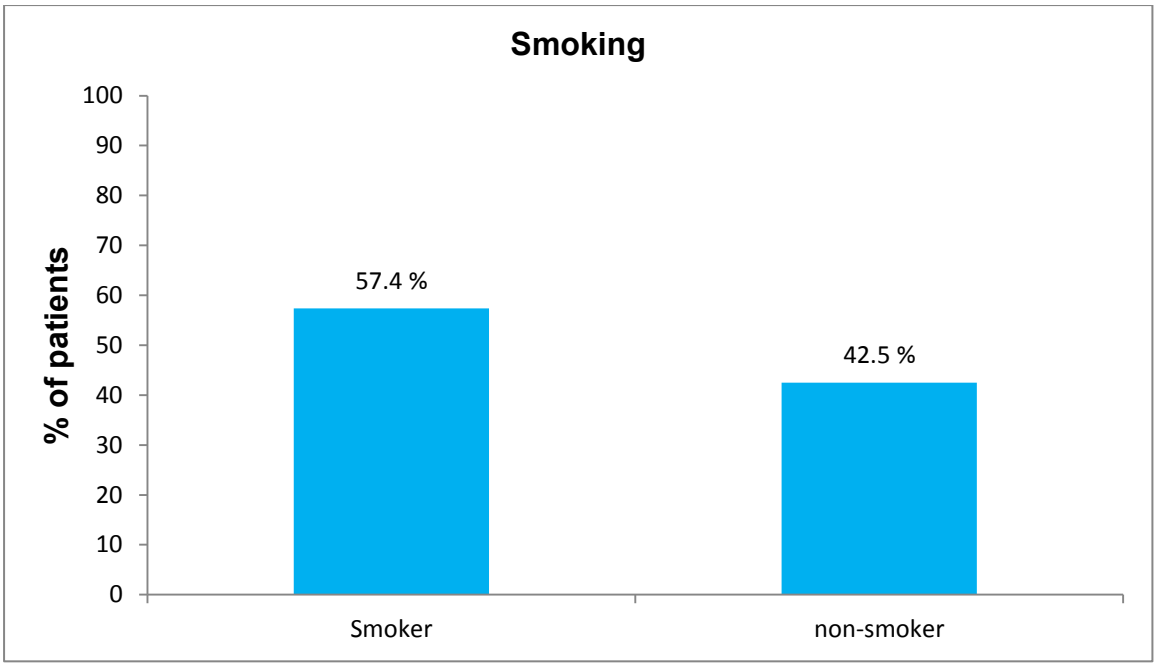
Smoking:

Among the 108 myocardial infarction patients 62 (57.4%) were smokers and 46 (42.5%) were non-smokers. It shows that smokers were more affected than non-smokers.

Table: 5 Smoking

S.no	Smoking	Number of patients	Percentage (%)
1.	Smokers	62	57.4 %
2.	Non - smokers	46	42.5 %

Figure: 4 Smoking



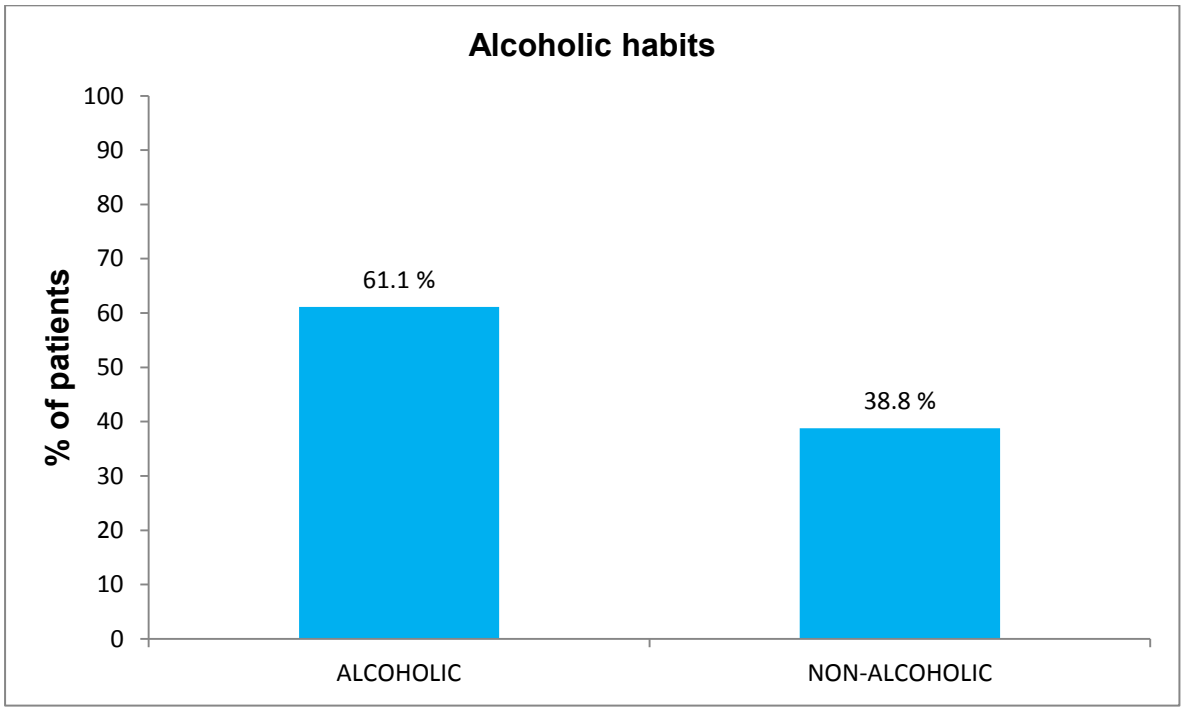
6.5. Alcoholic habits

Among the 108 myocardial infarction patients 66 (61.1%) were alcoholic and 42 (38.8%) were non – alcoholic. It shows that alcoholics were more affected than non alcoholics.

Table: 6 Alcoholic habits

S.no	Alcoholic habits	Number of patients	Percentage (%)
1.	Alcoholic	66	61.1%
2.	Non – alcoholic	42	38.8%

