“ROLE OF NOVEL BIOMARKER HEART TYPE FATTY ACID-BINDING PROTEIN(H-FABP) IN DIAGNOSIS OF ACUTE CORONARY SYNDROME IN EMERGENCY DEPARTMENT-A ONE YEAR CROSS SECTIONAL STUDY IN KLES DR. PRABHAKAR KORE HOSPITAL AND MRC”

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ABSTRACT

Background: Acute myocardial infarction (AMI) and related heart conditions are major global causes of death.Early diagnosis and treatment of AMI are crucial, but current biochemical markers like myoglobin, CK-MB, and troponins, though useful, have limitations in early detection.Heart-type fatty acid-binding protein (H-FABP), a small cytoplasmic protein prevalent in the heart, shows promise as an early biomarker for AMI.This study aimed to demonstrate the diagnostic efficacy of h-FABP compared to Trop-T and CK-MB, potentially establishing it as a reliable biomarker for early ACS diagnosis.

Methods: This prospective comparative cross-sectional study, conducted at KLES Dr. Prabhakar Kore Hospital and MRC from January to December 2023, included 50 patients with chest pain indicative of acute coronary syndrome (ACS). Patients underwent laboratory tests for cardiac Troponin-T (Trop-T), CK-MB, and h-FABP, with Trop-T and CK-MB measured at presentation and 6-12 hours post-admission, and h-FABP assessed qualitatively at presentation. The study collected data on patients' symptoms and medical history using a predefined protocol. Laboratory methods included electrochemiluminescence immunoassay (ECLIA) for Trop-T and CK-MB, and rapid chromatographic immunoassay for h-FABP. The primary outcome measure was the sensitivity of these markers for diagnosing ACS within the first 3 hours, while secondary outcomes included specificity, Positive Predictive Value (PPV), and Negative Predictive Value (NPV**).**

Results: The population comprised predominantly individuals aged 50-59 years (34%), followed by 30-39 years (22%), with a mean age of 52.68 ± 12 years. The male predominance was evident, with 74.4% males in AMI and 63.6% in UA. Typical chest pain was reported by 80% of the patients, with a statistically significant difference between AMI and UA ($p = 0.001$). Hypertension and diabetes prevalence showed no significant difference between the groups. ECG findings varied significantly, with 35.90% AMI patients showing inferior changes and all UA patients having normal ECGs ($p < 0.05$). 2D-Echo revealed significant differences in dysfunction patterns, with 38.5% of AMI patients showing systolic dysfunction. RWMA was present in all AMI but absent in UA ($p < 0.05$). Hs-FABP within 3 hours had a sensitivity of 76.92%, specificity of 100%, and a significant p-value (<0.0001). Troponin's sensitivity increased from 35.90% at 3 hours to 84.60% at 6-12 hours, with significant p-values at the latter interval. CKMB showed moderate sensitivity, with significant specificity but non-significant p-values.

Conclusion: The study highlights significant clinical and diagnostic distinctions between AMI and UA, particularly in ECG and 2D-Echo findings. H-FABP demonstrated high diagnostic accuracy within the initial hours of presentation, outperforming Troponin and CKMB in early sensitivity.

Keywords-

Acute Myocardial Infarction (AMI),Unstable Angina (UA),Heart type-Fatty Acid Binding Protein (Hs-FABP),Troponin,Creatine Kinase-MB (CKMB),Biomarkers

LIST OF ABBREVIATIONS

AMI - Acute Myocardial Infarction

UA - Unstable Angina

H-FABP - Heart-type Fatty Acid-Binding Protein

Trop-T - Troponin-T

CK-MB - Creatine Kinase-MB

CVD - Cardiovascular Disease

ECG - Electrocardiogram

RWMA - Regional Wall Motion Abnormality

ECLIA - Electrochemiluminescence Immunoassay

PPV - Positive Predictive Value

NPV - Negative Predictive Value

ACS - Acute Coronary Syndrome

CHD - Coronary Heart Disease

CAD - Coronary Artery Disease

MI - Myocardial Infarction

LV - Left Ventricular

2D-Echo - Two-Dimensional Echocardiography

NSTEMI - Non-ST-Elevation Myocardial Infarction

STEMI - ST-Elevation Myocardial Infarction

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Introduction

The term "cardiovascular disease" (CVD) encompasses a wide range of conditions that impact the heart and blood vessels, including acute coronary syndrome (ACS), coronary heart disease (CHD), coronary artery disease (CAD), and several more.1. Despite the common usage among medical professionals, CAD, ACS, and CHD do not mean the same thing. Different from CHD, which is a result of CAD, ACS is a part of CAD itself. In contrast, myocardial infarction (MI) is frequently associated with acute coronary syndrome (ACS), which generally presents as symptoms like unstable angina and is not reliant on coronary artery disease (CAD). Atherosclerosis in the coronary arteries is a hallmark of coronary artery disease (CAD), which may or may not manifest with symptoms.CHD includes the diagnoses of angina pectoris, myocardial infarction (MI), and silent myocardial ischemia; CAD refers to the pathologic process affecting the coronary arteries, primarily atherosclerosis.Thirdly, coronary heart disease (CHD) mortality is caused by coronary artery disease (CAD). Just to keep things simple, we'll call CAD as CHD from now on. The range of medical issues that were formerly categorised as "unstable angina" is now being progressively renamed as either MI or non-MI. The creation of new, more sensitive immunoassays (i.e., "high-sensitivity") for assessing cardiac troponins has allowed for this change.4 One of the top causes of death and disability in industrialised countries is congestive heart failure.5. Despite a marked decline in mortality rates in Western countries over the last several decades, this disease continues to be responsible for over a third of all fatalities in adults beyond the age of 35.6–8 Important details about the aims of primary and secondary CHD prevention, as well as the risk factors that cause the condition, are provided by the Framingham Heart Study. A longer and more complicated list of non-communicable diseases is being produced. The rising

prevalence of chronic diseases, the ageing of populations, the acceleration of globalisation, and the spread of urbanisation have all contributed to new challenges for modern health care systems.(10, 9). Despite the fact that cardiovascular disease (CVD) may be prevented, its incidence is on the rise worldwide owing to causes such as sedentary lifestyles, nicotine addiction, and unhealthy eating habits (traditional foods being lost in modern industrialised societies).11, 12 Social disparity increases the death rate from CVD, and negative lifestyle variables, such as increasing physical inactivity in a more "obesogenic" environment, are undoing the improvements in CVD statistics that were made in certain nations. 12,13.

Globally, deaths caused by cardiac diseases and acute myocardial infarction (AMI) rank second in mortality rates. Recent years have seen a meteoric rise in the incidence of myocardial infarction (MI) and angina pectoris, two conditions that together cause 40% of all fatalities caused by heart disease.

Angina pectoris occurs when blood clots obstruct coronary arteries, cutting off blood supply to the heart. Because of the reduced supply of oxygen and nutrients brought about by the blocked blood flow, the damaged or dead heart muscle tissue may be rapidly replaced. Because proper cardiac function requires a high concentration of oxygen, even a temporary reduction in blood flow could trigger tissue death.

To add insult to injury, 20% of fatalities occur outside of hospital emergency rooms. Patients admitted to emergency departments due to a high suspicion of acute myocardial infarction often report chest discomfort as a primary symptom. The sudden onset of heart problems is known as acute myocardial infarction (AMI). Therefore, finding and treating AMI early on has become the most crucial and effective way to save lives. Early identification of acute myocardial infarction

(AMI) is still challenging, despite the fact that it is now commonly recognised that biochemical marker serial evaluation is a crucial factor in AMI diagnosis.

A rapid method for early detection of AMI is crucial since the molecular markers myoglobin, creatine kinase-MB isoenzyme (CK-MB), and cardiac troponin I (cTnI 24 kDa) or troponin T (cTnT 37 kDa) are currently utilised in the diagnosis of AMI. However, when it comes to detecting AMI in its early stages, especially within 1-4 hours of its beginning, these cardiac marker proteins fall short. A little protein called myoglobin, with a molecular weight of 18 kDa, is secreted by the heart and found in the bloodstream after a myocardial infarction (MI). Although it has promise as an early AMI diagnostic tool, its inability to differentiate between cardiac and non-cardiac myoglobin makes it less accurate in identifying myocardial injury. Because their blood concentrations don't start to rise until 6-8 hours after the start of AMI, cTnI and CK-MB are less sensitive in the early stages, even if they show better specificity for myocardial injury. The heart-type fatty acid-binding protein (H-FABP) is a crucial cytoplasmic lipid transporter protein with a low molecular weight of 14.9 kDa. It has several characteristics with myoglobin and is composed of 132 amino acids. Its prevalence is highest in cardiac muscle. It is possible to differentiate H-FABP immunologically from other FABP forms, such as I-FABP and LFABP, which are found in the intestines and liver, respectively. Reports indicate that H-FABP demonstrates remarkable sensitivity, even in the hyper acute phase, within three hours of the injury onset.

Since the majority of the heart's energy comes from lipid oxidation and heart-type FABP (H-FABP) keeps insoluble fatty acids moving inside cells, it's really important for keeping the heart homoeostasis. Compared to troponins, this little protein moves through the interstitial space after cardiac cell damage at a substantially faster rate. It reaches its peak four to six hours after

symptoms begin and can be found in the bloodstream as early as 90 minutes after that. Because of its small molecular weight, this cytoplasmic marker is readily discharged into the circulation after heart injury. With these qualities, H-FABP is a promising option for myocardial damage markers, and new studies suggest it may even outperform cardiac troponins in early Acute coronary syndrome prognosis prediction.

New evidence suggests that H-FABP content is an early and sensitive biomarker of ischemia in acute myocardial infarction, rising well before signs of cardiac necrosis. After three hours of AMI, plasma HFABP levels rise and return to reference levels twelve to twenty-four hours later. In addition, individuals with severe conditions who visit emergency departments have shown that HFABP is a distinct prognostic indicator.

The electrocardiogram (ECG) has a 50% sensitivity for early diagnosis of acute myocardial infarction (MI) in patients presenting with ischemic-type chest pain 14. Additionally, heart-type fatty acid-binding protein (H-FABP) offers early prognostic information in acute coronary syndrome patients without ST elevation, as it peaks earlier and is more sensitive than troponins in detecting mild myocardial damage 15. Our study aims to employ the point-of-care H-FABP test, an innovative cardiac biomarker, which allows for bedside testing and rapid results.

Aims and Objectives

- To study the role of novel biomarker heart type fatty acid binding protein(HFABP) in early diagnosis of acute coronary syndrome in emergency department.

Review of Literature

Acute coronary syndrome (ACS) is a collection of symptoms that typically indicate acute myocardial ischemia. It can include unstable angina (UA), ST-segment elevation myocardial infarction (STEMI), and non-ST-segment elevation myocardial infarction (NSTEMI), among other conditions. Although unstable angina and non-ST-elevation myocardial infarction

(NSTEMI) can range in severity, they are related disorders that share many of the same pathophysiologic causes and symptoms. When there is significant myocardial damage due to ischemia and cardiac-specific troponins T or I, or the muscle and brain fraction of creatine kinase [CK-MB], are released into the circulation, a diagnosis of non-ST elevation myocardial infarction (NSTEMI) can be made. When a patient reports ischemic chest pain and no biomarker is found in their bloodstream after a few hours, it is assumed that they have had ultrasound ablation.. First, rest angina, which usually lasts longer than twenty minutes; second, new-onset severe angina, which usually starts less than two months ago; and third, a crescendo pattern of occurrence, which can be defined as an increase in intensity, duration, frequency, or all three, is an indication of unstable angina. Annually, about 1.36 million hospital admissions are required for ACS in the US. Out of this total, 0.81 million are for myocardial infarction (MI) and the remaining 1.36 million are for unspecified adverse cardiac events (UA). While 33% of myocardial infarction patients get STEMI, over 66% experience NSTEMI.16

ACS PATHOPHYSIOLOGY

Atherosclerosis : Endothelium Role

Plaque buildup during life mostly impacts the inner lining of big and medium-sized arteries; this condition is known as atherosclerosis. An acute ischemia event will be caused by the disease in

due time. This is influenced by a number of coronary risk factors, including smoking, diabetes, high cholesterol, hypertension, and high blood pressure. The years Endothelial dysfunction, brought on by these risk factors, damages the endothelium of blood vessels, a crucial first step in the development of atherosclerosis. 17–19 Reduced nitric oxide bioavailability and increased expression of adhession molecules (including selectins, vascular cell adhesion molecules, and intercellular adhesion molecules) and impaired vascular hemostasis (due to increased levels of endothelin 1) are symptoms of a dysfunctional endothelium. Additionally, the secretion of many locally active substances increases blood thrombogenicity..20, 21

Atherosclerotic Plaque Progression: Role of Inflammation

Monocytes and other inflammatory cells enter the subendothelium once endothelium damage has occurred. After entering, they bind to endothelium adhesion molecules and undergo macrophage differentiation. After breaking down oxidised low-density lipoprotein (LDL) that has made it past the artery wall, macrophages change into foam cells and produce fatty streaks. In order to lengthen the process and bring in more vascular smooth muscle cells and macrophages, which produce components for the extracellular matrix, activated macrophages release cytokines and chemoattractants such interleukins and monocyte chemoattractant protein 1. In addition, matrix metalloproteinases are digesting enzymes secreted by macrophages. The plaque dissolves because these enzymes break down the extracellular matrix.18 Plaque rupture susceptibility is influenced by the ratio of smooth muscle cells to macrophages, among other factors. Although it can lead to ACS, the most typical occurrence is plaque rupture, which, in 99% of cases, remains undetected.22 Time is a factor in the nonlinear and entirely unpredictable pace of advancement of atherosclerotic lesions.23

Plaques Stability and Rupture Tendency

Plaque stability in atherosclerosis differs. Characteristics of so-called high-risk or vulnerable plaques include large lipid cores, thin fibrous caps, a high concentration of T lymphocytes and macrophages, a relative absence of smooth muscle cells, eccentric outward remodelling, an increase in intraplaque haemorrhage, and a localised increase in neovascularity.31 Human atherosclerotic plaque composition can vary greatly, even within an individual.32 Increased macrophage activity at the plaque site is associated with inflammation, which in turn determines the "vulnerability" of plaques. Because of the thinning of the plaque cap and the enlargement of the lipid core brought about by this uptick in activity, the plaque is more likely to burst. Researchers have shown that higher levels of C-reactive protein (CRP) are positively correlated with more plaque ruptures, suggesting that these macrophages are actively working.35

Plaque Disruption, Thrombosis, and ACS

There is a complicated interplay between the endothelium, inflammatory cells, and blood thrombogenicity in the pathogenesis of ACS.36, 37 According to angiographical analysis, noncritical coronary lesions, which are defined as a vessel diameter less than 50% stenosis, might be associated with a rapid progression to severe or complete blockage in up to two-thirds of individuals with acute coronary syndrome (ACS). Balance of patient's prothrombotic and antithrombotic, local inflammation, blood flow, plaque lipid and tissue factor content, rupture severity, and inflammation level are some of the factors that influence the deegree of thrombus

formation and the likelihood that a specific plaque rupture will cause ACS.40–43 The majority of myocardial infarctions (MIs) (around 75%) are caused by plaque rupture, whereas 25% are due to superficial endothelial degradation, as shown in postmortem investigations.44 When endothelial erosion or plaque rupture occurs, the tissue factor-rich subendothelial matrix is exposed to the circulating blood. This matrix is a potent procoagulant. The exposure triggers the adhesion of platelets, which in turn triggers their activation, aggregation, and eventual development of a thrombus. Thrombi can grow in two ways: first, as a red clot composed of fibrin and restricted arterial flow; second, as a white clot composed of platelets and formed in regions of high shear stress; and third, as a partial occlusion of the artery by a fibrin-rich thrombi. Red clots, when combined with white clots, can cause complete obstruction. Several lines of evidence point to thrombosis as a critical component of ACS pathogenesis. 45–47

Treatment Goals and Approaches

Like the symptoms of acute coronary syndrome (ACS), the findings of coronary angiography and angioscopy are serious. Red clots occur in STEMI patients, but UA/NSTEMI patients only observe white clots. Less than half, nearly half The therapy aims and methods for UA/NSTEMI and STEMI are distinct because of the distinct underlying pathophysiologies of the two conditions. One common objective of revascularization in UA/NSTEMI is to improve blood flow and preevent reocclusion or recurrent ischemia. The purpose of antithrombotic therapy is to decrease coronary stenosis and prevent further thrombosis by removing the thrombus and promoting endogenous fibrinolysis. 50–54 However, with an ST-elevation myocardial infarction (STEMI), the infarct-related artery is typically completely blocked, and the first line of treatment is typically to reperfuse

the coronary arteries with medication or a catheter to return blood flow to normal.56 Other therapies, like as lipid-lowering and anti-ischemic medicine, are constantly used to stabilise plaques over time.