Figure: 5 Alcoholic habits

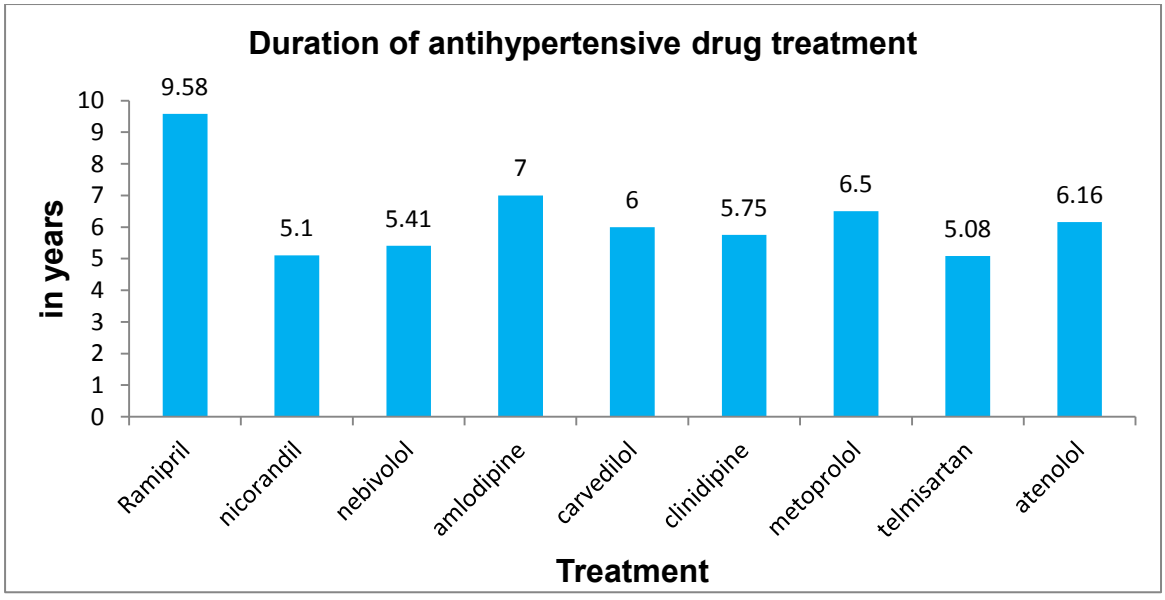


6.6. Duration of treatment

Table: 7 Duration of antihypertensive drug treatment among the study population

S.no	Drug treatment	Number of patients	Duration of treatment in years (mean ± SD)
1.	Ramipril	12	9.58 ± 2.77
2.	Nicorandil	12	5.1 ± 1.80
3.	Nebivolol	12	5.41 ± 1.20
4.	Amlodipine	12	7 ± 1.53
5.	Carvedilol	12	6 ± 1.70
6.	Clinidipine	12	5.75 ± 2.49
7.	Metoprolol	12	6.5 ±2.54
8.	Telmisartan	12	5.08 ± 2.61
9.	Atenolol	12	6.16 ± 2.36

Figure: 6 Duration of antihypertensive drug treatment among the study population



6.7. TROPONIN – I PROFILE OF THE PATIENTS

Table: 8 Effect of Ramipril vs Nicorandil on troponin- I profile of the patients

S.no	Treatment	Mean ± SD
1.	Ramipril	2.65 ± 0.49 * *
2.	Nicorandil	8.48 ± 6.8

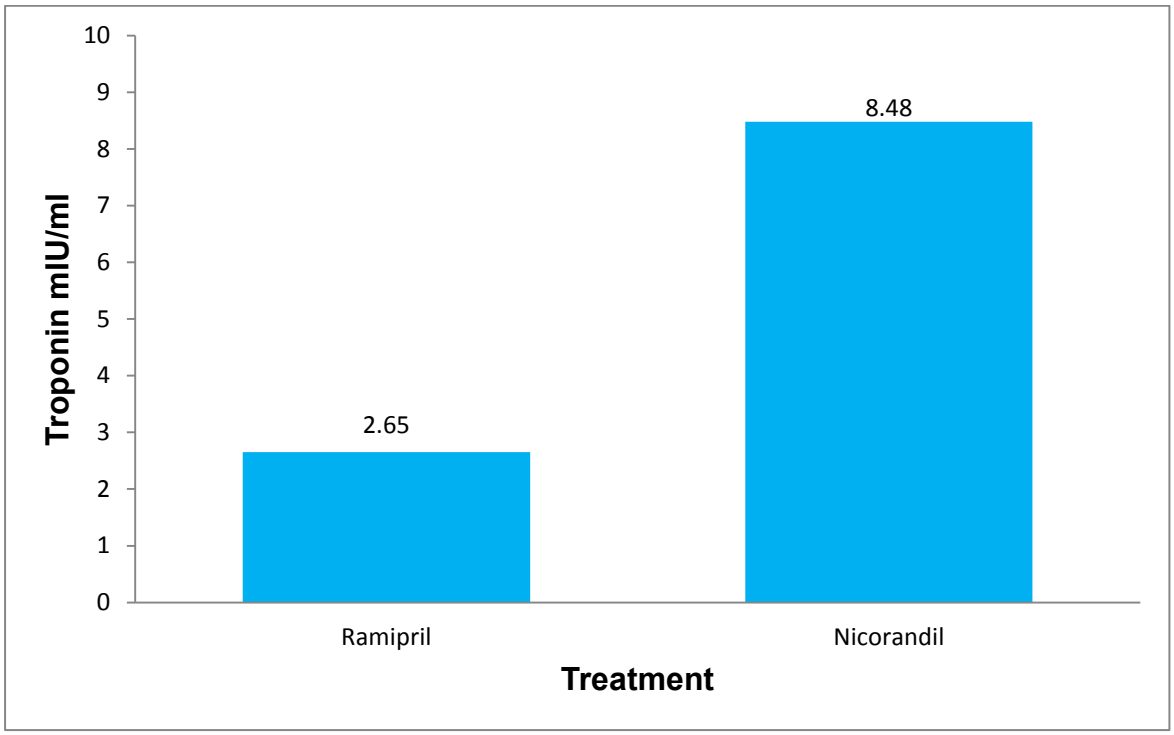


Figure: 7 Effect of Ramipril vs Nicorandil on troponin- I profile of the patients

Values are expressed in Mean ± SD * * P< 0.01

Table: 9 Effect of Nicorandil vs Amlodipine on troponin- I profile of the patients

S.no	Treatment	Mean ± SD
1.	Nicorandil	8.48 ± 6.89
2.	Amlodipine	3.98 ± 1.36*

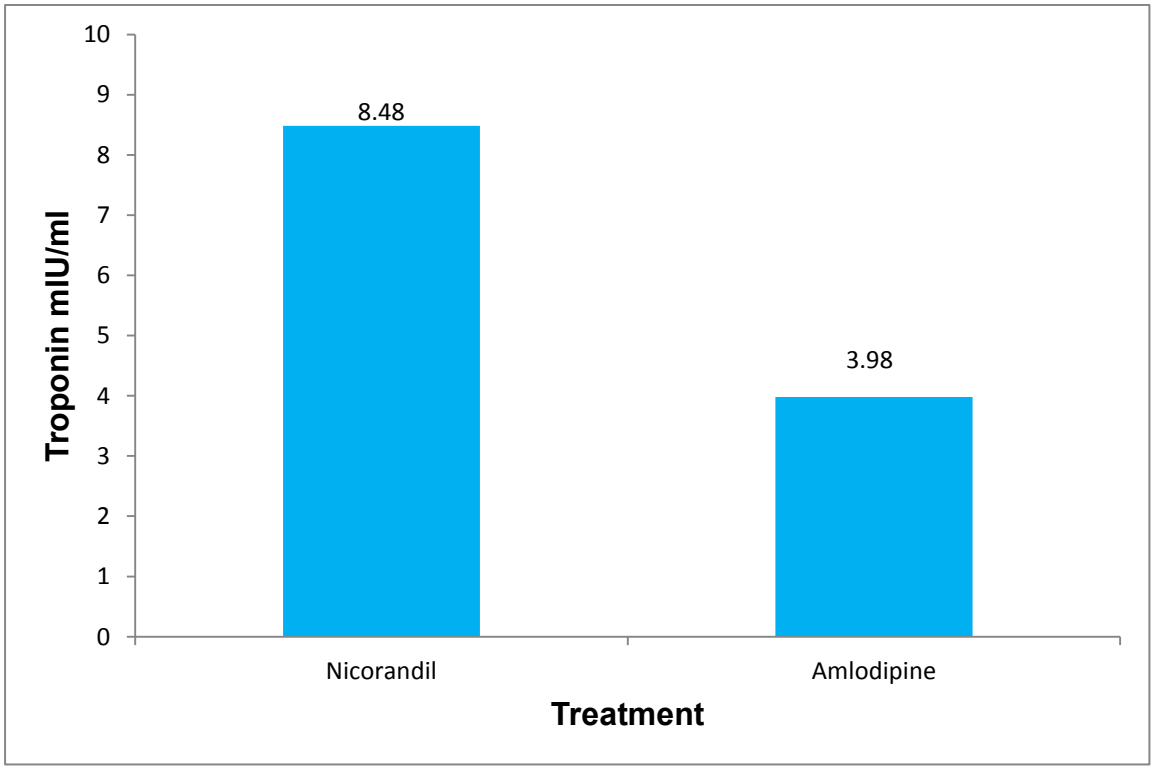


Figure: 8 Effect of Nicorandil vs Amlodipine on Troponin – I profile of the patients

Values are expressed in Mean ± SD * P< 0.05

Table: 10 Effect of different antihypertensive drugs on troponin – I profile of the patients

S.no	Treatment	Mean ± SD
1.	Ramipril	2.65 ± 0.49 * *
2.	Nicorandil	8.48 ± 6.89
3.	Nebivolol	4.85 ± 3.17
4.	Amlodipine	3.98 ± 1.36 *
5.	Carvedilol	5.43 ± 1.87
6.	Clinidipine	6.43 ± 3.64
7.	Metoprolol	4.75 ± 1.24
8.	Telmisartan	4.43 ± 1.27
9.	Atenolol	6.12 ± 4.10

Table: 11 Compilation of mean difference in antihypertensive drugs on troponin – I profile

s. no	Drug names	Mean difference of antihypertensive drugs								
		Ramipril	Nebivolol	Amlodipine	Telmisartan	Clinidipine	Metoprolol	Atenolol	carvedilol	Nicorandil
1.	Ramipril	-	2.203	1.328	1.778	3.778	2.095	3.470	2.778	**5.828**
2.	Nebivolol	2.203	-	0.8750	0.4250	1.575	0.1083	1.267	0.5750	3.625
3.	Amlodipine	1.328	0.8750	-	0.4500	2.450	0.6833	2.142	1.450	**4.500**
4.	Telmisartan	1.778	0.4250	0.4500	-	2.000	0.3167	1.692	1.000	4.050
5.	Clinidipine	3.778	1.575	2.450	2.000	-	1.683	0.3083	1.000	2.050
6.	Metoprolol	2.095	0.1083	0.6833	0.3167	1.683	-	1.375	0.6833	3.733
7.	Atenolol	3.470	1.267	2.142	1.692	0.3083	1.375	-	0.6917	2.358
8.	Carvedilol	2.778	0.5750	1.450	1.000	1.000	0.6833	0.6917	-	3.050
9.	Nicorandil	5.828	3.625	4.500	4.050	2.050	3.733	2.358	3.050	-

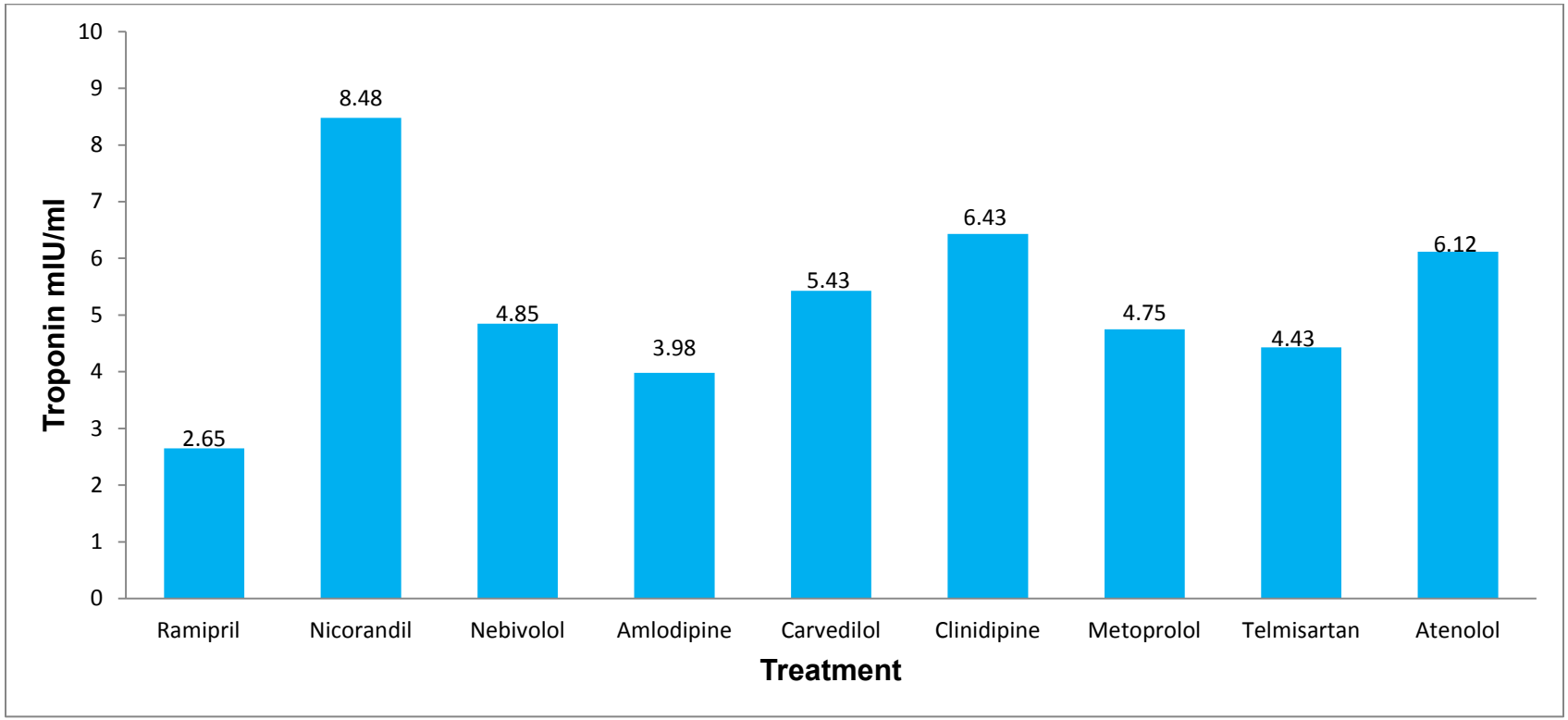


Figure: 9 Effect of different antihypertensive drugs on troponin – I profile of the patients

Data represents Mean ± Standard deviation

6.8. CK – MB profile of the patients

Table: 12 Effect of Ramipril vs Nicorandil on CK – MB profile of the patients

s. no	Treatment	Mean ± SD
1.	Ramipril	23.33 ± 19.97 * *
2.	Nicorandil	78.6 ± 45.7

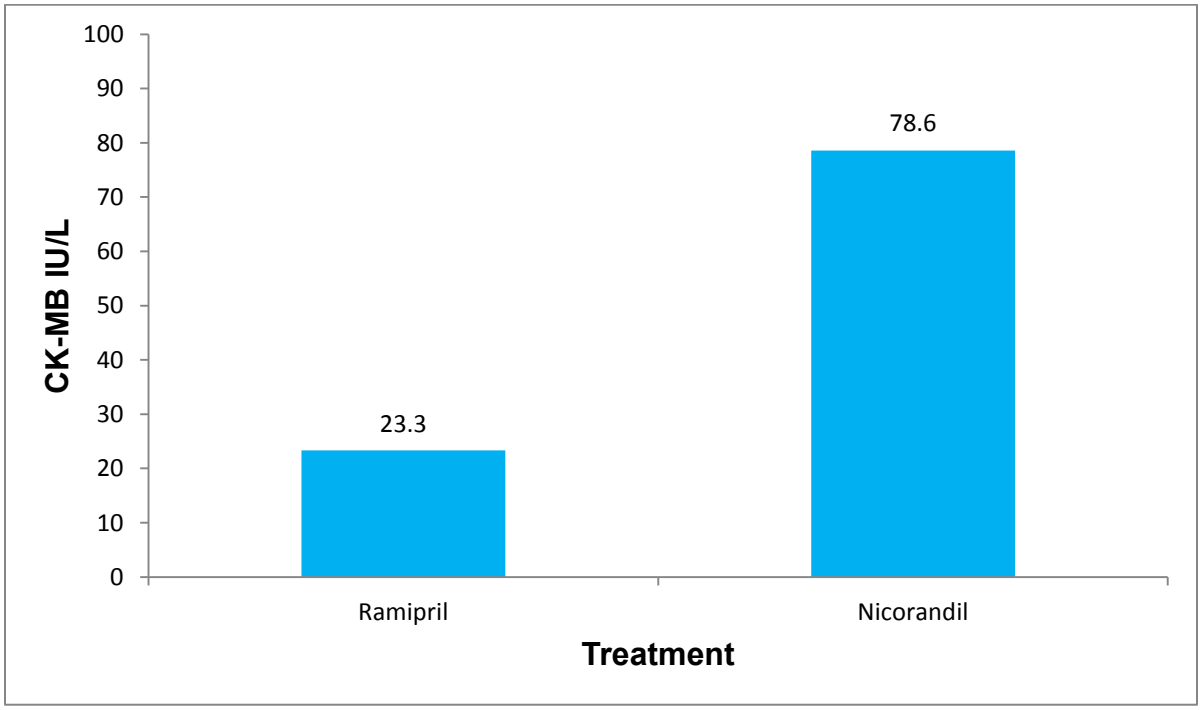


Figure: 10 Effect of Ramipril vs Nicorandil on CK – MB profile of the patients

Values are expressed in Mean ± SD * * P< 0.01

Table: 13 Effect of different antihypertensive drugs on CK – MB profile of the patients