EARLY ASSESSMENT

To differentiate between STEMI and UA/NSTEMI, a 12-lead electrocardiogram (ECG) and a medical evaluation are required, as their symptoms are similar. In 2011, the American Heart Association and the American College of Cardiology released recommendations for the treatment of UA/NSTEMI. An emergency department (ED) or other institution that can record a 12-lead electrocardiogram (ECG), identify biomarkers, and have a clinician examine the results should be the first stop for patients experiencing symptoms that might indicate acute coronary syndrome (ACS), according to the guidelines.57 It is recommended that patients who have previously been prescribed nitroglycerin take one pill under the tongue whenever they feel chest pain or discomfort. If the patient takes one dose of nitroglycerin and either doesn't feel better or notices an aggravation of symptoms within five minutes, they should immediately dial 9-1-1.57 s. Additionally, it is important for them to teach patients to identify the signs of ACS and to dial 9-1-1 immediately in the event that they occur.58

Acute coronary syndrome (ACS) symptoms, including chest tightness, should be given first attention in patient triage. There must to be a standard operating procedure that is particular to each institution for the assessment and management of chest pain. If the initiial diagnosis and treatment plan are still uncleear, the emergency department physician should obtain guidance from a cardiac specialist quickly. An estimated 20–25 percent of the 6–7 million Americans who seek

treatment in emergency departments (EDs) annually for chest pain or other symptoms that may suggest acute coronary syndrome (ACS) end up being diagnosed with unclassified myocardial infarction (MI) or undetermined apparent cause (UA).59 For those who are suffering from chest discomfort, the possible diagnoses are in Table 1.

TABLE 1. Chest Pain Differential Diagnosis

- Nonischemic cardiovascular
  - Aortic dissection[a]
  - Myocarditis
  - Pericarditis
  - Hypertrophic cardiomyopathy
  - Stress cardiomyopathy
- Chest wall/musculoskeletal
  - Cervical disk disease
  - Costochondritis
  - Herpes zoster
  - Neuropathic pain
  - Rib fracture
- Pulmonary
  - Pneumonia
  - Pulmonary embolus[a]
  - Tension pneumothorax[a]
  - Pleurisy
- Gastrointestinal
  - Cholecystitis
  - Peptic ulcer disease
    - Nonperforating
    - Perforating[a]
  - Gastroesophageal reflux disease
  - Esophageal spasm
  - Boerhaave syndrome (esophageal rupture with mediastinitis)[a]
  - Pancreatitis
- Psychiatric
  - Depression
  - Anxiety disorder/panic attack
  - Somatization and psychogenic pain disorder

[a] Potentially life-threatening conditions

CLINICAL Features

The likeliihood that symptoms and signs indicate an ACS secondary to CAD is shown in Table 2.[60]

Feature	High likelihood *Any of the following:*	Intermediate likelihood *Absence of high-likelihood features and presence of any of the following:*	Low likelihood *Absence of high- or intermediate-likelihood features but may have:*
History	Chest or left arm pain or discomfort as chief symptom reproducing previously documented angina Known history of CAD, including MI	Chest or left arm pain or discomfort as chief symptom Age ≥70 y Male sex Diabetes mellitus	Probable ischemic symptoms in absence of any of the intermediate-likelihood characteristics Recent cocaine use
Examination	Transient MR murmur, hypotension, diaphoresis, pulmonary edema, or rales	Extracardiac vascular disease	Chest discomfort reproduced by palpation
ECG	New, or presumably new, transient ST-segment deviation (≥1 mm) or T-wave inversion in multiple precordial leads	Fixed Q waves ST depression of 0.5-1.0 mm or T-wave inversion >1.0 mm	T-wave flattening or inversion <1 mm in leads with dominant R waves Normal ECG tracing
Cardiac markers	Elevated cardiac TnI, TnT, or CK-MB levels	Normal	Normal

ACS = acute coronary syndrome; CAD = coronary artery disease; CK-MB = muscle and brain fraction of creatine kinase; ECG = electrocardiography; MI = myocardial infarction; MR = mitral regurgitation; TnI = troponin I; TnT = troponin T.

A detailed and focused history taking and physical examination are required to ascertain the probability of a negative result and the probability that the presenting disease is acute coronary syndrome (ACS). A more severe form of angina known as stable angina manifests as deep, poorly localised chest or arm pain that gets better with rest, nitroglycerin, or both; UA pain, on the other hand, is open, occurs when at rest, and is more commonly reported as severe. The substernal (or epigastric) area may be the origin of symptoms that radiate to other areas of the body, including the jaw, left shoulder, and left arm. Some patients may also have what are known as "anginal equivalent" symptoms, which include chest pain, nausea, vomiting, diaphoresis, dyspnea, and inexplicable exhaustion.61 Women and the elderly are at a higher risk of experiencing unusual symptoms.. There are other symptoms of ACS besides syncope. In most cases, ischemia is not the

cause of intense, stabbing, pleuritic, palpable, responsive, or pinpoint pain (such as on the tip of a single finger). Chest discomfort that resolves after taking sublingual nitroglycerin is not a sign of acute coronary syndrome (ACS) in the emergency department. To identify ischemia due to coronary artery disease (CAD), the most relevant history-related features include a history of CAD, the kind of anginal symptoms (Table 2), being male, being elderly, and having many classical risk factors in that order of relevance. 62,63 Despite their negative associations with patients already diagnosed with ACS, conventional cardiac risk factors such as high blood pressure, high cholesterol, diabetes, smoking, and a family history of early coronary artery disease are only weak indicators of the probability of acute ischemia. 64

After an acute ischemic episode, a physical exam should mainly seek to 1) detect potential risk factors for myocardial ischemia and 2) evaluate hemodynamic consequences. While conducting the physical examination, it is important to record any symptoms that may indicate significant ischemia and a high risk, such as profuse sweating, pale complexion, sinus tachycardia, a third or fourth heart sound, basilar rales, and low blood pressure. It is also possible to arrive at a differential diagnosis by using physical exam findings. Aortic dissection may be indicated by irregular heartbeats or the bruit of aortic regurgitation; severe pericarditis might be suggested by a pericardial friction rub.

ECG- Electrocardiography

If a patient presents to the emergency department (ED) complaining of chest pain or any other symptoms that might indicate acute coronary syndrome (ACS), the 12-lead electrocardiogram (ECG) findings should be evaluated by a seasoned physician as soon as possible, preferably within

10 minutes, according to the ACC/AHA recommendations.57 When it comes to risk assessment and clinical diagnosis of ACS, the electrocardiogram (ECG) is a lifesaver. However, there are a few downsides to electrocardiography.

Abnormalities on the electrocardiogram (ECG) associated with UA range from 30% to 50% of patients; These results might be a combination of T-wave inversion, transiient ST-segment elevation, ST-segment depression, or a combination of these, depending on how serious the clinical presentation 65,66 Ischemia and prognosis can be accurately and significantly indicated by as little as a 0.05 mV new ST-segment deviation. Although it is not as precise, ischemia can be detected by 65-67 T-wave inversion if it is not severe (≥0.3 mV).54 Rechecks of cardiac biomarkers indicate acute MI in 90% of patients when at least two consecutive leads show an ST-segment elevation of 0.1 mV or higher.68 Research shows that patients are less likely to have issues if they do not detect variations in their ECG, therefore comparing the present study's results with those from the past is vital.69
The ACC/AHA guidelines suggest that patients admitted to the hospital for UA/NSTEMI should undergo continuous ST-segment monitoring or serial ECG tracings. 70,71

Cardiac Biomarkers of Necrosis

It is imperative that cardiac biomarkers be assessed in all patients exhibiting chest pain or other symptoms indicative of ACS.. Since troponin levels remain elevated for 5 to 14 days after myocardial necrosis, they are not a particularly helpful indicator of recurrent myocardial damaged. When a patient presents for examination a few days following the onset of symptoms, however, they can be helpful in detecting heart damage. The shorter half-life of CK-MB makes its levels

useful in diagnosing periprocedural MI and infarct extension (reinfarction).72 Pros and cons of each biomarker in Table 3,

TABLE 3. UA/NSTEMI Short-term Risk of Death or Nonfatal MI

Feature	High risk *At least 1 of the following features must be present:*	Intermediate risk *No high-risk feature, but must have 1 of the following:*	Low risk *No high- or intermediate-risk feature but may have any of the following:*
History	Accelerating tempo of ischemic symptoms in preceding 48 h	Previous MI, peripheral or cerebrovascular disease, or CABG; previous aspirin use	
Character of pain	Prolonged ongoing (>20 min) resting pain	Prolonged (>20 min) rest angina, now resolved, with moderate or high likelihood of CAD Rest angina (>20 min) or relieved with rest or sublingual nitroglycerin Nocturnal angina New-onset or progressive CCS class III or IV angina in the past 2 wk without prolonged (>20 min) rest pain but with intermediate or high likelihood of CAD[b]	Increased angina frequency, severity, or duration Angina provoked at a lower threshold New-onset angina with onset 2 wk to 2 mo before presentation
Clinical findings	Pulmonary edema, most likely because of ischemia New or worsening MR murmur S_3 or new/worsening rales Hypotension, bradycardia, tachycardia Age ≥75 y	Age ≥70 y	
ECG	Angina at rest with transient ST-segment changes >0.5 mm Bundle branch block, new or presumed new Sustained ventricular tachycardia	T-wave changes Pathologic Q waves or resting ST-depression <1 mm in multiple lead groups (anterior, inferior, lateral)	Normal or unchanged findings on ECG
Cardiac markers	Elevated cardiac TnT, TnI, or CK-MB (eg, TnT or TnI >0.1 ng/mL)	Slightly elevated cardiac TnT, TnI, or CK-MB (eg, TnT >0.01 but <0.1 ng/mL)	Normal

[a] CABG = coronary artery bypass graft; CAD = coronary artery disease; CCS = Canadian Cardiovascular Society; CK-MB = muscle and brain fraction of creatine kinase; ECG = electrocardiography; MI = myocardial infarction; MR = mitral regurgitation; NSTEMI = non–ST-elevation myocardial infarction; TnI = troponin I; TnT = troponin T; UA = unstable angina.

Table 4: Biiochemical Cardiac Markers for the Assessment and Treatment of Patients Suspected of Having Acute Coronary Syndrome (ACS) Who Do Not Have an ST-Segment Elevation by 12-Lead Electrocardiogram

Marker	Advantages	Disadvantages	POC test?	Comment	Clinical recommendation
Cardiac troponins	1. Powerful tool for risk stratification 2. Greater sensitivity and specificity than CK-MB 3. Detection of recent MI up to 2 wk after onset 4. Useful for selection of therapy 5. Detection of reperfusion	1. Low sensitivity in very early phase of MI (<6 h after symptom onset) and requires repeated measurement at 8 to 12 h, if results are negative 2. Limited ability to detect late minor reinfarction	Yes	Data on diagnostic performance and potential therapeutic implications increasingly available from clinical trials	Useful as a single test for efficiently diagnosing NSTEMI (including minor myocardial damage), with serial measurements Clinicians should familiarize themselves with diagnostic "cutoffs" used in their local hospital laboratory
CK-MB	1. Rapid, cost-efficient, accurate assays 2. Ability to detect early reinfarction	1. Loss of specificity in setting of skeletal muscle disease or injury, including surgery 2. Low sensitivity during very early MI (<6 h after symptom onset) or later after symptom onset (>36 h) and for minor myocardial damage (detectable with troponins)	Yes	Familiar to most clinicians	Previous standard and still acceptable diagnostic test in most clinical circumstances
Myoglobin	1. High sensitivity 2. Useful in early detection of MI 3. Detection of reperfusion 4. Most useful in ruling out MI	1. Very low specificity in setting of skeletal muscle injury or disease 2. Rapid return to normal range limits sensitivity for later presentations	Yes	More convenient early marker than CK-MB isoforms because of greater availability of assays for myoglobin; rapid-release kinetics make myoglobin useful for noninvasive monitoring of reperfusion in patients with established MI	

ACS = acute coronary syndrome; CK-MB = muscle and brain fraction of creatine kinase; ECG = electrocardiography; MI = myocardial infarction; NSTEMI = non–ST-segment elevation MI; POC = point-of-care.

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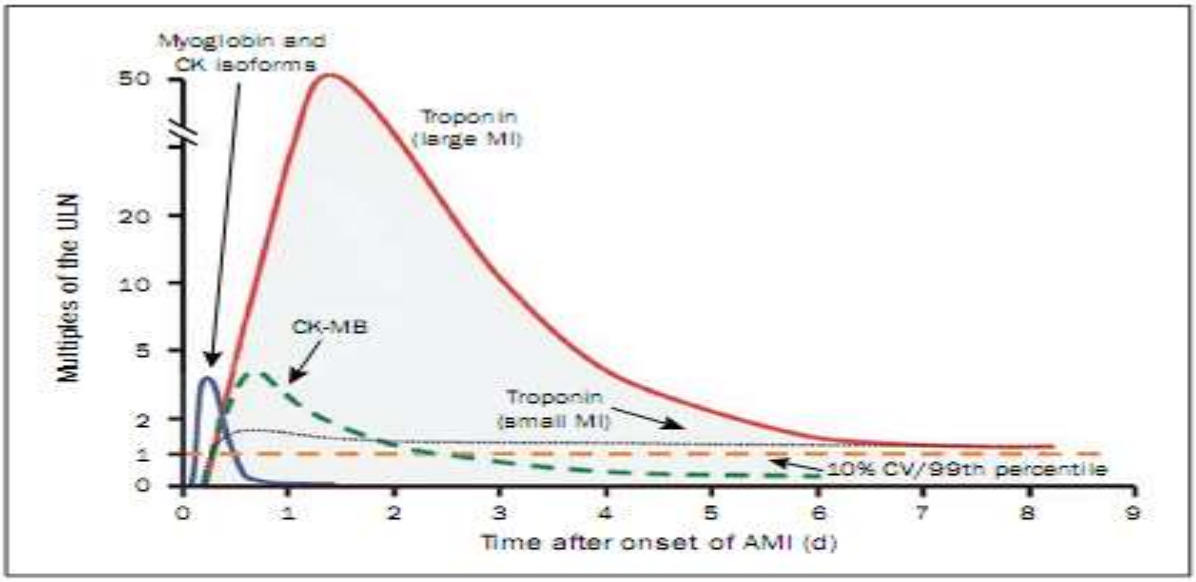


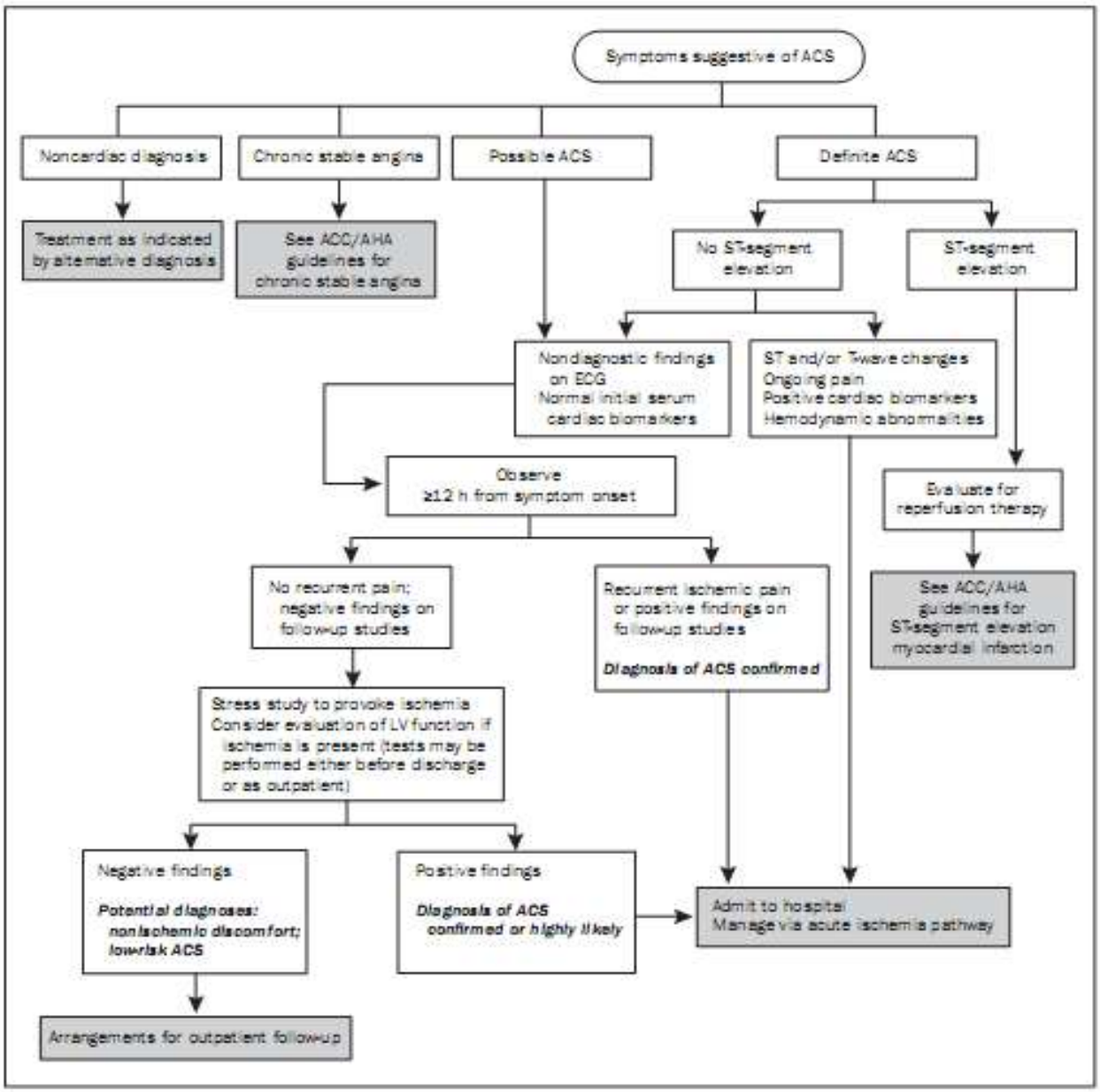
FIGURE 1. Timing of release of various biomarkers after acute myocardial infarction (AMI). The biomarkers are plotted showing the multiples of the cutoff for AMI over time. The dashed horizontal line shows the upper limit of normal (ULN, defined as the 99th percentile from a normal reference population without myocardial necrosis; the coefficient of variation [CV] of the assay should be 10% or less). The earliest rising biomarkers are myoglobin and creatine kinase (CK) isoforms (leftmost curve). The muscle and brain fraction of CK (CK-MB, dashed curve) rises to a peak of 2 to 5 times the ULN and typically returns to the normal range within 2 to 3 d after AMI. The cardiac-specific troponins show small elevations above the ULN in small infarctions (eg, as is often the case with non–ST-segment elevation MI) but rise to 20 to 50 times the ULN in the setting of large infarctions (eg, as is typically the case in ST-segment elevation MI). The troponin levels may stay elevated above the ULN for 7 d or more after AMI.