S.no	Treatment	Mean ± SD
1.	Ramipril	23.33 ± 19.97 * *
2.	Nicorandil	78.66 ± 45.76
3.	Nebivolol	33.44 ± 28.16
4.	Amlodipine	34 ± 23.77
5.	Carvedilol	68.25 ± 49.09
6.	Clinidipine	45.72 ± 27.04
7.	Metoprolol	55 ± 46.21
8.	Telmisartan	44.33 ± 24.73
9.	Atenolol	61.69 ± 34.92

Table: 14 Compilation of mean difference in antihypertensive drug treatment on CK-MB profile

s. no	Drug names	mean difference of antihypertensive drugs								
		Ramipril	Nebivolol	Amlodipine	Telmisartan	Clinidipine	Metoprolol	Atenolol	carvedilol	Nicorandil
1.	Ramipril	-	10.108	10.667	21.000	22.392	31.667	38.358	44.917	**55.333**
2.	Nebivolol	10.108	-	0.5583	10.892	12.283	21.558	28.250	34.808	45.225
3.	Amlodipine	10.667	0.5583	-	10.333	11.725	21.000	27.692	34.250	44.667
4.	Telmisartan	21.000	10.892	10.333	-	1.392	10.667	17.358	23.917	34.333
5.	Clinidipine	22.392	12.283	11.725	1.392	-	9.275	15.967	22.525	32.942
6.	Metoprolol	31.667	21.558	21.000	10.667	9.275	-	6.672	13.250	23.667
7.	Atenolol	38.358	28.250	27.692	17.358	15.967	6.672	-	6.558	16.975
8.	Carvedilol	44.917	34.808	34.250	23.917	22.525	13.250	6.558	-	10.417
9.	Nicorandil	55.333	45.225	44.667	34.333	32.942	23.667	16.975	10.417	-

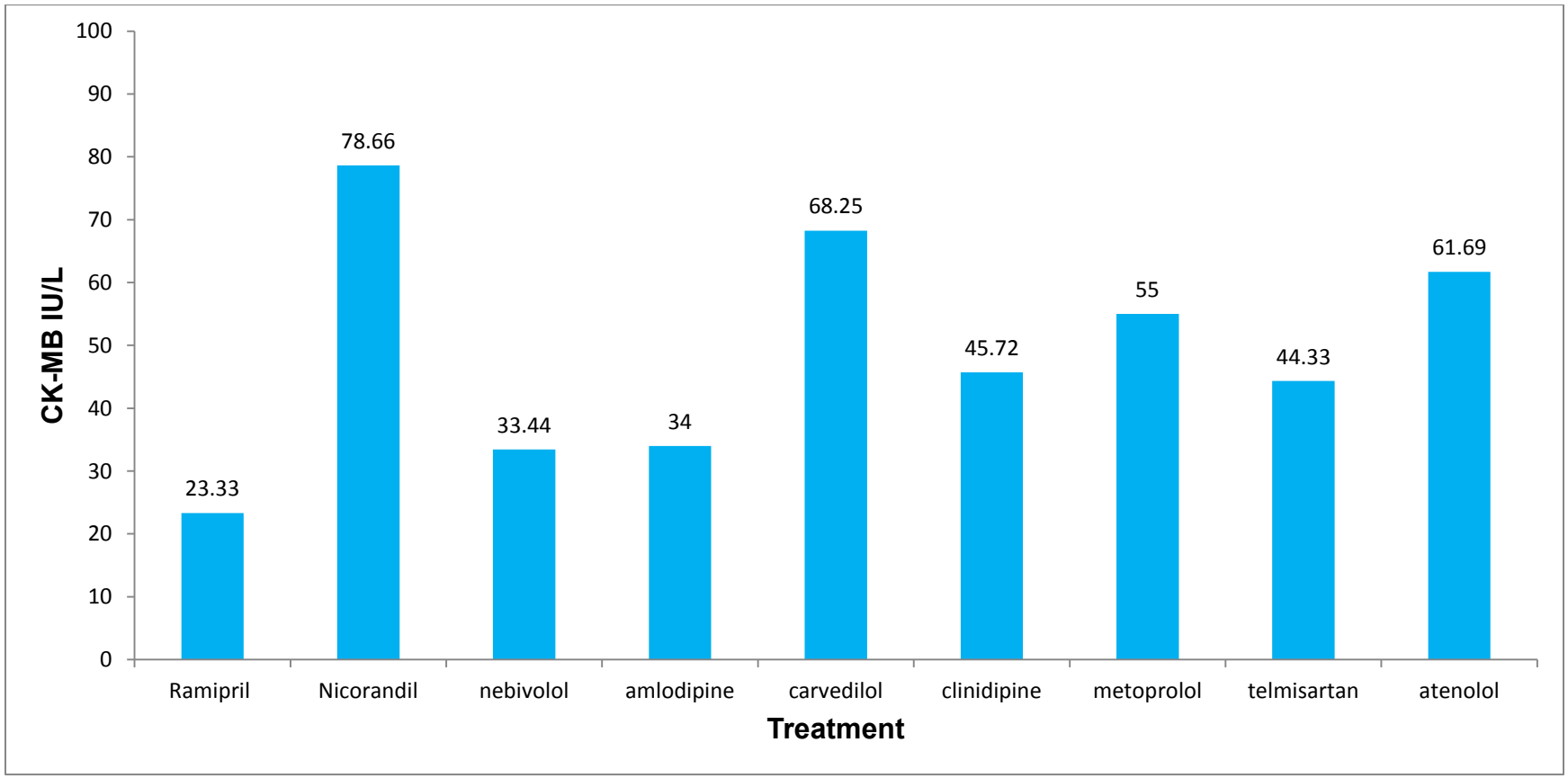


Figure: 11 Effect of different antihypertensive drugs on CK – MB profile of the patients

Data represents Mean ± Standard deviation

Table: 15 Scores of patient information leaflet usefulness assessment questionnaire (PILUAQ) [56]

S.no	questions	Number answered	Average
1.	**Amount of information**		
	a) Too much	27	18%
	b) Adequate	115	76.6%
	c) Too little	8	5.3%
2.	**Usefulness of the information**		
	a) Very useful	78	52%
	b) Useful	61	40.6%
	c) Not useful	11	7.3%
3.	**Readability of the leaflet**		
	a) Very easy	96	64%
	b) Easy	52	34.6%
	c) Very difficult	2	1.3%
4.	**Understandability of the content**		
	a) Very easy	58	38.6%
	b) Easy	84	56%
	c) Very difficult	8	5.3%
5.	**Usefulness of the PIL**		
	a) Very useful	81	54%
	b) Useful	57	38%
	c) Not useful	12	8%

Discussion

7. DISCUSSION

Acute myocardial infarction is a major cause of death and disability. In India, premature mortality in terms of years of life lost because of CVD is increased by 59% from 23.2 million (1990) to 37 million (2010) and the age standardized CVD death rate of 272 per 10, 0000 populations is higher than the global average of 235 per 10,000 populations.[53]

Approximately 15 million patients per year in the U.S and Europe present to the emergency department with chest pain or other symptoms suggestive of AMI.

Rapid identification of acute MI is critical for the initiation of effective evidence-based medical treatment and management.

ECG and measurement of cardiac troponin is the current diagnostic cornerstone for clinical assessment of acute myocardial infarction. ECG is often insufficient to diagnose AMI. [9]

In the past 30 years, improved immunochemical techniques have made it possible for rapid measurements of a variety of markers indicating myocardial cell death.

It includes myoglobin, CK, CK-MB, Troponin etc. Several of these are serum proteins which has been found to be more sensitive in detecting acute myocardial infarction.[12]

Rise in level of these markers have been reported in hypertension with myocardial infarction.

However, Treatment of hypertension patients with antihypertensive drugs implicates clinical and circulating improvement.[14]

In this present study, the effect of antihypertensive drugs on cardiac workload was evaluated with the help of cardiac markers (Troponin – I, CK–MB) in post myocardial infarction patients.

We have included patients those who are diagnosed to have post myocardial infarction with a previous history on antihypertensive drugs like Ramipril, Nicorandil, Nebivolol, Amlodipine, Carvedilol, Clinidipine, Metoprolol, Telmisartan and Atenolol. We analyzed the effectiveness of these antihypertensive drugs on cardiac workload with the help of Troponin–I and CK-MB of the patients was examined.

DEMOGRAPHY

The study comprised of 108 patients diagnosed as post myocardial infarction. Among the 108 post myocardial infarction patients 48.1% were in the age group of 40 – 60 years, 44.4% of patients were in the age group of 60 – 80 years and 7.4% were in the age group of 80 – 90 years. **(Table: 2, Figure: 2)**

In our study, among 108 patients males were accounted for 77.7% and females were accounted for 22.2%. **(Table: 3, Figure: 3)**

Sonia [53] *et. al.,* resulted women experience their first acute myocardial infarction on average 9 years later than men. The result of this study was found to be similar with above study and indicated that males are more prone to myocardial infarction.

In this study population majority of the patients were having normal body mass index (BMI - 18.5 – 24.9). **(Table: 4)**. Among the 108 patients smokers were accounted for 57.4%, non-smokers were accounted for 42.5% and 61.1% were alcoholic and 38.8% were non-alcoholic. **(Table: 5, 6, Figure: 4, 5)**

Nasrin Hesabi[54] et.al., resulted effective risk factors on myocardial infarction such as age, sex, hypertension, diabetes and smoking which is similar to our study.

A total 108 patients was included in the study and duration on antihypertensive therapy was recorded. The incidence rates for second – MI was resulted that Ramipril shows (9.58 ± 2.77), Nicorandil (5.1 ± 1.80), Nebivolol (5.41±1.20), amlodipine (7±1.53), carvedilol (6 ± 1.70), Clinidipine (5.75 ± 2.49), metoprolol (6.5 ± 2.54), telmisartan (5.08 ± 2.61) and atenolol (6.16 ± 2.36). **(Table: 7, Figure: 6)**

Doson Chua [18] *et. al.,* resulted that the routine use ACE inhibitors in MI patients reduce reinfarction and mortality risk.

Our result coincides with Doson Chua *et. al.,* that ACE inhibitors decrease the incidence of second MI.

Our study revealed that the Ramipril showed a greater control on troponin – I profile of the patients when compared to other drugs. In this, Ramipril (2.65 ± 0.49) showed a significant control (P< 0.05) on troponin – I profile when compared to Nicorandil (8.48 ± 6.8) **(Table: 8, Figure: 7)**

After Ramipril, Amlodipine showed a greater control on troponin – I profile of the patients when compared to other drugs. In this, amlodipine (3.98 ± 1.36) showed a significant control (P< 0.05) on troponin – I profile when compared to Nicorandil (8.48 ± 6.89). **(Table: 9, Figure: 8)**

Ramipril (2.65 ± 0.49) showed a significant control than amlodipine (3.98 ± 1.36) and showed a greater control than Telmisartan (4.43 ± 1.27), Metoprolol (4.75 ± 1.24), Nebivolol (4.85 ± 3.17), carvedilol (5.43 ± 1.87), Atenolol (6.12 ± 4.10), Clinidipine (6.43 ± 3.64) and Nicorandil (8.48 ± 6.89). Among the nine drugs Ramipril showed a greater control in troponin – I profile of the patients. **(Table: 10, Figure: 9)**

(Table: 11, 14) shows compilation of mean difference of antihypertensive drugs on troponin-I and CK-MB profile of the patients.

In present study, Ramipril showed a greater control on CK – MB profile of the patients when compared to other drugs. In this, Ramipril (23.3 ± 19.97) showed a significant control (P< 0.01) on CK - MB profile when compared to Nicorandil (78.6 ± 45.7). **(Table: 12, Figure: 10)**

Ramipril (23.3 ± 19.97) showed a significant control than Nebivolol (33.44 ± 28.16) and showed a greater control than Amlodipine (34 ± 23.77), Telmisartan

(44.33 ± 24.73), clinidipine (45.72 ± 27.04), Metoprolol (55 ± 46.21), Atenolol (61.69 ± 34.92), Carvedilol (68.25 ± 49.09) and Nicorandil (78.66 ± 45.76). Among the nine drugs Ramipril showed a greater control in CK – MB profile of the patients. **(Table: 13, Figure: 11)**

Kamble[14] ***et. al.,*** says that the metabolic state of severely infarct myocardium is indicated by the increase of marker CK and CK – MB. They reported that Enalapril (ACE inhibitor) was found to have promising effect than atenolol.

Our results coincides with the results of kamble *et. al.* that ACE inhibitors was found to have greater control in troponin - I and CK – MB profile in myocardial infarction patients.

The developed patient information leaflet was assessed for usefulness using the PILUAQ which is a 5 item questionnaire. It results that 76.6% of the population found the amount of information provided in the leaflet was adequate. About 52% of respondents found information provided was very useful and 64% of respondents stated that the leaflet was very easy to read. About 56% respondents found that the content in the leaflet was easy to understand and 54% found that the leaflet was very useful to them in understanding about their disease condition. **(Table: 15)**

Conclusion

8. CONCLUSION

In this study the effect of antihypertensive drugs like Ramipril, Nicorandil, Nebivolol, Amlodipine, Carvedilol, Clinidipine, Metoprolol, Telmisartan and Atenolol on cardiac workload with help of Troponin–I and CK – MB level in post myocardial infarction patients was evaluated.

Our study revealed that Ramipril has significant control on troponin-I and CK-MB level in post MI, While Amlodipine showed a significant control only on troponin-I.

Duration of antihypertensive drug treatment among the study population revealed that Ramipril decreases the incidence of second MI symptoms for longer duration and decrease the release of cardiac markers compared to other drugs. It may due to decrease in workload of heart by ACE inhibitors.

Patient information leaflet was prepared and distributed through cardiology department to improve patients understanding of disease management and the developed leaflet was found to be very useful by the patients.