Laboratory Tests

It is standard practice to take a chest radiograph upon admission to check for pulmonary congestion, which is an indicator of a poor prognosis, and to rule out other possible causes of chest pain..74 For instance, if a patient has ACS symptoms and persistent tachycardia, it is important to check their thyroid function. It is also recommended that certain individuals get evaluated for potential secondary causes of ACS. Other circulating risk indicators might potentially be measured as well.

Emergency department

The present emergency department routes for the evaluation and treatment of patients with acute coronary syndrome rely on four main diagnostic tools: patient history, the outcomes of stress tests, electrocardiogram (ECG), and levels of cardiac markers. The ACC/AHA guidelines suggest the route in Figure 2.



Patient assessment and treatment algorithm for suspected acute coronary syndrome (ACS) (Figure 2). An acronym for "American Heart Association" and "American College of Cardiology,"

respectively Electrocardiography (ECG) and left ventricular (LV) are synonyms. Hospitalization is necessary for individuals with confirmed ACS to get further treatment. It is acceptable to place unless there is evidence of hemodynamic or electrical instability, active, ongoing ischemia or damage. In such cases, critical care unit admission is indicated. Rapid reperfusion therapy should be considered for patients who display persistent elevation of the ST-segment. Those patients who present with suspicious chest discomfort in addition to symptoms that rule out a cardiac diagnosis (such as gastrointestinal or musculoskeletal disorders) may be advised to return to their primary care physician for further evaluation before being discharged. Also present in this context is persistent stable angina. A hospital's telemetry ward, a chest pain unit, or the emergency department can monitor the heart rates of other patients who may be experiencing acute coronary syndrome. Electrocaardiogram (ECG) (or continuous 12-lead ECG monitoring) and cardiac biomarker meeasurements should be taken at regular, prearranged intervals. Discontinuation of the route and hospitalisation ensues in the case that the patient experiences new ST-segment abnormalities or elevations of cardiac markers. A diagnosis of acute coronary syndrome is likely in these cases. If the patient is still pain-free and the EKG and cardiac marker tests come back negative, it is advisable to conduct an early stress test either before discharge or within 72 hours of being an outpatient. Patients who do not receive a positive result from their diagnostic tests may nevertheless be given advice regarding their treatment plan, medications, and potential follow-up exams. Patients with left ventricular (LV) dysfunction or stress test findings of ischemia must be hospitalised and treated according to a protocol for acute ischemia.75

RISK STRATIFICATION

The 30-day death rates for individuals with UA varied from 1.7% to 7.4%, whereas for those with NSTEMI they were 11.1%, demonstrating that the results for patients with ACS include the full risk spectrum.76 Early risk classification helps with prognosis estimation, therapy selection (e.g., glycoprotein [GP] IIb/IIIa inhibitors and early invasive approach), and care location selection (e.g., coronary care unit or monitored step-down unit). 77–79

High-Risk Clinical Subgroups

Patients with ACS are more likely to have adverse outcomes if they are older, have diabetes (diabetic patients with UA/NSTEMI have a risk of adverse outcomes that is around 50% higher than nondiabetic patients), have extracardiac vascular disease, show signs of congestive heart failure (CHF; Killip class II or higher), and present with ACS despite long-term aspirin therapy. 80–84

Electrocardiography

The admission ECG reliably predicts the prognosis, whether it's short- or long-term. In the Thrombolysis in Myocardial Infarction (TIMI) III Registry, patients with UA/NSTEMI had a risk of death or MI that was almost double at 30 days and one year for every 0.05 mV ST deviation.65 There was an elevated risk of death and a correlation between ST depression of 0.05 mV or more on the admission ECG and a higher 4-year mortality rate, according to another study.67 Alternatively, a T-wave inversion of 0.1 mV or more was linked with either no higher risk of mortality or MI in the future or a very little increase in risk.67 Leads displaying ST elevation are a helpful risk indicator for STEMI patients.85

Troponins and Other Markers

Troponin is useful as a risk assessment tool for a number of individuals showing symptoms of acute myocardial infarction. Patients with a poor prognosis who are at high risk and might benefit from targeted treatment—GP IIb/IIIa inhibitors, early invasive surgeries, or both—are identified when troponin elevations of any magnitude are detected.86 In addition, there is a quantitative correlation between the severity of elevated troponin levels and the probability of mortality. 87 . Inflammation markers in plasma have lately attracted attention as possible risk indicators for individuals with ACS; C-reactive protein (CRP) is the best studied of these markers. An increased risk of mortality is linked to raised C-reactive protein levels, which can be detected by a high-sensitivity C-reactive protein test. Patients' C-reactive protein levels differentiated high-risk from low-risk groups when troponin levels were normal; 4.5% of this group died within 14 days. When these individuals' CRP levels were high, the morrtality rate increased to 5.8%; when levels were normal, it was just 0.4%.88 It is worth noting that the CRP threshold in the ACS setting is practically five times higher (>15 mg/L) compared to the stable CAD condition (>3 mg/L) (to convert to nmol/L, multiply by 9.524). Increased white blood cell counts have been associated with worse mortality and recurrent MI in patients with UA/NSTEMI, providing another clear indication of inflammation. There are 89,90 An independent predictor of mortality or recurrent MI at six months was shown to be myeloperoxidase in a study including 1090 individuals with ACS. 91

As far as prognoses for patients with atrial fibrillation (ACS) are concerned, B-type natriuretic peptide (BNP) is quite strong. The risk of both immediate and delayed death rose directly proportionate to the increase in N-terminal proBNP levels, according to the GUSTO-IV (Global Utilisation of Strategies To Open Occluded Arteries IV) study, which included 6,809 patients with UA/NSTEMI..92 In the OPUS-TIMI 16 study, patients with myocardial infarction who had high

blood nitric oxide (BNP) levels (>80 pg/mL; multiply by 1.0 to get ng/L) were two to three times more likely to die at 10 months than those whose levels were normal.93 There was an increased risk of short-term death for people with STEMI who had high BNP levels.94 It has been found that the peak BNP level increases as the size of the cardiac infarct increases.9.5 (It has been proposed that a multimarker strategy, which makes use of many biomarkers, might enhance risk classification and patient outcomes. 96

In order to provide patients with ACS with a comprehensive risk assessment and an accurate prognostication technique, many teams have developed an integrated strategy that uses a variety of predictor factors to generate a multivariable risk model. Seven distinct risk factors comprise the TIMI risk score: being 65 years old or older, having three or more CAD risk factors, having documented CAD during catheterization, having a ST deviiation of 0.5 mm or more, having two or more episodes of angina in the last 24 hours, taking aspirin within the last week, having elevated cardiac markers, and finally, being at least 65 years old. Patients may be categorised along a 10-fold risk gradient, from 4.7% to 40.9% (P<.001), using this scoring system.97 The TIMI risk score can identify high-risk individuals; these patients have had better results with less intrusive therapies and with newer, stronger drugs such GP IIb/IIIa inhibitors.98.99 In unstable angina, the GRACE risk score is better for predicting death than the WHO risk score, while in unstable angina, the PURSUIT risk score is better than the WHO risk score.two hundred and one It is possible to estimate the mortality rate of STEMI patients using a variety of risk assessments..102,103

UNSTABLE ANGINA/NSTEMI

Reducing ischemia and preventing unfavourable ischemic events from happening again are the main objectives of early treatment for patients with UA/NSTEMI, as stated in the 2011 ACC/AHA

recommendations.57 Doing so will necessitate the administration of anti-ischemic, antiplatelet, and anticoagulant drugs. Aside from strict medical treatment, two new alternatives for patients with UA/NSTEMI have emerged: an early invasive operation and an initial conservative strategy. Our decisions about the intensity and kind of medical therapy to administer to patients are informed by risk grading (Table 5).

TABLE 5. Anti-Ischemic Therapy Recommendations

Nonpharmacological care
Bed rest for all patients
Continuous electrocardiographic monitoring for patients with ongoing chest pain at rest
Supplemental oxygen for patients with cyanosis or respiratory distress
Finger pulse oximetry or arterial blood gas measurement for patients with hypoxemia determination to confirm adequate arterial oxygen saturation
Pharmacological care
Nitroglycerin, sublingual tablet or spray, followed by intravenous administration for all patients
Morphine sulfate, intravenously for patients who have symptoms that are not immediately relieved with nitroglycerin or who have acute pulmonary congestion, severe agitation, or both
β-Blocker, intravenous, followed by oral administration (if not contraindicated) for patients with ongoing chest pain
Nondihydropyridine CCB as initial therapy in the absence of severe LV dysfunction or other contraindications for patients with continuing or frequently recurring ischemia when β-blockers are contraindicated
ACE inhibitor for patients with hypertension despite treatment with nitroglycerin and a β-blocker and with LV systolic dysfunction or CHF; patients with diabetes

ACE = angiotensin-converting enzyme; CCB = calcium channel blocker; CHF = congestive heart failure; LV = left ventricular.

Initial Conservative Strategy and Early Invasive Strategy

One early invasive strategy is to regularly catheterize the heart within four to twenty-four hours of admission. The next step, based on the coronary architecture, is to revascularize the affected area using either perrcutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). As a precautionary measure following initial medical treatment, a catheterization and revascularization operation may be undertaken if ischemia recurs despite intense medical therapy, whether at rest or during a noninvasive stress test.. Class I evidence was awarded to the early invasive technique by the 2011 ACC/AHA guidelines. A suggestion for high-risk individuals with UA/NSTEMI (Table 6).57 Since the results obtained by conservative and intrusive strategies are comparable for low-risk individuals, the recommendations advise using one or the other. On the

other hand, for women who exhibit low-risk traits, the recommendations place the conservative approach in class I.

Invasive	Recurrent angina or ischemia at rest or with low-level activities despite intensive medical therapy Elevated cardiac biomarkers (TnT or TnI) New or presumably new ST-segment depression Signs or symptoms of HF or new or worsening mitral regurgitation High-risk findings from noninvasive testing Hemodynamic instability Sustained ventricular tachycardia PCI within 6 mo Prior CABG High risk score (eg, TIMI, GRACE) Reduced left ventricular function (LVEF <40%)
Conservative	Low risk score (eg, TIMI, GRACE) Patient or physician preference in the absence of high-risk features

CABG = coronary artery bypass grafting; GRACE = Global Registry of Acute Coronary Events; HF = heart failure; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary intervention; TIMI = Thrombolysis in Myocardial Infarction; TnI = troponin I; TnT = troponin T.

Both of these broad approaches have only been tested in ten randomised studies thus far. Although the first three trials and the most current study did not find any noticeable changes in the results across the methods, the remaining six investigations have shown that an early intrusive procedure delivers considerable benefits.

As a part of the TACTICS-TIMI 18 trial, which stands for "Treat Angina With Aggrastat and Determine Cost of Therapy with an Invasive or Conservative Strategy—Thrombolysis in Myocardial Infarction," 104,200 patients who were given aspirin, heparin, and tirofiban were randomly assigned to a conservative or early invasive strategy.55 At six months, the rate of significant end points such as mortality, MI, or rehospitalization for ACS was 15.9% in the early invasive group and 19.4% in the cautious approach group (odds ratio, 0.78; P=.025).55.An early invasive strategy was equally helpful for both men and women with non-ST-segment elevation ACS, according to a meta-analysis of eight randomised trials comparing conservative and invasive strategies. This was determined based on elevated levels of necrosis biomarkers, which indicated high-risk disease.108

A recent randomised trial called TIMACS compared the outcomes of two treatment strategies for high-risk patients with UA/NSTEMI. One strategy involved intervening within 24 hours of presentation, while the other allowed for intervention at any time greater than 36 hours after presentation. The patients were divided into two groups.109

Nitroglycerin

Nitroglycerin, a vasodilator, reduces ventricular preload and oxygen demand on myocardial by widening the major coronary arteeries and boosting collateral flow to ischemic areas.. Every five minutes, under the tongue or in the mouth spray 0.3–0.6 mg of nitroglycerin for the first three doses. The adminiistration of intravenous nitroglyceriin should be initiated in the event that pain persists. An initial dose rate of 5-10 μg/min should be maintained and increased every three to five minutes until the symptoms go away or the systolic blood pressure falls below 100 mm Hg. In cases where the patient has not experienced pain for 12 to 24 hours following the pain episode's

subsidence, topical or oral nitrates can be administered instead of intravenous nitroglycerin. Nitroglycerin should not be used in patients who have hypotension, or who have taken sildenafil or tadalafil within the past two days.110

Other Analgesics, Morphine

It is recommended to provide morphine if ischemia-related symptoms persist after three doses of nitroglycerin or if they reappear during therapy. The patient's respiratory rate and blood pressure should be closely monitored while administering intravenous morphine sulphate injections ranging from 1 to 5 mg every 5 to 30 minutes. In addition to its powerful analgesic and anxiety-reducing benefits, morphine's hemodynamic effects make it a potentially beneficial medication for the treatment of UA/NSTEMI. The 2007 ACC/AHA recommendations suggested using class IIa morphine instead of class I for uncontrolled ischemia pain. This was because, despite the data being susceptible to uncontrolled selection biases, results from a big observational registry indicated that morphine usage was associated with an increased adjusted chance of mortality.111 According to the ACC/AHA guidelines, if a patient presents with UA/NSTEMI, they should immediately discontinue using aspirin and other NSAIDs. The EXTRACT-TIMI 25 study demonstrated an increased chance of adverse cardiovascular events, and these medications are recognised to pose hazards to cardiovascular health. 111–113

Beta Blockers

The myocardium's oxygen demand is reduced by β-blockers because they reduce heart rate and myocardial contractility by blocking β-1 adrenergic receptors. As to the 2007 ACC/AHA

guidelines, if there are no contraindications, oral β-blocker medication should be initiated during the initial 24 hours following the onset of ACS.57. Administering intravenous β-blockers (class IIa recommendation) to a patient who has hypertension when they are first seen makes sense. Patients with tachycardia, hypotension, or Killlip class II or III CHF were more likely to experience cardiogenic shock when given intravenous β-blockers compared to those who did not, according to the COMMIT research (Clopidogrel and Metoprolol in Myocardial Infarction). The use of intravenous β-blockers was warned against in the 2007 ACC/AHA recommendations due to this study.114 Exclusion criteria for β-blockade include severe sinus bradycardia (heart rate less than 50 beats per minute), marked first-degree atrioventricular block (ECG P-R interval greater than 0.24 seconds) or any second or third degree atrioventricular block, persistent hypotension, pulmonary edoema, a history of bornchospasm, symptoms of low output (such as oliguria), and an increased risk of cardiogenic shock.67 Evidence from several placebo-controlled studies shows that β-blockers can decrease the occurrence of recurrent ischemia, MI, or both in patients with UA/NSTEMI.115–118