References

9. REFERENCES

1. Jan Vojacek, Petr jansky, Tomas janota. Third universal definition of myocardial infarction. Elsevier journal 2013; 228 -235.
2. Kristian Thygesen, Joseph S. Alpert, Allan S. Jaffe. Third Universal Definition of Myocardial Infarction. Circulation 2012; 126: 2020-2035.
3. Arsalan Khaledifard, Koorosh Etemad, Soghra Ahmadi, Ali ahmadi. Current Status of Myocardial Infarction and Risk Factors for Associated Mortality in Iran: A Review. Journal of Epidemiology and Public Health Reviews 2016; 1.1.
4. Robert E. O Connor part10: Acute coronary syndrome: 2010. AHA guideline for cardio pulmonary resuscitation and emergency cardiovascular care. Circulation 2010; 122 (suppl 3):S787–S817.
5. Maziarzafari. A. Definition, etiology, symptoms, diagnosis of Myocardial infarction 2017; http://emedicine.medscape.com/article/155919-overview#a8.
6. Michael Bolooki .H, Arman Askari. Treatment of Acute myocardial infarction 2010.http://www.clevelandclinicmeded.com/medicalpubs/diseasemanagement /cardiology/acute- myocardial-infarction/ (available online).
7. Leon shargel, Alan H. Mutnick. Hypertension: definition and types. Comprehensive pharmacy review 8th edition, 612-614.
8. Guidelines for the diagnosis and management of hypertension in adults. Definition and classification of hypertension. National heart foundation of Australia 2016.

9. Epidemiology of hypertension Global health observatory data (GHO) http://www.who.int/gho/ncd/risk_factors/blood_pressure_prevalence_text/en/.
10. Arun chockalingam, Norman R. Campbell, George Fodor. Worldwide epidemic of hypertension. Can J cardiol 2006; 22(7): 553-555.
11. Craig Anderson, Leonard Arnold. Guideline for the diagnosis and management of hypertension in adults 2016; 15-33.
12. Roger walker, Cate Whittlesea. Hypertension and cardiac markers. Clinical pharmacy and therapeutics 5th edition, 2012; 9-307.
13. Singh B, AK. Gupta, TP. Singh. Cardiac biomarkers: when to test? – Physician perspective. JIACM 2011; 12(2): 117-21.
14. Kamble M. M, S.M.Vaidya. Effect of antihypertensive drugs on cardiac enzymes in hypertension with myocardial infarction in NIDDM. Indian journal of clinical biochemistry 2002; 17(2): 60-63.
15. Kristin newby L, Alan B. Storrow, W.Brian Gibler. Bedside multimarker testing for risk stratification in chest pain units. Circulation 2001; 103: 1832-1837.\
16. Giampiero Mazzaglia. Adherence to antihypertensive medications and cardiovascular morbidity among newly diagnosed hypertensive patients 2009; available online at http://circ.ahajournals.org.
17. Yoshiyama M, Y Nakamura, T Omura. Angiotensin converting enzyme inhibitor prevents left ventricular remodelling after myocardial infarction in angiotensin II type 1 receptor knockout mice. Heart 2005; 91:1080–1085.
18. Dirk Westermann, Johannes Tobias Neumann. Diagnosis of Myocardial Infarction Using a High-SensitivityTroponin I 1-Hour Algorithm. JAMA *Cardiol*. 2016; 1(4):397-404.

19. Doson Chua, Andrew Ignaszewski, Erin Schwenger. Angiotensin-converting enzyme inhibitors: An ACE in the hole for everyone. BC medical journal 2011; 53 (5): 220-223.
20. Mehmet Akif Cakar, Huseyin Gunduz, Mehmet Bulent Vatan. The Effect of Admission Creatinine Levels on One-Year Mortality in Acute Myocardial Infarction. The Scientific World Journal 2012.
21. Vinay Rao, Prasannalakshmi Rao, Nikita Carvalho. Risk Factors for Acute Myocardial Infarction in Coastal Region of India: A Case–Control Study. Heart India 2014; 2 (3): 70-75.
22. Pieter J de Kam, Adriaan A Voors, Francesco Fici. The revised role of ACE-inhibition after myocardial infarction in the thrombolytic/primary PCI era. *JRAAS* 2004; 5(11): 161–168.
23. Tobias Reichlin, Willibald Hochholzer, Stefano Bassetti. Early Diagnosis of Myocardial Infarction with Sensitive Cardiac Troponin Assays. N Engl J Med 2009; 361: 858-67.
24. Asli Tanindi, Mustafa Cemri. Troponin elevation in conditions other than acute coronary syndromes. Vascular Health and Risk Management 2011:7: 597–603.
25. Claudio Picariello, Chiara Lazzeri, Paola Attana. The Impact of Hypertension on Patients with Acute Coronary Syndromes. International Journal of Hypertension 2011; 1-7.
26. Swee Han Lim, Ziwei Lin. Update on the use of cardiac markers in the diagnosis of acute coronary syndrome. Journal of Acute Medicine 2013; 3: 125-131.

27. James A. de Lemos, Thomas W. Wallace. Prevalence and Determinants of Troponin T Elevation in the General Population. Circulation 2006; 113: 1958-1965.
28. Andrea Milde ohrn, Christopher Sivert Nielsen. Pain Tolerance in Persons with Recognized and Unrecognized Myocardial Infarction: A Population-Based, Cross-Sectional Study. *J Am Heart Assoc.* 2016; 5:1-8.
29. Robert A. Byrne, Yukinori Harada. Prognostic Value of Cardiac Troponin T and Sex in Patients Undergoing Elective Percutaneous Coronary Intervention. *J Am Heart Assoc.* 2016; 5: 1-8.
30. Sabesan Mythili, Narasimhan Malathi. Diagnostic markers of acute myocardial infarction (Review). Biomedical Reports 2015; 3: 743-748.
31. Hafidh A Al-Hadi, Keith A Fox. Cardiac Markers in the Early Diagnosis and Management of Patients with Acute Coronary Syndrome. SQU MED J 2009; 9(3) 231-246.
32. Pedrinelli R, Ballo P. Hypertension and Acute myocardial infarction an overview. J. Cardiovasc Med 2012; 13(3): 194-202.
33. Alharbi F.F, P.C Souverein. Risk of Acute Myocardial Infarction after discontinuation of antihypertensive agents: a case – control study. Journal of human hypertension 2017; 23: 1-5.
34. Giovanni Corrao, Federica Nicotra. Cardiovascular Protection by Initial and Subsequent Combination of Antihypertensive Drugs in Daily Life Practice. Hypertension 2011; 58: 566-572.

35. Garry Taverny, Yanis Mimouni, Antihypertensive pharmacotherapy for prevention of sudden cardiac death in hypertensive individuals. Cochrane Hypertension group 2016; 3: 1-58.
36. James J DiNicolantonio, Hassan Fares. β-Blockers in hypertension, diabetes, heart failure and acute myocardial infarction: a review of the literature. Open Heart 2015; 2: 1-12.
37. Muhammad Firdaus, Chittur A Sivaram, Prevention of Cardiovascular Events by Treating Hypertension in Older Adults: An Evidence-Based Approach. The journal of clinical hypertension 2008; 10(3): 219-225.
38. Csaba Farsang. Indications for and utilization of Angiotensin receptor II blockers in patients at high cardiovascular risk. Vascular Health and Risk Management 2011:7 605–622.
39. Giovanni Corrao, Rea, Fedrico. Protective effects of antihypertensive treatment in patient aged 85 years or older. Journal of hypertension 2017; 1-5.
40. Neil Poulter. ARBs in Hypertension. Br J Cardiol 2010; 17:1-9.
41. Scott D. Solomon, Jens J. Thune. Effect of Antecedent Hypertension and Follow-Up Blood Pressure on Outcomes after High-Risk Myocardial Infarction. Hypertension. aha. Journals 2007; 51: 48-54.
42. Noah Jarari1, Narasinga Rao. A review on prescribing patterns of antihypertensive drugs. Clinical Hypertension 2016; 22: 7.
43. Saad Shafqat, Hiba Arif. Drug compliance after stroke and myocardial infarction: A comparative study. Neurology India 2007; 55(2): 130-135.
44. Lori M. Dickerson, Maria V. Gibson. Management of Hypertension in Older Persons. aafp 2005; 71(3): 469-476.

45. Shahid Akbar, Mohammad S. Alorainy. The current status of beta blockers use in the management of hypertension. Saudi Med J 2014; 35 (11): 1307-1317.
46. Robert J Henning, Koushik Reddy, Asma Khaliq. Recent advances in the diagnosis and treatment of acute myocardial infarction. *World J* Cardiol 2015; 7(5): 243-276.
47. Jennifer Frank. Managing Hypertension Using Combination Therapy. J. aafp 2008; 77(9): 1279-1286.
48. Bryan Williams. Recent Hypertension Trials: Implications and Controversies. JACC 2005; 45 (6): 813-827.
49. Chantal Bourgault, Eleanor Elstein. Antihypertensive drugs and MI risk: the modifying effect of history of drug use. Pharmacoepidemiology and drug safety 2001; 10(4): 287-294.
50. Myron L. Weisfeldt, Susan J. Zieman. Advances in the prevention and treatment of cardiovascular Disease. Health affairs 2007; 26 (1): 25-37.
51. Norm R.C. Campbell, Rollin Brant. Increases in Antihypertensive Prescriptions and Reductionsin Cardiovascular Events in Canada. Hypertension aha.journals 2009; 53: 128-134.
52. Mathias Abiodun Emokpae. Serum Creatine Kinase-MB Isoenzyme activity among Subjects with Uncomplicated Essential hypertension: Any Sex Differences. Med. Sci. 2017; 5(8): 1-10.
53. Dorairaj prabhakaran, panniyammakal jeemon. Cardiovascular diseases in India. Current epidemiology and future direction. Circulation 2016; 133:1605-1620.

54. Sonia s. Anand, shofiqul islam. Risk factors for myocardial infarction in women and men: insights from the INTERHEART study. European heart journal 2008; 29(7): 932-940.

55. Nasrin Hesabi, Fatemeh Kiani. Assessment of risk factors in patients with myocardial infarction. Global journal of health science 2016; 8(1): 255-262.

56. Ramesh. A, Poornima. D. Assessment of patient information leaflet usefulness in selected chronic diseases – A south Indian based study. Indian journal of pharmacy practice 2014; 7(1): 23-28.

Annexures

Annexure – 1

(IEC Approval Form)

VIVEKANANDHA MEDICAL CARE HOSPITAL

SPONSORED BY : ANGAMMAL EDUCATIONAL TRUST.
Elayampalayam - 637 205. Tiruchengode, Namakkal Dt., Tamil Nadu.
Phone : 04288 - 234677, 94890 59111, FAX : 04288 - 234676, Emergency : 04288 - 234108.
Website : www.vivekanandha.ac.in email : vivekanandhamedicalcare@gmail.com

Healing Touch with Mother's Care

Ref. No.: SVCP/IEC/JAN/2016/14 Date: 23.07.2016

To

S. Swetha
M-Pharm. (Pharmacy Practice) Student,
Swamy Vivekanandha College of Pharmacy,
Elayampalayam, Tiruchengode – 637205.

Sub: Approval of the Study Protocol- Reg

The Institutional Ethics Committee reviewed and discussed your application to conduct the study entitled "CLINICAL STUDY OF CARDIAC MARKERS IN POST MYOCARDIAL INFARCTION PATIENTS ON ANTIHYPERTENSIVE DRUG THERAPY" under the guidance of Mr. S. Anandkumar on 15.07.2016.

The following documents were reviewed:

a. Study protocol
b. Patient Information Sheet/ Informed Consent Form
c. Study data collection form
d. Principal Investigator's/ Co-PI current CV.
e. Investigator's undertaking

The following members of the ethics committee were present in the meeting at Vivekananadha Medical Care Hospital.

1. Dr. Sathish K M - Chairman
2. Dr. Palanisamy A - Member Secretary
3. Dr. Poovendran T - Member
4. Dr. Ananda Thangadurai S - Member
5. Dr. Vinoth Prabhu V - Member

We approve the study to be conducted in its presented form.

The Institutional Ethics Committee to be informed about the progress of the study, any serious adverse events occurring in the course of the study, any changes in the protocol and patient information/informed consent and to provide a copy of the final report on completion.

Dr. A. Palanisamy,
MEMBER SECRETARY,
Institutional Ethics Committee,
VIVEKANANDHA MEDICAL CARE HOSPITAL,
ELAYAMPALAYAM-637 205,
Tiruchengode Tk, Namakkal Dt, T. N.

Annexure – 2

(Informed Consent English)

Vivekanandha Medical Care Hospital, Elayampalayam

Institutional Ethics Committee

INFORMED CONSENT FORMAT FOR RESEARCH PROJECTS

(Strike off items that are not applicable)

I / We (write name of the investigator(s) here), am / are carrying out a study on the topic: as part of my / our research project being carried out under the aegis of the Department of:

(*Applicable to students only*): My / our research guide is:

The justification for this study is:

The objectives of this study are:

Primary Objective:

Secondary Objective:

Sample size:

Study volunteers / participants are (specify population group & age group):

Location:

We request you to kindly cooperate with us in this study. We propose collect background information and other relevant details related to this study. We will be carrying out:

Initial interview (specify approximate duration):

Data collected will be stored for a period of years. We will / will not use the data as part of another study.

Health education sessions: Number of sessions: 1.Approximate **duration** of each session:

Clinical examination (Specify details and purpose):

Blood sample collection: Specify quantity of blood being drawn:

No. of times it will be collected:

Whether blood sample collection is part of routine procedure or for research (study) purpose:

1. Routine procedure 2. Research purpose

Specify **purpose**, discomfort likely to be felt and side effects, if any:

Whether blood sample collected will be stored after study period: Yes / No, it will be destroyed

Whether blood sample collected will be sold: Yes / No

Whether blood sample collected will be shared with persons from another institution: Yes / No

Medication given, if any, duration, side effects, purpose, benefits:

Whether medication given is part of routine procedure: Yes / No (If not, state reasons for giving this medication)

Whether alternatives are available for medication given: Yes / No (If not, state reasons for giving this particular medication)

Final interview (specify approximate duration): NA If **photograph** is taken, purpose:

Benefits from this study**:**

Risks involved by participating in this study:

How the **results** will be used:

If you are uncomfortable in answering any of our questions during the course of the interview / biological sample collection, **you have the right to withdraw from the interview / study at anytime.** You have the freedom to withdraw from the study at any point of time. Kindly be assured that your refusal to participate or withdrawal at any stage, if you so decide, will not result in any form of compromise or discrimination in the services offered nor would it attract any penalty. You will continue to have access to the regular services offered to a patient. You will **NOT** be paid any remuneration for the time you spend with us for this interview / study. The information provided by you will be kept in strict confidence. Under no

circumstances shall we reveal the identity of the respondent or their families to anyone. The information that we collect shall be used for approved research purposes only. You will be informed about any significant new findings - including adverse events, if any, – whether directly related to you or to other participants of this study, developed during the course of this research which may relate to your willingness to continue participation.

Consent: The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator/s. Having understood the same, I hereby give my consent to them to interview me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements).

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date: Witness:

Annexure– 3

(Informed Consent Tamil)

Xg;Gjy; gbtk;

Njjp:

----------.Mfpa ehd;> VMCH kUj;Jtkidapy; ---------- Jiwapd; fPo;> ---------- ---------- vd;w jiyg;gpy; Ma;T Nkw;nfhs;s cs;Nsd;.

vd; Ma;T topfhl;b:

Ma;T Nkw;nfhs;tjw;fhd mbg;gil:

Ma;tpd; Nehf;fk;:

Ma;T Nkw;nfhs;Sk; ,lk;:

Ma;tpd; gyd;fs;:

,e;j Ma;tpy; fpilf;Fk; jfty;fs; ---------- tUlq;fs; ghJfhf;fg;gLk;. ,it NtW ve;j Ma;tpw;Fk; gad;gLj;jg; gl khl;lhJ. ve;j epiyapYk; cq;fisg; gw;wpa jfty;fs; ahUf;Fk; njhptpf;fg;gl khl;lhJ. mit ,ufrpakhf itf;fg;gLk;.