Calcium Channel Inhibitors

By reducing myocardial oxygen demand and improving myocardial blood flow via preventing contraction of both the vascular smooth muscle and the myocardium, calcium channel blockers have a dual benefit. Patients who have Prinzmetal variant angina, are not candidates for β-blockade, or experience chronic or repeated symptoms after using full-dose nitrates and β-blockers should think about taking these medications, as stated in the ACC/AHA recommendations.57 These individuals are recommended to take calcium channel blockers like diltiazem or verapamil, which reduce heart rate. These drugs should not be given to patients who have pulmonary edoema

or severe left ventricular failure.119 Among randomised trials evaluating calcium channel blockers for individuals with acute coronary syndrome (ACS). Patients suspected of having an ACS who were treated with verapamil had a trend towards reduced chances of death or MI, the data showed.120,121 Both myocardial infarction and refractory angina can be effectively treated with dilazem.122 When used without a β-blocker, the adverse effects of nifedipine's non-cardiac heart rate lowering effect might be observed in individuals suffering from acute myocardial infarction (MI).123 Despite the lack of data in ACS patients, studies with normotensive patients with CAD or hypertensive patients with cardiovascular risk factors have shown the significant effectiveness of amlodipine and felodipine, two newer dihydropyridine calcium antagonists.124,125

RAAS Inhibitors

Within the first twenty-four hours after the procedure, patients with pulmonary congestion or a left ventricular ejection fraction of forty percent or less should be given an oral angiotensin-converting enzyme inhibitor (ACE) or, in the absence of an ACE inhibitor, an angiotensin II receptor blocker, according to the 2011 ACC/AHA recommendations. Patients without these symptoms should not get this medication unless there are other known contraindications, such hypotension, according to Class IIa guidelines.57 Several large trials shown a significant reduction in death rates when ACE inhibitor treatment was started within twenty-four hours after myocardial infarction, which is why these medicines are recommended.Patients at higgh risk of cardiovascular events after myocardial infarction (MI) benefited equally from captopril and the angiotensin II receptor blocker Valsartan, however the two medications were harmful when taken together (126,127 persons).128 Most people with high-risk chronic CAD should take an ACE inhibitor.130

Plerenone, a selective aldosterone receptor blocker, was found to reduce mortality and morbidity rates in the EPHESUS trial, which looked at patients with myocardial infarction (MI) who also had left ventricular dysfunction, chronic heart failure (CHF), or diabetes mellitus.131 Plerenone should be given to these patients over the long term even when there is no evidence of severe renal failure or hyperkalemia. 57

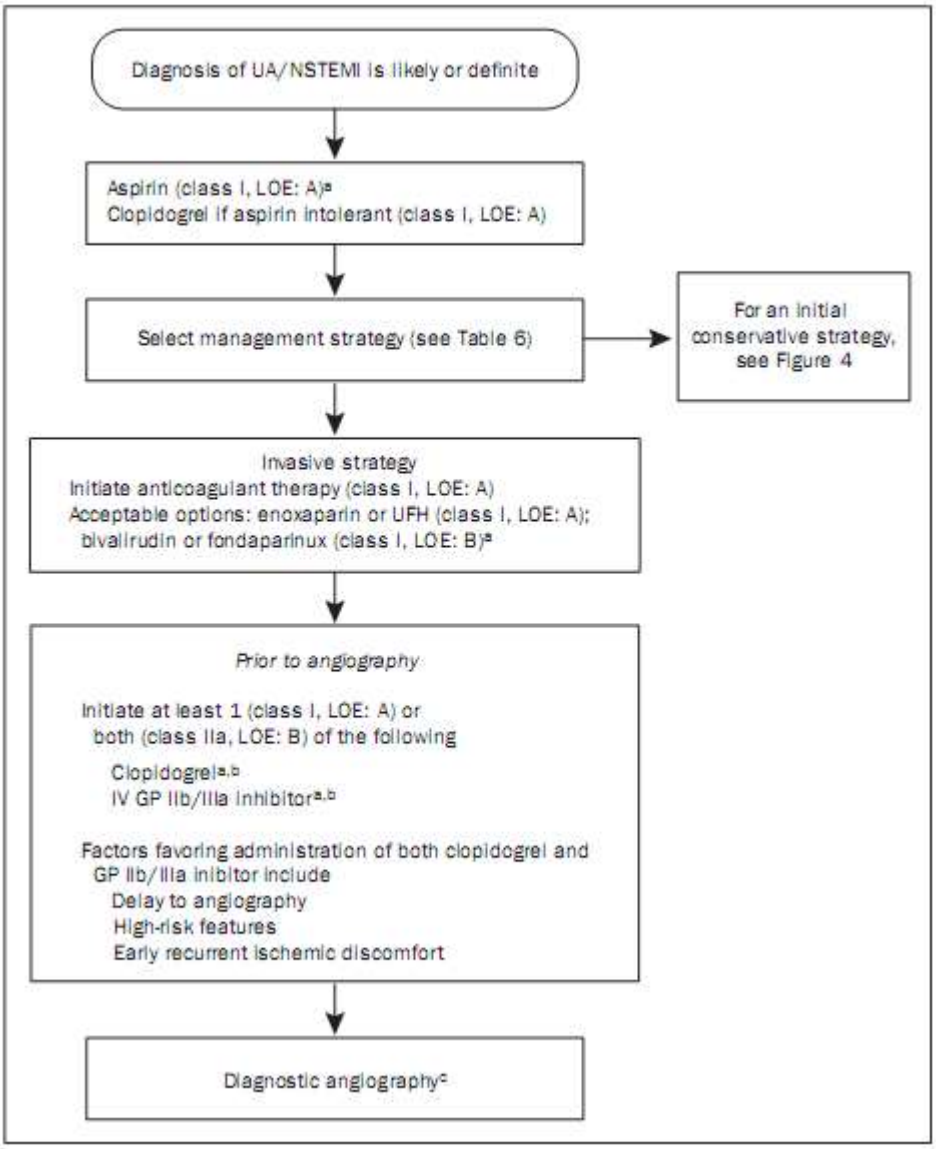
Anti-Ischemic Treatments

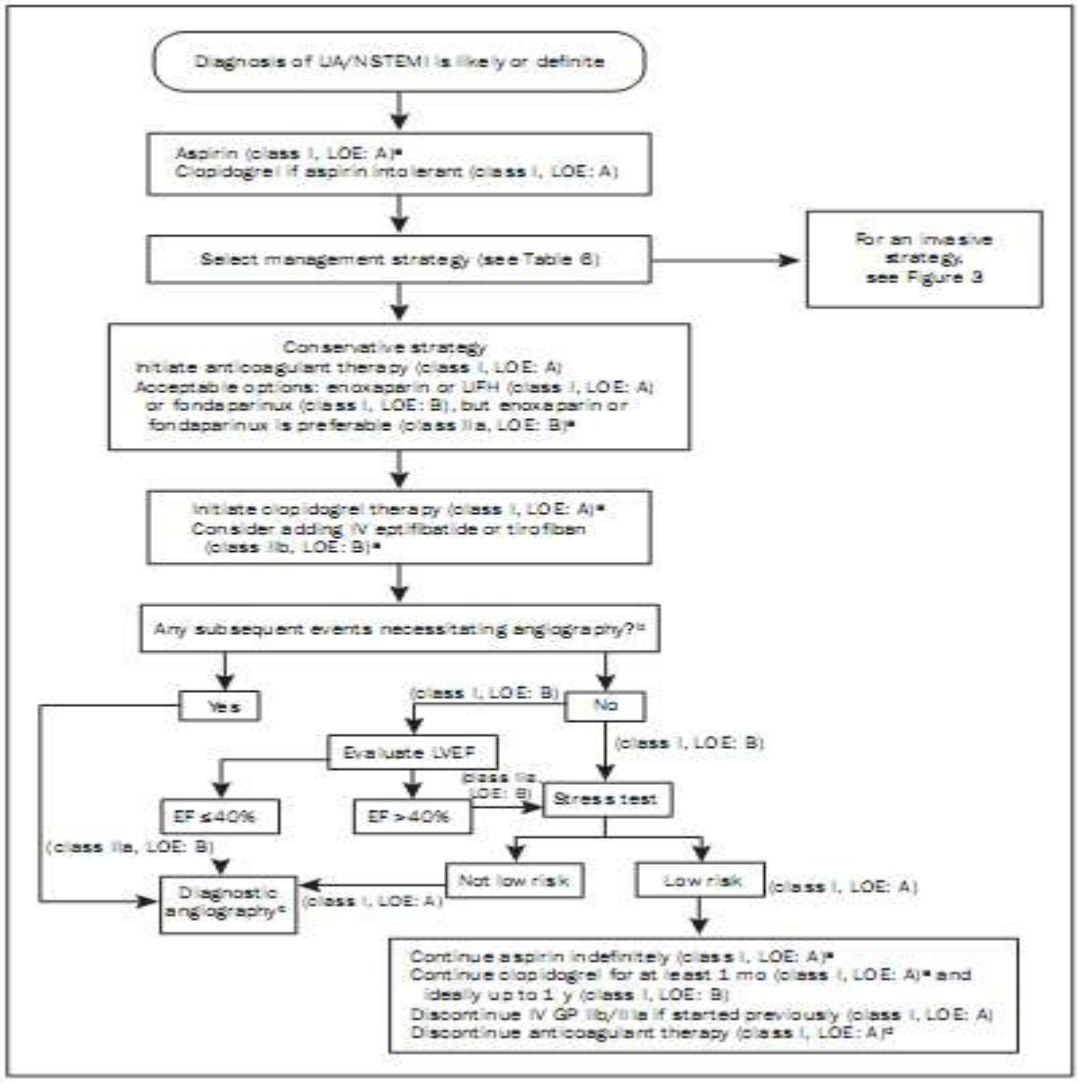
You can treat chronic refractory angina with ranolazine, an anti-ischemic medication that has recently been licenced, either on its own or with nitrates, β-blockers, or amlodipine. According to the MERLIN-TIMI 36 trial (Metabolic Efficiency with Ranolazine for Less Ischemia in Non—ST-Elevation Acute Coronary Syndromes—Thrombolysis in Myocardial Infarction), when administered within 48 hours of the start of UA/NSTEMI, ranolazine significantly reduced the incidence of recurrent ischemia compared to placebo (HR, 0.87; 95% CI, 0.76-0.99; P=.03). The use of ranolazine as a composite end goal failed to enhance outcomes for myocardial infarction, recurrent ischemia, or cardiovascular death (HR, 0.92; 95% CI, 0.83-1.02; P=.11).132,133

Antithrombotic therapy

The foundation of treating patients with UA/NSTEMI is antithrombotic medication. The first part, antiplatelet medication, lowers platelet activation and aggregation—two crucial processes in thrombus formation following plaque rupture—and the second part, anticoagulant therapy, stops

fibrin strands from getting stuck in clots by targeting the clotting cascade. The specific antithrombotic medicines should be tailored to the therapeutic plan adopted, according to the ACC/AHA recommendations. Both the intrusive strategy management algorithm (Figure 3) and the conservative strategy management algorithm (Figure 4) describe the process of agent selection for patients.





Antiplatelet Therapy

Because, aspirin inhibits the production of thromboxane A2, aspirin decreases platelet aggregation by permanently inhibiting cyclooxygenase 1. Four separate randomised studies shown that aspirin significantly lowers of mortality or MI by over 50% compared to placebo for individuals presenting with NSTEMI/UA135 thousand The American College of Cardiology and the American Heart Association both recommend a 162–325 mg starting dosage for long-term

secondary prevention, with subsequent daily doses of 75–162 mg.57 The use of aspirin is strictly prohibited in cases of active bleeding, known platelet illness, or documented aspirin allergy, including but not limited to asthma and anaphylaxis. Clopidogrel is recommended as an alternative to aspirin for individuals who are unable to take the former.57 . This impact not only reduces blood viscosity and delays bleeding periods, but it also lessens platelet activation and aggregation. Treatment with aspirin and clopidogrel is recommended for the majority of patients with UA/NSTEMI.

In the CURE (Clopidogrel in Unstable Angina to Prevent Recurrent Events) experiment, 12,562 patients were randomly allocated to one of two therapy groups: aspirin alone (75-325 mg/d) or aspirin + clopidogrel (300 mg loading dose, then 75 mg/d).136 Patients with UA/NSTEMI, regardless of risk level, who were given aspirin with clopidogrel (11.4%) had a 20% decreased risk of cardiovascular death, MI, or stroke compared to those who were given aspirin alone (9.3%; P<.0001).53 After only two hours of treatment, the Kaplan-Meier curves started to diverge, indicating that the experiment was already producing positive results. These advantages persisted throughout the whole year of treatment. While clopidogrel significantly raised the risk of serious bleeding, it had no effect on the risk of minor, non-life-threatening haemorrhage. Clopidogrel treatment before percutaneous coronary intervention (PCI) was linked with a 31% lower risk of cardiac events at 30 days and 1 year (PCI-CURE, a prespecified subgroup analysis).137 The class I data from the PCI-CURE study, the CREDO trial, and the CLARITY-TIMI 28 trial is included in the 2005 guidelines from the ACC, the AHA, and the Society for Coronary Angiography and Interventions. Also, a meta-analysis indicated that clopidogrel pretreatment decreased the risk of cardiovascular mortality, MI, or stroke from randomization to 30 days by 41%; P=.001, therefore it's recommended to take it before a percutaneous coronary intervention

(PCI). Patients who used clopidogrel in the five days leading up to CABG procedures were more likely to experience significant bleeding (138, 139, and 140).53 Hence, the American College of Cardiology and the American Heart Association advise, if feasible, to stop taking clopidogrel five days before to surgery. Roughly 57,141 Currently, the majority of hospitals either start clopidogrel administration right after admission (to reduce the chances of early ischemia events and pretreatment before percutaneous coronary intervention) or wait to start medication until coronary angiography is finished. Patients have the choice to start taking the medication either before or after PCI or CABG with the second option

Inhibitors of P2Y12 ADP.

The high incidence of recurrent atherothormbotic events despite dual-antipllatelet treatment with aspirin and clopidogrel highlights the critical need to identify more potent P2Y12 ADP receptor inhibitors.

Prasugrel, an irreversible antagonist of the P2Y12 ADP receptor, was recently licenced by the US Food and Drug Administration. Multiple studies have shown that compared to 75 or 150 mg of clopidogrel daily, prasugrel generates almost double the amount of platelet inhibition.142 A total of 13,608 patients at high risk for acute coronary syndrome (ACS) who were scheduled for percutaneous coronary intervention (PCI) were randomly assigned to receive clopidogrel or prasugrel, with a loading dose of 60 mg and a maintenance dose of 10 mg daily, respectively, in the TRITON-TIMI 38 trial.143 Compared to the clopidogrel group, the prasugrel group had a considerably reduced incidence of cardiovascular death, MI, or stroke (9.9% vs. 12.1%; P<.001) at six to fifteen months. Use of prasugrel resulted in a 52% decrease in the occurrence of stent thrombosis (1.1% vs. 2.4%; P<.001). After comparing prasugrel (2.4% of patients) with clopidogrel (1.8% of patients; P=.03), it was shown that prasugrel was linked with a greater risk

of TIMI severe bleeding, including a fatal bleeding risk. With a half-life of around 12 hours, ticagrelor (AZD6140) is a reversible oral P2Y12 receptor antagonist. A recent research called PLATO, which stands for "Study of Platelet Inhibition and Patient Outcomes," randomly assigned 18,624 patients with ACS to receive either clopidogrel for up to 12 months or ticagrelor (180 mg loading dose followed by 90 mg twice daily).144 Patients on ticagrelor had a hazard ratio of 0.84 and those getting clopidogrel had a hazard ratio of 11.7%. The major end point of these medications was mortality from vascular causes, MI, or stroke, with a 95% confidence range of 0.77 to 0.92 (P<.001). Titicagrelor, as opposed to clopidogrel, reduced the occurrence of death from all causes (4.5% vs. 5.9%; P<.001). Both the ticagrelor and clopidogrel groups had similar significant bleeding rates (11.6 and 11.2 percent, respectively; p=.43).

Inhibitors of GP IIb/IIIa.

Several large trials, including patients with UA/NSTEMI, discovered that GP IIb/IIIa inhibitors significantly benefited high-risk patients, those receiving PCI, or both. These inhibitors are selective anti-aggregation agents that block the final common channel, preventing platelets from cross-linking via fibrinogen. The number of persons randomised to these trials was 54,145.. At this time, tirofiban, eptifibatide, and abciximab are the three medications that can be employed. Assuming that there will be no discernible delay in angiography and that PCI is expected, tirofiban or IV eptifibatide is the superior choice. It is recommended to use abciximab instead. Inhibitors of GP IIb/IIIa mainly increase the risk of bleeding, most commonly near the location of vascular

intervention. Therefore, it is crucial to monitor patients closely for any signs of bleeding and do complete blood cell counts regularly.

It appears that GP IIb/IIIa inhibition is particularly beneficial for patients who are more prone to have problems, such as those with diabetes, recurrent angina, increased troponin concentrations, ST-segment abnormalities, history of aspiirin use, or a TIMI risk score of 4 or higher.73 Evidence suggests that GP IIb/IIIa inhibition might continue to be beneficial even after clopidogrel administration.148 The optimal starting point for administering GP IIb/IIIa inhibitors has been the subject of some debate. Early Glycoprotein IIb/IIIa Inhibition in Non-ST-Segment Elevation Acute Coronary Syndrome (EARLY ACS) was a randomised controlled trial that included 9,492 patients. Participants were either given GP IIb/IIIa inhibitors immediately after angiography or given a temporary prescription. The compoosite end objective of adverse cardiovascular events was not associated with early eptifibatide, while there was a statistically significant association between the two and an increase in bleeding rates.149 Aspirin and anticoagulant therapy should be supplemented with clopidogrel or an intravenous GP IIb/IIIa inhibitor in patients with UA/NSTEMI who are to undergo initial invasive treatment, according to a Class I recommendation from the 2011 ACC/AHA guidelines. This should be done prior to diagnostic angiography. Continuing, they argue that it is reasonable to include both agents (class IIa recommendation). [57]

Anticoagulant Therapy

The 2011 ACC/AHA recommendations suggest that patients with UA/NSTEMI who are going to be treated with an invasive approach before diagnostic angiography is done should take aspirin and anticoagulant medication (upstream), but they should also be given intravenous GP IIb/IIIa

inhibitors or clopidogrel. Finally, they propose a class IIa recommendation—combining the two agents—to cap it all off.57

Anticoagulant Medication

The 2011 ACC/AHA UA/NSTEMI recommendations (class I recommendation) state that all patients (without contraindications) should begin anticoagulant therapy as soon as practicable following presentation. The recommendations include four medications: fondaparinux, enoxaparin, bivalirudin and unfractionated heparin (UFH)

UFH

Compared to aspirin alone, UFH is associated with a lower risk of myocardial infarction and death in a number of randomised studies. 135 thousand The anticoagulant effects of UFH might differ.151 Activated partial thromboplastin time should also be monitored often; a minimum of every six hours, until two consecutive readings fall within the desired range, is recommended, followed by every twenty-four hours.57 It is recommended that UFH be administered for a minimum of 48 hours following UA/NSTEMI manifestation.57, 152

Heparin with LMW - Low Molecular Weight.

As a result of the significant recurrence rates of ischemia events even while utilising UFH, low-molecular-weight heparins (LMWHs) were developed to enhance anticoagulation. Thrombin

production and activity are both impeded by their effects on factor Xa and factor IIa. Additional advantages over UFH include increased absorption, less binding to plasma proteins, and a decreased incidence of thrombocytopenia; the latter two factors render anticoagulant dose monitoring superfluous.

Only enoxaparin, out of the several LMWHs investigated for the treatment of UA/NSTEMI, has shown a significant improvement over UFH. There are three more: enoxaparin, daloteparin, and nadroparin. Clinical trials such as ESSENCE (Efficacy and Safety of Subcutaneous Enoxaparin in Non-Q-Wave Coronary Events) and the TIMI 11B found that enoxaparin was 20% more effective than UFH in reducing the risk of death, MI, recurrent ischemia, or a combination of these outcomes.154 According to the SYNERGY study, which compared enoxaparin to UFH in the setting of an early invasive surgery, the new technique of enoxaparin was not worse than UFH. The trial also examined revascularization and glycoprotein IIb/IIIa inhibitors.155 Both the older studies and the more recent A-to-Z (Aggrastat to Zocor) regimen found that enoxaparin clearly beat UFH when used in conjunction with a cautious approach.156 in all Enoxaparin or fondaparinux (refer to Factor Xa Inhibitors) should be used as anticoagulant therapy instead of UFH for UA/NSTEMI patients receiving conservative treatment, according to a class IIa guideline in the 2011 ACC/AHA recommendations. This recommendation is in place until a coronary artery bypass graft (CABG) is scheduled within 24 hours.57 The likelihood of enoxaparin's beneficial effects increases in patients with higher risk factors, including ST-segment deviation, elevated troponin concentrations, high TIMI risk scores, and raised troponin levels.97 While most studies have found no correlation between LMWHs and UFHs and serious bleeding rates, the SYNERGY trial found that enoxaparin significantly increased the risk of major bleeding when given at the

same time as LMWHs. 155

Indirect Thrombin Inhibitors

One possible advantage of direct thrombin inhibitors over indirect ones is that they can directly block clot-bound thrombin without requiring a cofactor like antithrombin. A recent study examined the use of bivalirudin in patients with UA/NSTEMI as part of the ACUITY (Acute Catheterization and Urgent Intervention Triage Strategy) trial. Patients, who were managed with an early invasive strategy for acute coronary syndrome (ACS), were randomly assigned to one of three antithrombotic regimens: UFH (or enoxaparin) plus a GP IIb/IIIa inhibitor, bivalirudin plus a GP IIb/IIIa inhibitor, or bivalirudin alone.159 At 30 days, there was no difference in the rates of mortality, MI, unplanned revascularization for ischemia, and significant bleeding between the bivalirudin plus GP IIb/IIIa inhibitor group and the UFH plus inhibitor group, according to the primary end point. In the 30-day net clinical outcomes, there was a significant difference between the groups that received UFH with a GP IIb/IIIa inhibitor and those that received bivalirudin alone. This difference was primarily caused by a significantly reduced risk of serious bleeding (10.1% vs. 11.7%; P=.015). The ACC/AHA recommendations suggest bivalirudin, a class I medication, for patients with UA/NSTEMI who have been selected for an early invasive surgery. Additionally, according to the guidelines, it is OK to forego administering an intravenous GP IIb/IIIa antagonist to patients using thienopyridines in conjunction with bivalirudin (a class IIa prescription).57 Recombinant hirudin, argatroban, and other direct thrombin inhibitors should only be given to patients with heparin-induced thrombocytopenia, according to the 2011 ACC/AHA guidelines.57

Inhibitors of factor Xa.

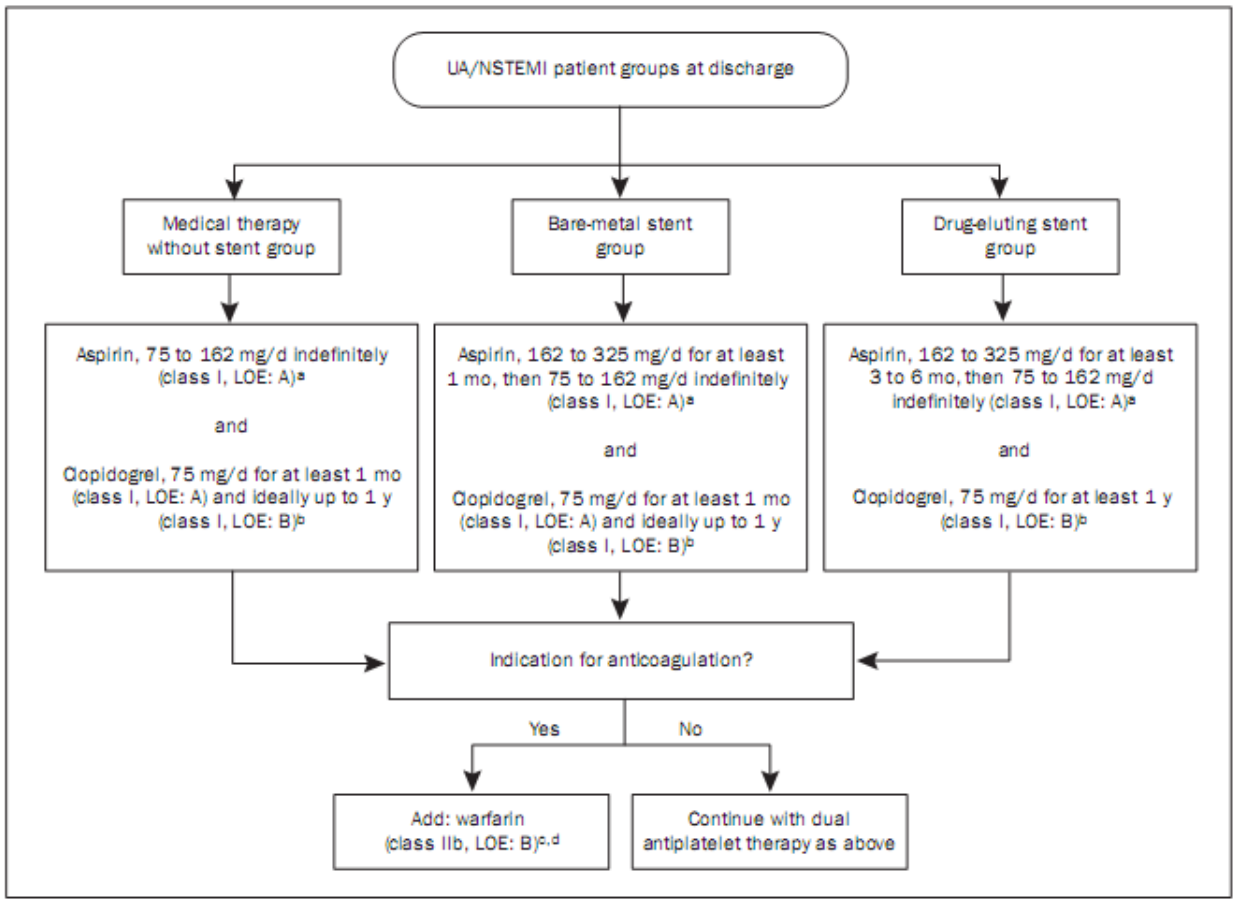
In order for the synthetic pentasaccharide fondaparinux to block factor Xa indirectly, antithrombin is required. In the OASIS-5 (Fifth Organisation to Assess Strategies in Acute Ischemic Syndromes) trial, which comprised 20,078 patients at high risk for UA/NSTEMI, the treatment choices for one group were standard-dose enoxaparin while the other group received subcutaneous fondaparinux 2.5 mg once day.160 After nine days, it was shown that fondaparinux was just as effective as enoxaparin in lowering the three main outcomes: myocardial infarction (MI), refractory ischemia (RI), and death. The fondaparinux group, in contrast to the enoxaparin group, had a rate of significant bleeding that was approximately half lower. Fondaparinux was determined to be better than enoxaparin when considering the main outcome and serious bleeding at 9 days as a composite variable (7.3% vs. 9.0%; HR, 0.81; P<.001). Mortality rates at 30 and 6 months were also significantly lower when fondaparinux was used. Supplemental UFH administered during catheterization decreased the incidence of catheter-related thrombi in the subset of percutaneous coronary intervention (PCI) patients whose risk was more than three times higher in the fondaparinux arm compared to the enoxaparin arm.
The 2011 ACC/AHA recommendations contain a class I recommendation for fondaparinux as treatment for UA/NSTEMI if the patient intends to undergo conservative or early invasive therapy, or if coronary artery bypass grafting (CABG) is not planned within 24 hours.57 They go on to say that individuals chosen for a conservative treatment approach due to a higher risk of bleeding should use fondaparinux (class I) instead of other anticoagulants.

Oral Anticoagulation.

Oral anticoagulation with a mix of warfarin and aspirin after ACS is better than aspirin alone, according to studies. The key is to have a high enough dose of anticoagulation.the range of 161 to 603. While warfarin therapy necessitates international normalised ratio monitoring, clopidogrel plus aspirin provides comparable benefits without this drawback. Additionally, clopidogrel has a proven history of helping individuals with ACS who have PCI and stenting done. Therefore, using aspirin with warfarin does not provide any therapeutic advantage. A combination of warfarin, aspirin, and clopidogrel may be required after UA/NSTEMI in some situations (such as individuals with atrial fibrillation, a mechanical prosthetic valve, or left ventricular thrombus).

Discharge Antithrombotic Therapy.

Figure 5 shows the antithrombotic drug recommendations based on 2011 ACC/AHA guidelines. Few details are known about the pros and cons of using aspirin, clopidogrel, and warfarin as a triple antithrombotic regimen. This course of treatment should only be used in cases when there are substantial symptoms. To keep the INR between 2.0 and 2.5, a class IIb guideline recommends the lowest effective doses and the shortest feasible administration period, such as 81 mg of aspirin for aspirin and 2.5 mg of warfarin, which can be modified as needed.57



LIPID-LOWERING THERAPY

Statins should be started lipid-lowering treatment for all patients with UA/NSTEMI, regardless of baseline LDL cholesterol levels, unless there are contraindications. It is advised to start or raise the dosage of cholesterol-lowering medicine in order to drop the LDL cholesterol concentration below 100 mg/dL if it is 100 mg/dL or above. An update to the 2011 ACC/AHA guidelines57 and the Adult Treatment Panel III guidelines164 state that in order to maintain a class IIa LDL cholesterol concentration of 70 mg/dL or below, it is suggested to continue titrating at a dose.

Those with UA who took pravastatin had a 26% decreased risk of mortality compared to those who took placebo in the LIPID (Long-Term Intervention with Pravastatin in Ischaemic Disease) research (P=.004). Myocardial infarction, stroke, and coronary revascularization were all markedly decreased as well.165 Inteensive lippid lowering with high-dose atorvastatin (80 mg/d) decreased the primary composite end point of all-cause death, MI, and UA requiring reehospitalization or revaascularization by 16% compared to modrate lipid lowering after ACS with standard-dose pravastatin (40 mg/d), according to an analysis of the PROVE IT (Pravastatin or Atorvastatin Evaluation and Infection Therapy)-TIMI 22 trial.166 The outcome was an improvement in health markers like C-reactive protein and low-density lipoprotein (LDL) cholesterol levels. 167

H-Fatty acid binding proteins (FABPs)

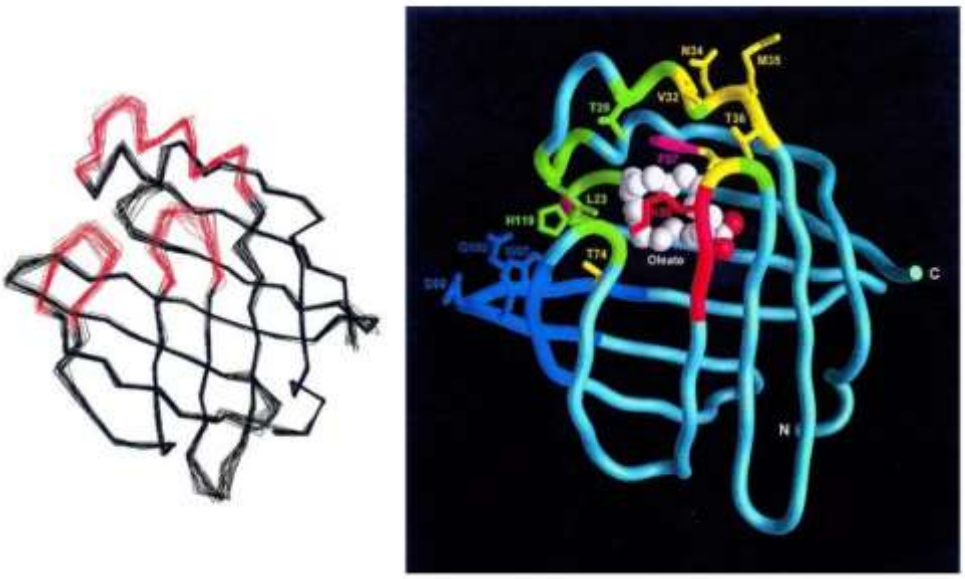


Figure-6 3-D STRUCTURE OF HEART TYPE FATTY ACID BINDING PROTEIN

Liver, intestine, heart, and striated muscle are just a few examples of organs that actively metabolise fatty acids; they all include FABPs, which are low-molecular-mass proteins. One of the primary functions of FABPs is to transport long-chain, unsaturated fatty acids into the cell nucleus.168 Both the myocardium and skeletal muscle have the same isoform of FABP, which is called heart-type FABP (H-FABP). However, the quantity of this protein in the latter is only 10%-30% of what it is in the former. The ratio of H-FABP in healthy donors is excellent, and its concentration is quite low, ranging from 2-4 μg/l. Age, gender, and the body's natural rhythms all play significant roles in determining the H-FABP reference value. Because males typically have more muscle mass, their plasma H-FABP concentrations tend to be higher than women's. The renal function decreases with age, which may explain why there is an ageing effect on plasma H-FABP

levels. This is because the kidneys are primarily responsible for clearing H-FABP. 169 Since H-FABP becomes detectable in the bloodstream soon after myocardial infarction starts, it has been proposed as a potential early indicator for the diagnosis of myocardial infarction. In patients who do not have renal impairment, its plasma concentration recovers to normal in 12–24 hours after a myocardial infarction (MI), and it rises in 2-3 hours after the event.170 There is some evidence that H-FABP can diagnose ACS as well as myoglobin or perhaps better than myoglobin due to its higher cardiac tissue composition. 171 in Seino et al. discovered that the fast H-FABP assay could consistently rule out non-AMI patients within three hours of the condition commencing, when comparing the diagnostic accuracy of the blood quick test for H-FABP with the rapid cTnT test for myocardial ischemia. 172 Consequently, H-FABP, in conjunction with troponin, may aid in the diagnostic evaluation of ACS patients in the ED, complementing the ECG and clinical evaluation. Because myoglobin and H-FABP are present in different amounts in skeletal muscle and myocardium, a low mioglobin/H-FABP ratio may be exclusive to the heart. Plasma from patients with heart injury had a low myoglobin/H-FABP ratio (values 2-10) compared to patients with skeletal muscle damage, whose ratios were found to be high (20-70).173 However, when compared to H-FABP evaluation alone, myoglobin/H-FABP ratio approaches to improve myocardial injury identification have not shown a substantial advantage. Nakata et al. demonstrated that H-FABP outperformed cTnT, CKMB, and myoglobin in terms of diagnostic value and sensitivity in patients suspected of having acute coronary syndrome (ACS) within 6 hours of the beginning of severe chest pain. Furthermore, in comparison to cTnT, CK-MB, and myoglobin, Nagahara et al. discovered that H-FABP had a superior negative predictive value (about 40%), sensitivity (75%-77%), and positive predictive value (84%-91%).Page numbers 174–176 However, the cTnT sensitivity for ACS was reduced since these

trials used troponins with inadequate sensitivity. O'Donoghue et al. recently evaluated 2287 patients with ACS from the OPUS-TIMI 16 trial for H-FABP, Troponin, and BNP levels. The researchers found that increasing H-FABP levels was associated with an increased risk of mortality and severe cardiac events at the 10-month follow-up, even after controlling for other known clinical risk factors and biomarkers. It provides additional predictive information even when initial troponin or BNP levels are unknown.177