,e;j Ma;tpy; gq;Nfw;f xg;Gf;nfhs;Stjhy; ve;j tpjkhd gyDk; cq;fSf;Ff; fpilf;fhJ. ve;j Neuj;jpy; Ntz;LkhdhYk; Ma;tpypUe;J tpyfpf; nfhs;Sk; chpik cq;fSf;F cz;L.

Ma;tpypUe;J tpyfpf;nfhs;tjhy; cq;fSf;F mspf;fg;gLk; rpfpr;irapy; ve;j tpj khw;wKk; ,Uf;fhJ.

,e;j Muha;r;rpf;fhf cq;fsplk; rpy Nfs;tpfs; Nfl;fg;gLk; / rpy ,uj;j khjphpfs; my;yJ jpR khjphpfs; vLf;fg;gLk;.

NkYk;> ,e;j Ma;tpy; gq;F nfhs;tJ cq;fs; nrhe;j tpUg;gk;. ,jpy; ve;j tpjf; fl;lhaKk; ,y;iy. ePq;fs; tpUg;gg;gl;lhy;> ,e;j Ma;tpd; KbTfs; cq;fSf;Fj; njhpag;gLj;jg;gLk;.

Ma;thshpd; ifnahg;gk; :

Njjp :

Ma;Tf;Fl;gLgthpd; xg;Gjy;:

ehd; ,e;j Muha;r;rpapd; Nehf;fk; kw;Wk; mjd; gad;ghl;bidg; gw;wp njspthfTk;> tpsf;fkhfTk; njhpag;gLj;jg; gl;Ls;Nsd;. ,e;j Muha;r;rpapy; gq;F nfhs;sTk;> ,e;j Muha;r;rpapd; kUj;Jt uPjpahd Fwpg;Gfis tUk; fhyj;jpYk; cgNahfg;gLj;jpf; nfhs;sTk; KO kdJld; rk;kjpf;fpNwd;.

Ma;Tf;Fl;gLgthpd; ngah;> Kfthp :

ifnahg;gk; :

Njjp :

Annexure 4 (Data Entry Form)

DATA ENTRY FORM

Patient name: DOA: DOD:

Age/sex: weight: height:

Reason for admission:

Diagnosis:

Past medical history:

Past medication history:

Social/family history:

Vital signs:

S.no	Date	Temp	BP	PR	RR

Hematology:

S. no	Lab parameter	Values	Normal range	S. no	Lab parameter	Values	Normal range

S.no	Cardiac markers	Value	Normal range

Image study report:

Medication chart:

S.no	Name of the drugs		Dose	Frequency	Date of admission					
	Brand name	Generic name								

Discharge medication:

Annexure 5 (Scores of patient information leaflet usefulness assessment questionnaire)

Scores of Patient information leaflet (PIL) Usefulness Assessment Questionnaire in MI

Questions

1. Amount of information

a) Too much

b) Adequate

c) Too little

2. Usefulness of the information

a) Very useful

b) Useful

c) Not useful

3. Readability of the leaflet

a) Very easy

b) Easy

c) Very Difficult

4. Understandability of the content

a) Very Easy

b) Easy

c) Very Difficult

5. Usefulness of the PIL

a) Very useful

b) Useful

c) Not useful

Myocardial infarction(MI) – what is it?

An MI is a heart attack which happens when blood vessels that supply blood to your heart are blocked. This can damage your heart and lead to an abnormal heart rhythm, heart failure or may become life-threatening.

Signs and Symptoms of MI

- ✓Chest pain
- ✓ Heart burn
- ✓Abdominal pain
- ✓Nausea or vomiting
- ✓Feeling weak
- ✓Breathlessness
- ✓Cold and sweaty
- ✓Heart is beating very fast
- ✓Sometimes no symptoms at all .

- ✓Check and control your BP and blood sugar level regularly
- ✓ Keep your cholesterol levels under control
- ✓ Manage your stress
- ✓ Follow up with your physician as directed
- ✓ Do exercise regularly

DO'S

- ➢ Take your medicines as directed by your physician

Quit smoking and alcohol

Eat a heart healthy diet.

- ➢Reduce salt intake
- ➢Eat foods low in cholesterol
- ➢Limit saturated and trans fats
- ➢Eat variety of fruits and vegetables every day .

Physical activity and exercise

- ➢The goal is 30 to 60 min a day, 5 to 7 days a week.
- ➢Ask your health care provider how often & how long to exercise.

Maintain a healthy weight

- ✓Avoid stressful work
- ✓ Tell your doctor if you develop cough, swelling , constipation after taking your medicine

DONT'S

- ➢Don't take OTC medicines without asking your health care provider first
- ➢Don't stop taking medicines without consulting your physician .

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Department of pharmacy practice
Elayampalayam

tpNtfhde;jh nkbf;fy; Nfh; `h];gpl;ly>; ,Uja kUj;Jt rpfpr;ir gphpT> visahk;ghisak;> jpUr;nrq;NfhL.

khuilg;G vd;why; vd;d?

,aj;jpw;F ,uj;jk; nfhz;L tUk; jkdpapy; KOtJkhf milg;G Vw;gl;lNyh my;yJ ,uj;jk; te;J Nruhtpl;lNyh khuilg;G Vw;gLfpwJ.

mwpFwpfs;:

- mjpf mOj;jj;Jld; neQ;rpy; typ
- tpah;j;jy
- neQ;nrhpr;ry;
- tapw;W typ
- Fkl;ly; kw;Wk; the;jp
- %r;R jpzwy;
- ,jak; kpf Ntfkhf Jbj;Jf; nfhz;bUj;jy;

- ✓ ,uj;j mOj;jk; kw;Wk; rh;f;fiuapd; msit fl;Lg;ghl;by; itj;Jf; nfhs;sTk;
- ✓ kd cisr;riy rkhspf;fTk;.
- ✓ cq;fs; kUj;Jtiuj; njhlh;G nfhs;tij tof;fkhff; nfhs;sTk;.
- ✓ clw;gapw;rp nra;tij tof;fkhff; nfhs;sTk;

nra;aNtz;bait

- kUj;Jthpd;MNyhridg;b kUe;Jfiscl;nfhs;sTk;.
- Gifg;gpbj;jy; kw;Wk; kJ mUe;Jtij epWj;jp tplTk;.
- MNuhf;fpakhd czit cl;nfhs;sTk;.
- cztpy; cg;gpd; msit Fiwj;Jf; nfhs;sTk;
- nfhOg;G rj;J mjpfk; cs;s czit jtph;f;f Ntz;Lk;.
- goq;fs; kw;Wk; fha;fwpfis mjpfk; cl;nfhs;s Ntz;Lk;.
- jpdKk; 30-60 epkplq;fs; kw;Wk; thuj;jpw;F5-7ehl;fs; clw;gapw;rp nra;tij ,yf;fhf nfhs;sTk;.
- vt;tsT fhyk; kw;Wk; vt;tsT Kiw clw;gapw;rp nra;a Ntz;Lk; vd kUj;JtUld;MNyhrpf;fTk;.

- ✓ cly; viliaf; fl;Lg;ghl;by; itf;fTk;.

- kd mOj;jk; jUk; Ntiyia jtph;f;fTk;.
- kUe;Jfs; cl;nfhz;l gpwF ,Uky;> tPf;fk; Nghd;w gpur;ridfs; te;jhy; kUj;Jtiu mZfTk.;

nra;a$lhjit

- kUj;Jthpd; MNyhrid gb ghpe;Jiuf;fg;gl;l kUe;Jfs; vLj;Jf nfhs;tij jtph;g;gNjh my;yJ Rakhf kUe;ij cl;nfhs;tNjh $lhJ.

Rthkp tpNtfhde;jh kUe;jpay; fy;Y}hp bghh;l;nkz;l; Mg; ghh;k]p g;uhrpl;b];, jpUr;nrq;NfhL

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This Certificate is awarded to

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