Within 10 hours following the initial acute myocardial infarction (AMI), H-FABP can be utilised to assess a recurrent infarction that could otherwise go undetected by CK-MB, cTnT, and cTnI assessment due to the slower return of plasma concentration of these markers to reference values. This is due to the fact that within one day following an AMI, H-FABP levels often revert to normal. Reduced renal function may impact the therapeutic utility of H-FABP due to its renal clearance. Correction for predicted renal function allows H-FABP to be used to successfully estimate infarct size, according to de Groot et al.178

It is also possible to use the rapid release of H-FABP to determine successful myocardial reperfusion in patients with AMI. Results demonstrated a quick increase in myoglobin and plasma H-FABP levels after successful reperfusion and a slow rise after failure reperfusion.176 A recent study by Suzuki and colleagues showed that individuals with acute coronary syndrome (ACS) are more likely to have negative outcomes within 30 days if their H-FABP test is positive.176 A higher plasma H-FABP concentration is significantly associated with an increased risk of death and cardiac events.179 Although H-FABP is most often used to detect myocardial necrosis, a new study suggests it may also be helpful in detecting ischemia, which can occur even when no myocardial necrosis is present. Thus, it might be useful in the early diagnosis of acute coronary syndrome in individuals presenting with nonspecific chest discomfort. Full turn

A small, soluble protein known as heart-type fatty acid binding protein (H-FABP) has a molecular weight of fifteen kilodaltons. It has 132 amino acids. It is one among the most abundant proteins in the heart and accounts for 5-15% of the total cytosolic pool in the aqueous cytoplasm. In 1988, Additional research has validated the initial suggestion by Glatz et al.181 that it may be a useful biochemical marker for the early diagnosis of AMI.Plasma and interstitial fluid do not normally contain 182-183 H-FABP. On the other hand, when cardiac cells are injured, it is released into the circulation. The concentration of H-FABP in the cytoplasm is about 200,000:1.184 times higher than in the vascular system. In typical conditions, the amount of H-FABP in blood plasma or serum is below 5 μg/L. Consequently, measuring H-FABP in plasma is an excellent way to detect and quantify cardiac tissue damage early on.

AMI (ACUTE MYOCARDIAL INFARCTION) and H-FABP

The secretion of heart-type FABP into plasma begins no later than two hours after symptoms begin. Within four to six hours, it should reach its peak, and after twenty hours, it should be back to normal. 184 The sensitivity of H-FABP for the diagnosis of AMI is greater than 80% when performed within 30–210 minutes after the onset of symptoms.185 Only during the first six hours after symptoms start will additional cardiac signs including CK, CK-MB (mass or activity), I cTnI, and cTnT start to build up in the plasma. A sensitivity level of about 64% has been demonstrated.186 total Serum and urine H-FABP concentrations in patients with AMI can rise above reference values as early as 1.5 hours after symptoms begin. In the first twenty-four hours after symptoms appear, measuring H-FABP serially may help with acute myocardial infarction (AMI) diagnosis, early reperfusion treatment selection, infarct-related artery reperfusion selection, early detection of re-infarction, infarct size estimation, and other related tasks. 187 Recent research

has cast doubt on the usefulness of H-FABP and myoglobin as early markers, especially when compared to more targeted indicators like cTnI. 188–189

High concentrations of FABP are found only in the heart. This protein is abundant in the heart, but it is also present in other organs, but at much lower concentrations. 186 total Skeletal muscle fibres range in concentration from 0.05 to 0.2 mg/g moist weight of tissue for this compound. 190 Brain, adrenal glands, fat, kidney, aorta, testes, breast glands, placenta, and stomach have also been identified with extremely low concentrations. 186 total
In cases of renal failure, the kidneys secrete heart-type FABP, which stays in the bloodstream for more than twenty-five hours after an acute myocardial infarction (AMI). Myoglobin and H-FABP levels were significantly greater in renal failure patients (Gorski et al., 2015). These marker concentrations were unaffected by dialysis. 191 Additionally, our findings show that H-FABP has a much lower diagnostic utility for AMI in patients with renal insufficiency. 192 Injections into muscles, electric cardioversion, and intense cardiopulmonary resuscitation are all potential causes of skeletal muscle injury during AMI, which can lead to H-FABP leaking. The test findings may be impacted by this. 193 When used alone, H-FABP may make the diagnosis of AMI difficult in some patient populations. Blood levels of H-FABP in healthy people increase after strenuous physical activity.194

MYOGLOBIN and H-FABP

Several important characteristics are shared by myoglobin and H-FABP. In the cytosol of cardiac cells, you could discover: 4. Both are released two hours after symptoms begin, peak six hours later, and then recover to their usual baseline concentration twenty-four hours later. 5)

Sixteen and seventeen Kda are the molecular weights of the proteins, correspondingly. 6) Fatty acids and oxygen, the building blocks of mitochondrial oxidation, are present in high amounts. Protein concentrations in the heart and skeletal muscles are not the same. Skeletal muscle had a myoglobin concentration of 4.0 mg/g, whereas the heart had 2.5 mg/g of wet weight of tissue. Heart tissue has 0.5 mg/g wet weight of tissue of H-FABP, while skeletal muscle contains 0.05-0.2 mg/g wet weight of tissue. Myoglobin levels in skeletal muscle are two times higher than those in cardiac muscle. The amount of H-FABP present in skeletal muscle is a negligible 10–50% of what is seen in the heart. The concentration of H-FABP in normal plasma, which is less than 5 εg/L, is 10-15 times lower than that of myoglobin, which ranges from 30-80 εg/L. Because of this, H-FABP binds to the heart more strongly than myoglobin. Myoglobin to H-FABP is typically approximately 1:5 in the heart, but it can be closer to 21:70 in skeletal muscle, depending on the kind of muscle. 195 Due to its detectability in both cardiac and skeletal muscle, myoglobin and H-FABP have limited specificity as early indicators of cardiac damage. The myoglobin:H-FABP ratio can be utilised to differentiate between skeletal and cardiac muscle damage because, upon injury, myoglobin and H-FABP are released into plasma in a ratio that corresponds to their levels in the damaged tissue. A myoglobin:H-FABP ratio of about 1:5 is thought to be more usually linked with cardiac injury, whereas a ratio of 21:70 is more commonly linked with skeletal muscle damage (193). Using the ratio instead of only one marker improves the diagnostic specificity for AMI, according to some researchers. Overlapping does happen, therefore you shouldn't use this ratio as a rule of thumb. Testing H-FABP was not thought to be beneficial by all researchers. 193, 196

MATERIALS AND METHODS

Study design: A Prospective comparative cross-sectional study

Study Site: Kles Dr Prabhakar kore hospital and Mrc

Study Population : Patients presenting with chest pain suggestive of acute coronary syndrome

Time Frame: January 2023 to December 2023

Sample Size: 50

The minimum sample size formula based on prevalence rate is

$$= \frac{Z^2 P(1-P)}{d^2}$$

where P is the prevalence rate and d is the percentage likely difference in the prevalence.
zα is linked with the level of significance. For 5% level of the significance zα = 1.96.
Ref: Enter here the name of the article and the author.

Parameters:

- Prevalence rate of ACS (P): 59%
- d=25%d = 25\%d=25% of PPP = 14.75%

Using these values, the sample size is calculated to be 43. To account for rounding, the sample size were increased to 50.

Inclusion Criteria:

- Age > 18
- Patients presenting with chest pain suggestive of ACS and presenting within 24 hours of onset of symptoms (e.g., acute chest pain or discomfort, and/or pain in the neck, jaw, or upper arm suggestive of ACS).

ECG Interpretation Criteria (in the absence of LVH and LBBB):

- **ST elevation:** New ST elevation at the J-point in two adjacent leads with cut-off values of ≥0.1 mV in other leads and/or ≥0.2 mV in leads V2–V3. For women, the cut-off values are ≥0.15 mV.
- **ST depression and T-wave changes:** T inversion ≥0.1 mV in two contiguous leads with a strong R-wave or R/S ratio > 1, and/or new horizontal or downsloping ST depression ≥0.05 mV in two contiguous leads.

Exclusion Criteria:

- A clear non-cardiac cause identified
- Suspected pulmonary thromboembolism or pericarditis
- Signs and symptoms lasting for more than 24 hours
- Social issues or severe comorbidities (e.g., disseminated cancer) prohibiting participation
- Chronic renal failure
- Stroke
- Known hepatic dysfunction
- Pregnancy
- Patient unable (e.g., due to cognitive impairment) or unwilling to consent

Methodology:

Patients presenting to the hospital and diagnosed with ACS (as per the above diagnostic criteria) were undergo laboratory tests for the following biochemical markers. Their levels were

determined, and the data compared. Patients ʾsymptoms and past medical history were documented at admission using a predefined protocol.

Diagnostic Criteria:

The standard diagnosis were made after a critical review of all clinical presentations. Diagnostic outcomes were categorized into:

1. ST-elevation myocardial infarction (STEMI)
2. Non-ST-elevation myocardial infarction (NSTEMI)
3. Unstable angina

Laboratory Tests:

- **Trop-T:** Electrochemiluminescence immunoassay, 2 antibodies sandwich principle (ECLIA) > 0.1 ng/L
- **CK-MB:** Electrochemiluminescence immunoassay, 2 antibodies sandwich principle, Short Turn Around Time (STAT) > 25 IU/L
- **H-FABP:** Rapid chromatographic immunoassay designed for qualitative determination of H-FABP in blood samples with a cut-off level of > 7 ng/L. The test is based on a dual monoclonal antibody sandwich method, using two distinct monoclonal antibodies and the gold-labelled method. It requires 100-120 μL of blood sample, and results are interpreted within 15 minutes after sample application.

Outcome Measures:

Primary Outcome Measure:

- Sensitivity of H-FABP, CK-MB, and Trop-T for the diagnosis of ACS within the first 3 hours of presentation.

Secondary Outcome Measures:

- Specificity of H-FABP, CK-MB, and Trop-T for the diagnosis of ACS.
- Positive Predictive Value (PPV) of H-FABP, CK-MB, and Trop-T for the diagnosis of ACS.
- Negative Predictive Value (NPV) of H-FABP, CK-MB, and Trop-T for the diagnosis of ACS.

Statistical Analysis:

All collected data were entered into a Microsoft Excel sheet and then transferred to SPSS software version 26 for analysis. Qualitative data were presented as frequencies and percentages and analyzed using the chi-square test. Quantitative data were presented as mean and standard deviation (SD) and compared using the t-test. A p-value < 0.05 were considered statistically significant. Sensitivity, specificity, PPV, and NPV were calculated for the diagnostic tests H-FABP, CK-MB, and Trop-T.

Results

Table no 7:- Age group amongst study population

Age group (in years)	N	%
30-39	11	22
40-49	9	18
50-59	17	34
60-69	8	16
70-79	3	6
80-90	2	4
Total	50	**100**

In the above table it was observed that most of the study population was between 50-59 years of age group (34%) followed by 30-39 years (22%). The mean age of the study population was 52.68 ± 12 years

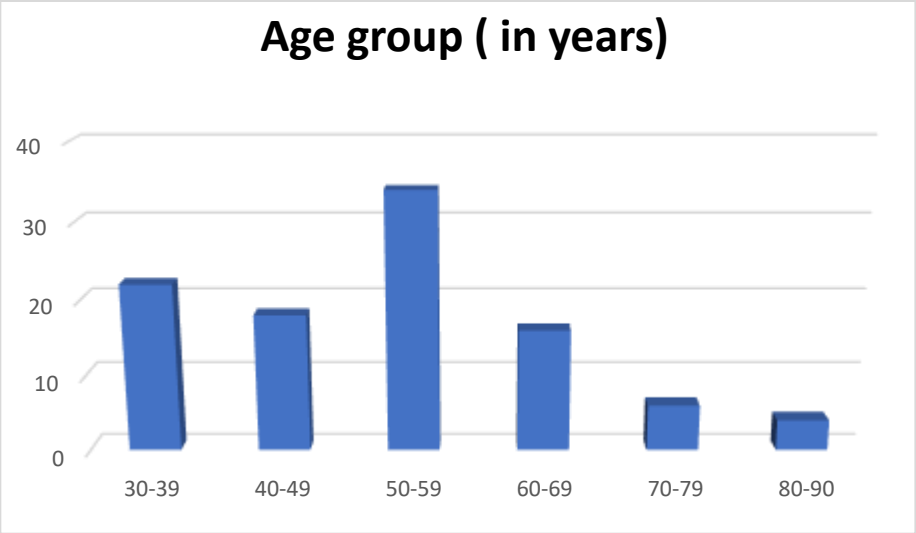


Figure-7

Table no 8:- Gender distribution amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
Sex	Female	Count	10	4	14
		%	25.60%	36.40%	28.00%
	Male	Count	29	7	36
		%	74.40%	63.60%	72.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

In the analysis of sex distribution among patients diagnosed with Acute MI and Unstable Angina, males are predominant in both categories. Specifically, for Acute MI, 25.6% of patients are female, while 74.4% are male. For Unstable Angina, 36.4% of patients are female, and 63.6% are male. Overall, 28% of the patients are female and 72% are male, indicating a higher prevalence of these conditions in males.

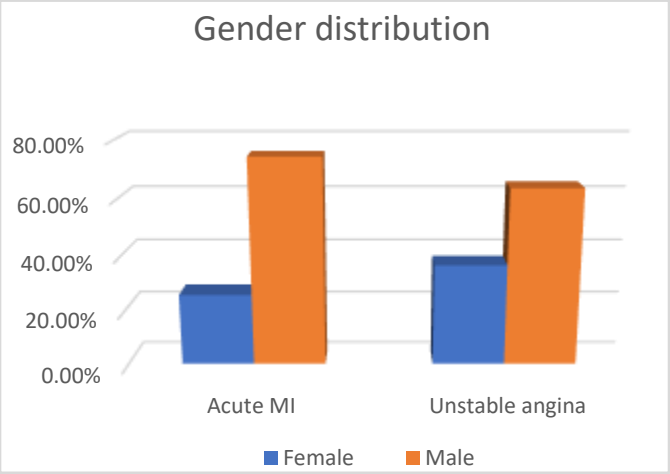


Figure-8

Table no 9:- Chest pain amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
Chest pain	Atypical	Count	10	0	10
		%	25.60%	0.00%	20.00%
	Typical	Count	29	11	40
		%	74.40%	100.00%	80.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

P value-0.001

The distribution of chest pain type among patients with Acute MI and Unstable Angina shows a significant difference, with typical chest pain being much more common. Among patients with Acute MI, 25.6% experience atypical chest pain and 74.4% have typical chest pain. In contrast, all patients with Unstable Angina (100%) report typical chest pain, with none experiencing atypical chest pain. Overall, 20% of the patients have atypical chest pain, while 80% have typical chest pain. The p-value of 0.001 indicates that this difference is statistically significant.

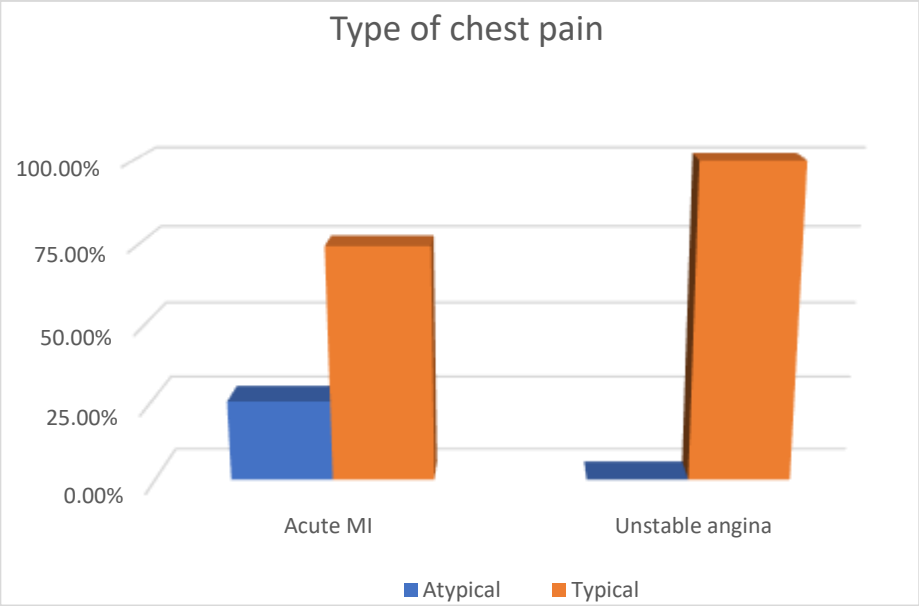


Figure-9

Table no 10:- Past history of hypertension amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
Hypertension	No	Count	17	6	23
		%	43.60%	54.50%	46.00%
	Yes	Count	22	5	27
		%	56.40%	45.50%	54.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

The occurrence of hypertension among patients diagnosed with Acute MI and Unstable Angina is relatively similar. For Acute MI, 43.6% of patients do not have hypertension, whereas 56.4% do have hypertension. For Unstable Angina, 54.5% of patients do not have hypertension, and 45.5% have hypertension. In total, 46% of the patients do not have hypertension, while 54% do have

hypertension, showing no significant difference in hypertension prevalence between the two groups.

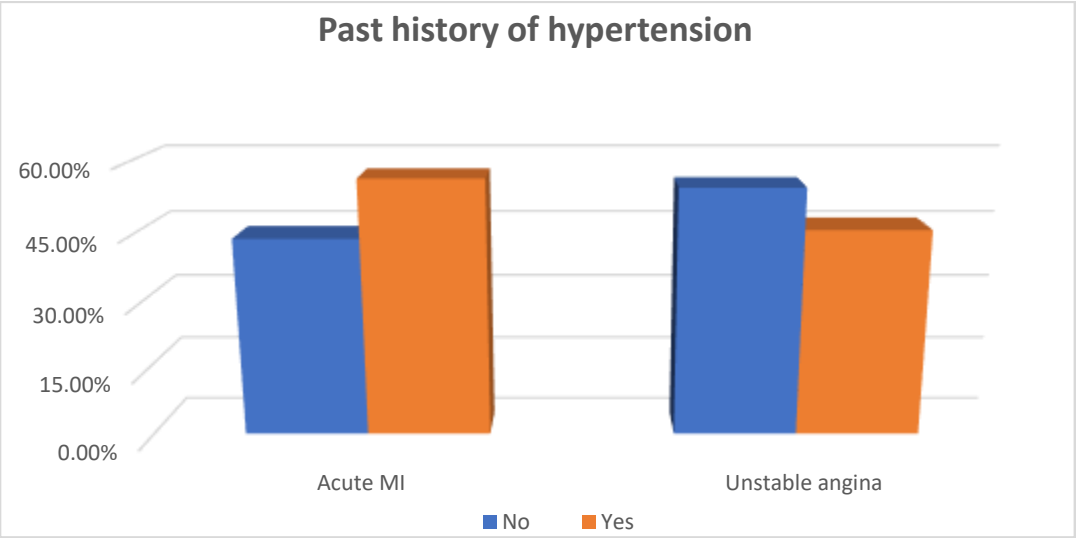


Figure-10

Table no 11:- Past history of Diabetes amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
Past history of Diabetes	No	Count	23	8	31
		%	59.00%	72.70%	62.00%
	Yes	Count	16	3	19
		%	41.00%	27.30%	38.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

Regarding the past history of diabetes, the distribution is fairly similar between patients with Acute MI and Unstable Angina. Among those with Acute MI, 59% do not have a history of diabetes, whereas 41% do. For patients with Unstable Angina, 72.7% do not have a history of diabetes, while 27.3% do. Overall, 62% of the patients do not have a past history of diabetes, and 38% do, indicating no significant difference between the two diagnostic groups.

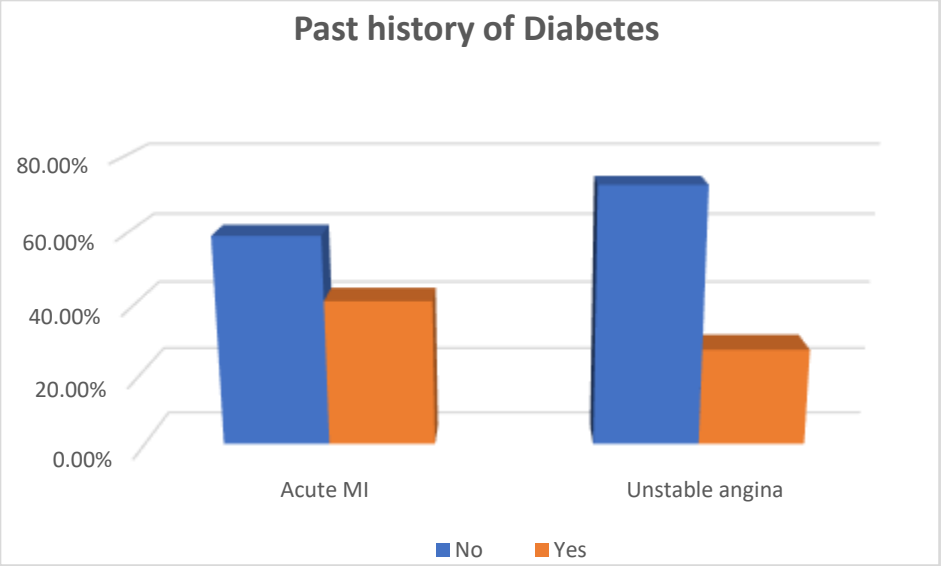


Figure-11

Table no 12:- ECG findings amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
ECG	Anterior	Count	9	0	9
		%	23.10%	0.00%	18.00%
	Anterolateral	Count	8	0	8
		%	20.50%	0.00%	16.00%
	Inferior	Count	14	0	14
		%	35.90%	0.00%	28.00%
	NSTEMI	Count	8	0	8
		%	20.50%	0.00%	16.00%
	Normal	Count	0	11	11
		%	0.00%	100.00%	22.00%
Total		Count	39	39	50
		%	100.00%	100.00%	100.00%

P value - < 0.05

ECG findings differ significantly between patients with Acute MI and those with Unstable Angina. In the Acute MI group, 23.10% have anterior changes, 20.50% have anterolateral changes, and 35.90% have inferior changes, 20.50% had NSTEMI with none having a normal ECG. Conversely, all patients with Unstable Angina (100%) have a normal ECG. Overall, 18% of the patients have anterior ECG changes, 16% have anterolateral changes, 28% have inferior changes,16% had NSTEMI and 22% have normal ECGs. The p-value of less than 0.05 indicates a significant difference in ECG findings between the two groups.

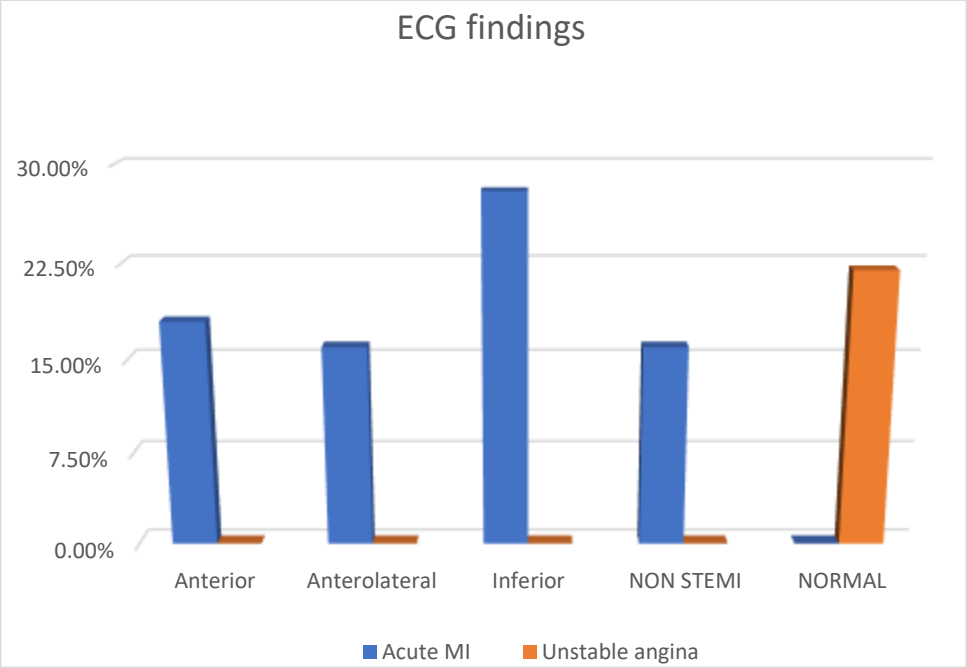


figure-12

Table no 13:- 2D- Echo dysfunction findings amongst study population

	Diagnosis	Total

			Acute MI	Unstable angina	
2D-Echo dysfunction	Both	Count	4	0	4
		%	10.30%	0.00%	8.00%
	Diastolic	Count	14	7	21
		%	35.90%	63.60%	42.00%
	No	Count	6	4	10
		%	15.40%	36.40%	20.00%
	Systolic	Count	15	0	15
		%	38.50%	0.00%	30.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

P value - < 0.05

The distribution of 2D-Echo dysfunction varies between patients with Acute MI and those with Unstable Angina. Among Acute MI patients, 10.3% have both systolic and diastolic dysfunction, 35.9% have diastolic dysfunction, 15.4% have no dysfunction, and 38.5% have systolic dysfunction. For Unstable Angina, 63.6% have diastolic dysfunction, 36.4% have no dysfunction, and none have systolic or both dysfunctions. Overall, 8% of patients have both types of dysfunction, 42% have diastolic dysfunction, 20% have no dysfunction, and 30% have systolic dysfunction. The p-value of less than 0.05 indicates a significant difference in 2D-Echo dysfunction findings between the two groups.

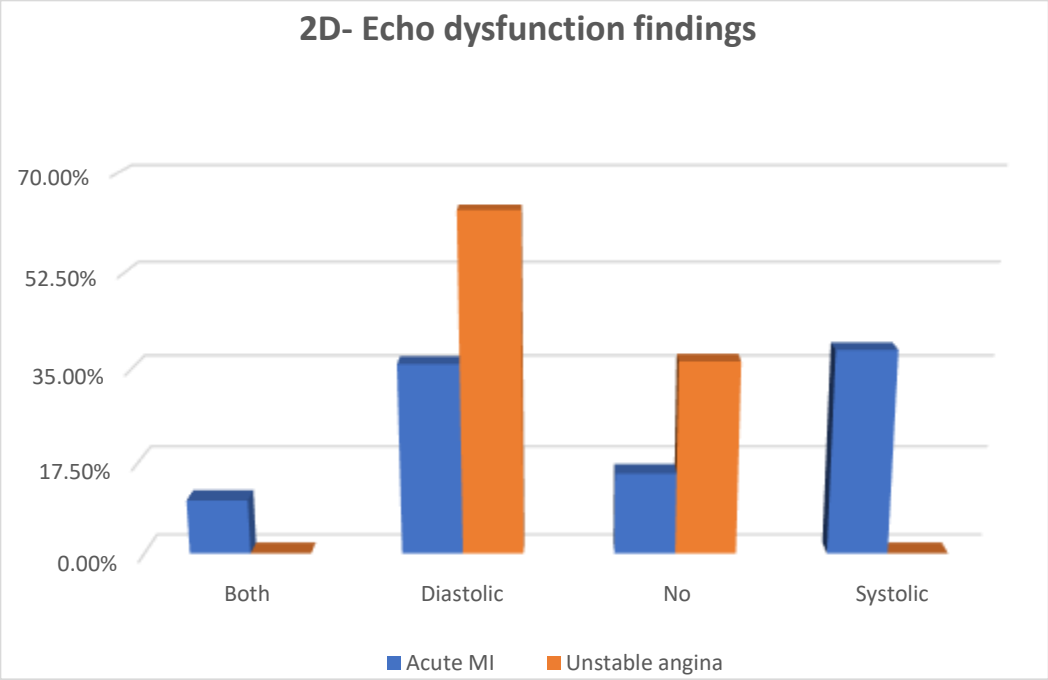


Figure-13

Table no 14:- 2D- Echo RWMA findings amongst study population

	Diagnosis	Total

			Acute MI	Unstable angina	
2D-Echo RWMA	No	Count	0	11	11
		%	0.00%	100.00%	22.00%
	Yes	Count	39	0	39
		%	100.00%	0.00%	78.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

P value - < 0.05

In the above table, 2D-Echo RWMA findings show a distinct difference between patients with Acute MI and those with Unstable Angina. In the Acute MI group, all patients (100%) exhibit RWMA, whereas none of the patients with Unstable Angina show RWMA (100% have no RWMA). Overall, 78% of the patients have RWMA, while 22% do not. The p-value of less than 0.05 indicates a significant difference in the presence of RWMA between the two diagnostic groups.

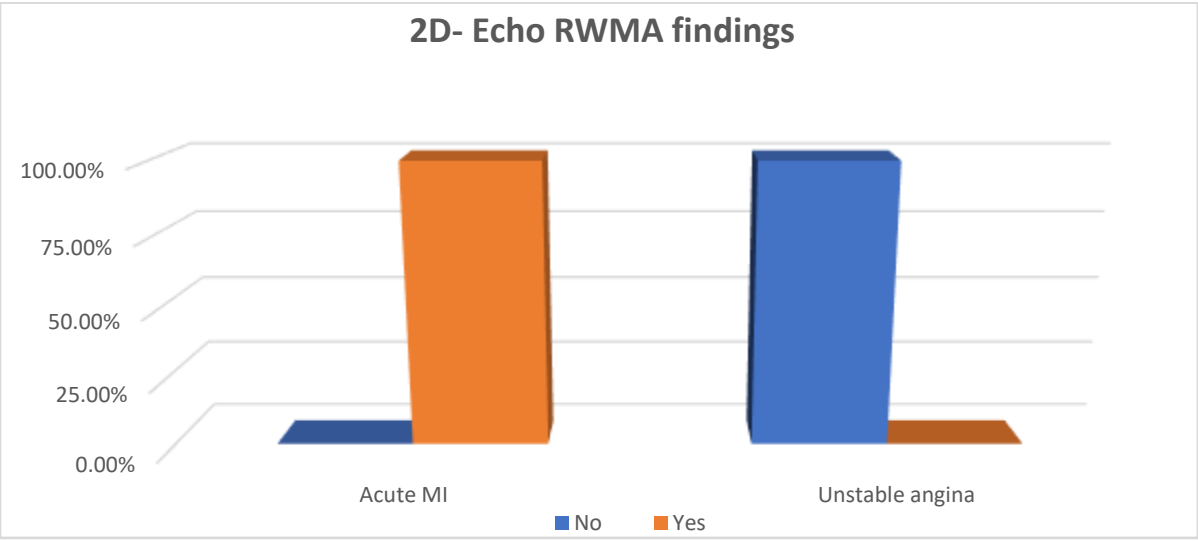


Figure-14

Table no 15:- Diagnostic validity of Hs-FABP in acute coronary syndromes within 3 hours from the onset of presentation amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
H FABP at presentation	Negative	Count	9	11	20
		% within Diagnosis	23.10%	100.00%	40.00%
	Positive	Count	30	0	30
		% within Diagnosis	76.90%	0.00%	60.00%
Total		Count	39	11	50

	% within Diagnosis	100.00%	100.00%	100.00%

Variable	**%**
Sensitivity	76.92%
Specificity	100%
PPV	100%
NPV	55%
Accuracy	82%
p- value	0.0001(S)

The sensitivity and specificity of Hs-FABP within 3 hours of presentation was 76.92% and 100% respectively. PPV and NPV is 100% and 55% respectively with significant p value (<0.0001).

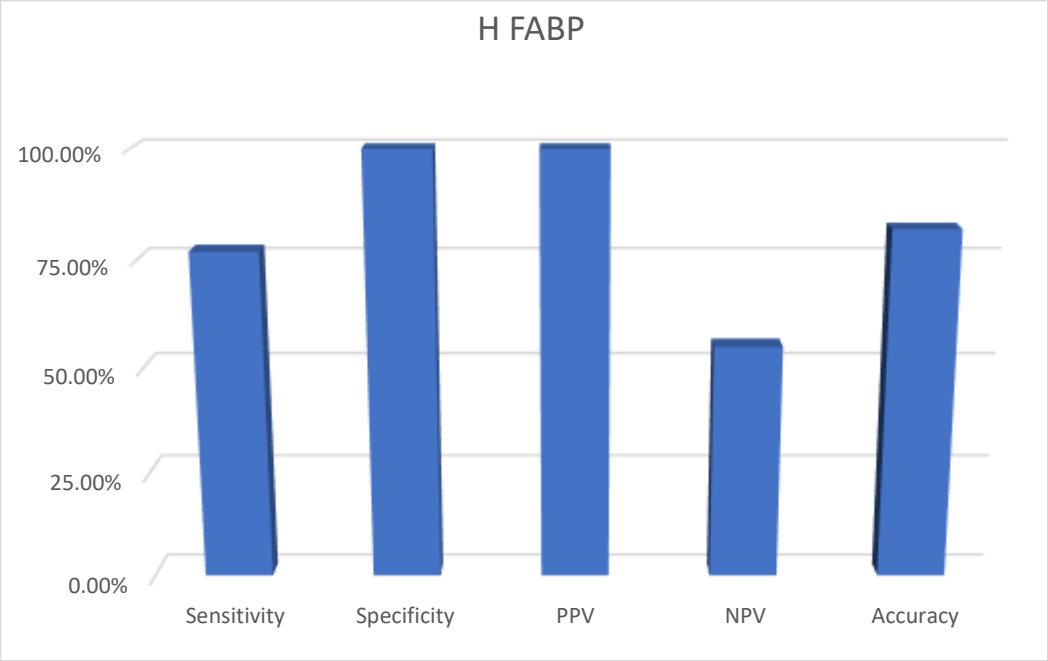


Figure-15

Table no 16:- Diagnostic validity of troponin in acute coronary syndromes within 3 hrs from the onset of presentation amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
Trop T at presentation	Negative	Count	25	11	36
		% within Diagnosis	64.10%	100.00%	72.00%
	Positive	Count	14	0	14

		% within Diagnosis	35.90%	0.00%	28.00%
Total		Count	39	11	50
		% within Diagnosis	100.00%	100.00%	100.00%

Variable	**%**
Sensitivity	35.90%
Specificity	100%
PPV	100%
NPV	30.56%
Accuracy	50%
p- value	0.017

The sensitivity and specificity of troponin within 3 hours of presentation was 35.90 % and 100% respectively. PPV and NPV is 100% and 30.56%respectively with significant p value

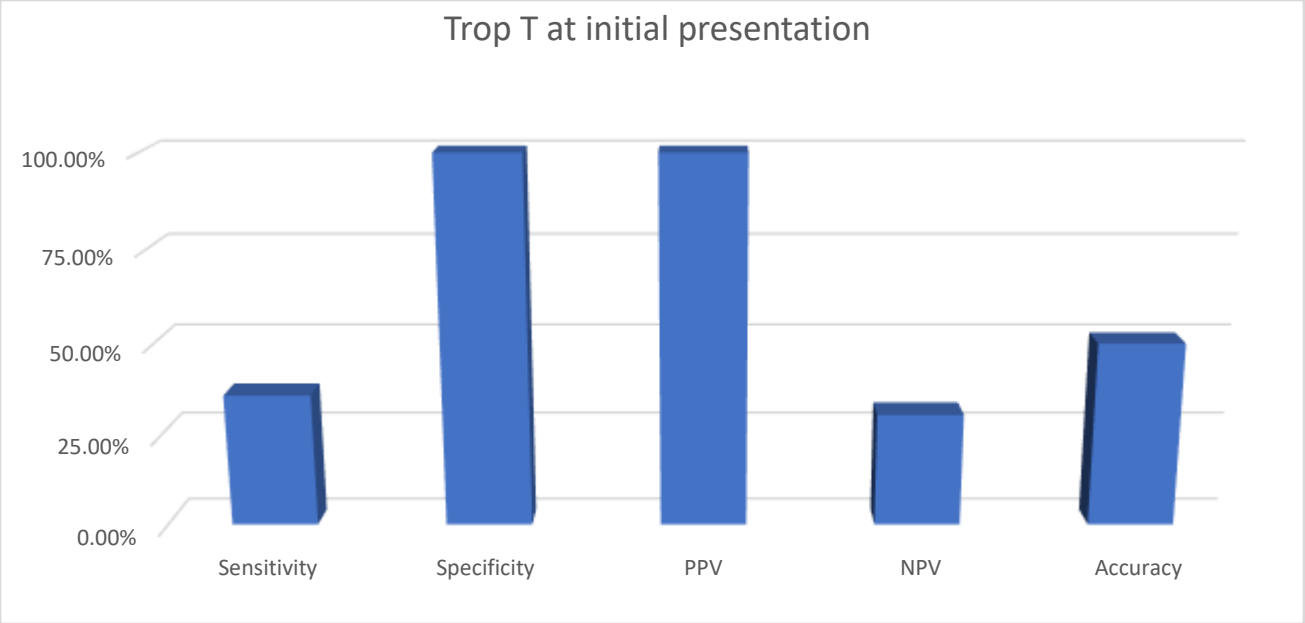


figure-16

Table no 17:- Diagnostic validity of troponin in acute coronary syndromes between 6-12 hrs from the onset of presentation amongst study population

			Diagnosis		Total
			Acute MI	Unstable angina	
	Negative	Count	6	11	17

Trop T 6-12 hrs		%	15.40%	100.00%	34.00%
	Positive	Count	33	0	33
		%	84.60%	0.00%	66.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

Variable	**%**
Sensitivity	84.60%
Specificity	100%
PPV	100%
NPV	40%
Accuracy	86.20%
p- value	0.0001(S)

The sensitivity and specificity of troponin between 6-12 hours of presentation was 84.60% and 100% respectively. PPV and NPV is 100% and 40% respectively with significant p value (0.0001)

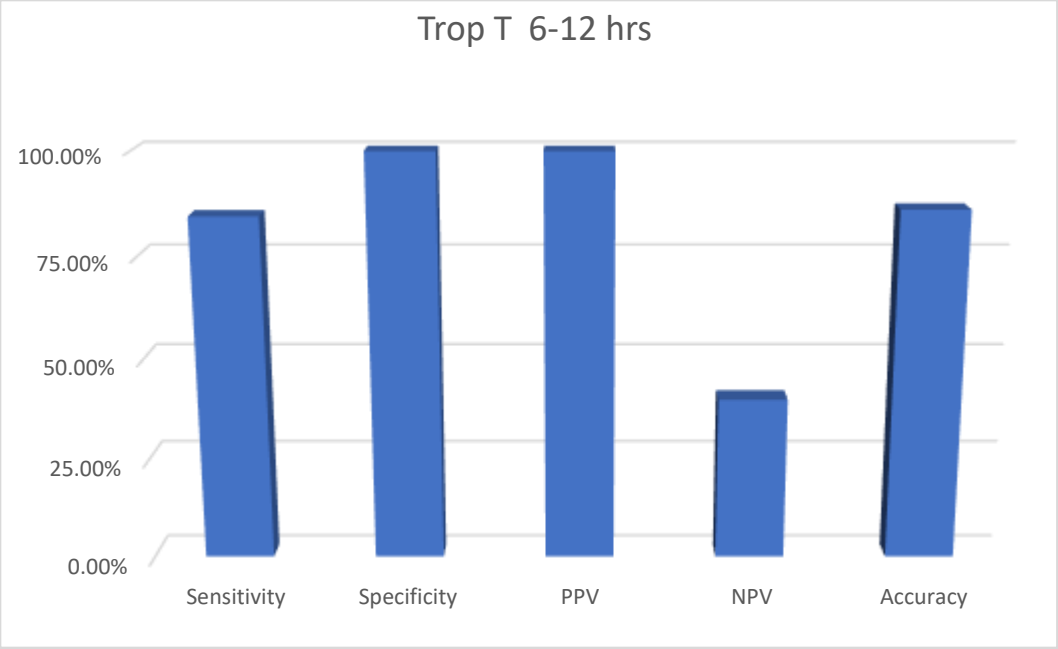


figure-17

Table no 18:- Diagnostic validity of CK MB in acute coronary syndromes within 3hrs from the onset of presentation amongst study population

	Diagnosis		Total
	Acute MI	Unstable angina	

CKMB at presentation	Negative	Count	22	11	33
		% within Diagnosis	56.40%	100.00%	66.00%
	Positive	Count	17	0	17
		% within Diagnosis	43.60%	0.00%	34.00%
Total		Count	39	11	50
		% within Diagnosis	100.00%	100.00%	100.00%

Variable	**%**
Sensitivity	43.59%
Specificity	100%
PPV	100%
NPV	33.33%
Accuracy	56%
p- value	0.001

The sensitivity and specificity of CKMB within 3 hours of presentation was 43.59% and 100% respectively. PPV and NPV is 100% and 33.33%respectively with significant p value

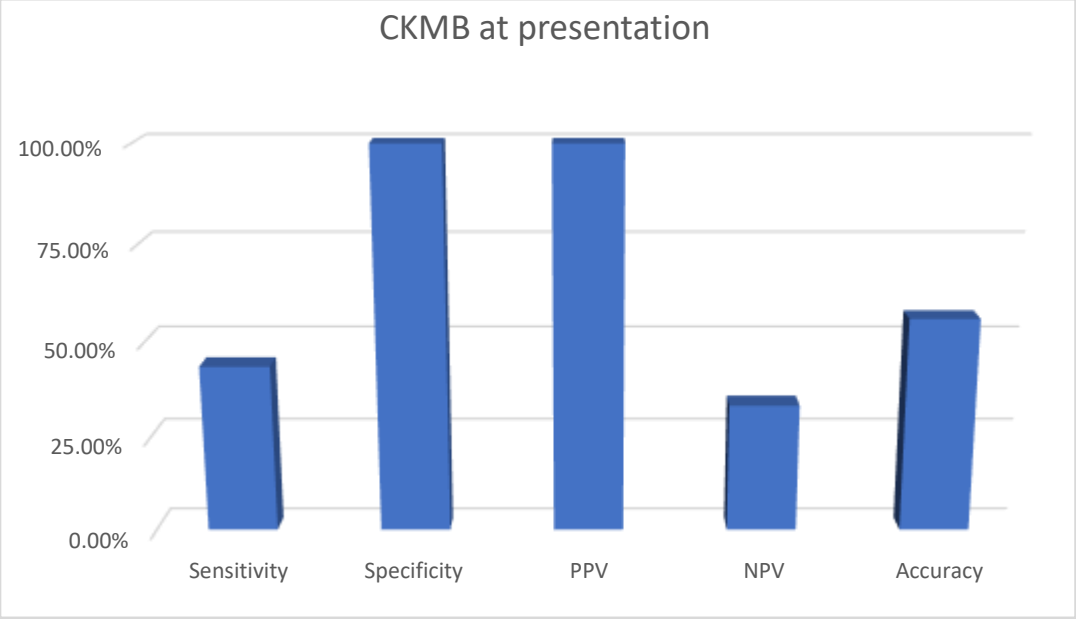


Figure-18

Table no 19:- Diagnostic validity of CK MB in acute coronary syndromes between 6-12 hrs from the onset of presentation amongst study population

	Diagnosis	Total

			Acute MI	Unstable angina	
CKMB 6 -12 hr	Negative	Count	13	11	24
		%	33.30%	100.00%	48.00%
	positive	Count	26	0	26
		%	66.70%	0.00%	52.00%
Total		Count	39	11	50
		%	100.00%	100.00%	100.00%

Variable	**%**
Sensitivity	66.70%
Specificity	100%
PPV	100%
NPV	23.53%
Accuracy	70.12%
p- value	0.0001(S)

The sensitivity and specificity of CKMB within 6-12 hours of presentation was 66.70% and 100% respectively. PPV and NPV is 100% and 23.53% respectively with non significant p value

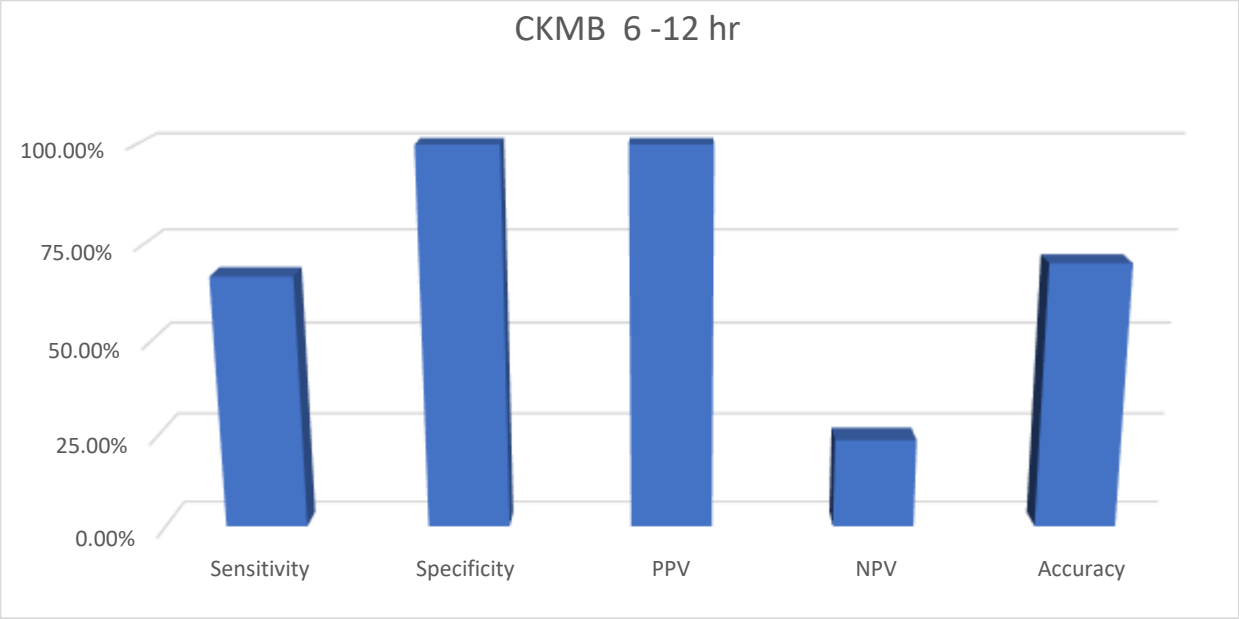


Figure-19

Table no 20:- Diagnostic validity of H-fabp,Troponin and CK MB in acute coronary syndromes at 3 hrs from the onset of presentation amongst study population

Variable	HFABP at presentation	Trop T at presentation	CKMB at presentation
Sensitivity	76.92%	35.90%	43.59%
Specificity	100%	100%	100%
PPV	100%	100%	100%

NPV	55%	30.56%	33.33%
Accuracy	82%	50%	56%
p- value	0.0001(S)	0.017	0.001

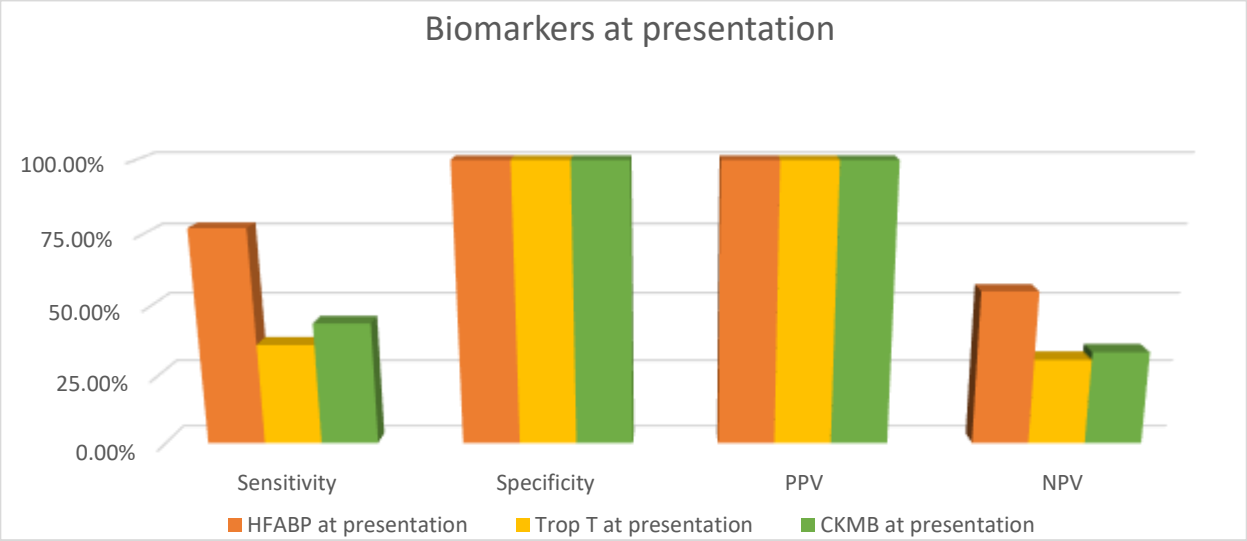


Figure-20

Discussion

In Western countries, acute coronary syndrome (ACS) is a leading cause of hospital admission. 197 In fact, the primary cause of death in these nations is cardiovascular disease, specifically acute myocardial infarction. 198,199 Younger patients have rarely been investigated, despite the fact that the features and clinical course of this condition in older age groups have been extensively described 200 and clinical practice recommendations include a part devoted specifically to older

patients 201. This could be because, while incidence fluctuates based on the population, age restrictions considered, and socioeconomic changes, it is substantially lower in younger individuals than in elderly ones. 202–204

Women accounted for 2% of hospital admissions and males for 6% in a recent Spanish research that focused on patients under the age of 45. Readmission rates to hospitals were much higher among this age group compared to those whose first incident happened later in life, according to the study. 208 Patients with early-onset ACS may not live as long as those who survive, and those who do will incur high medical and societal costs. 209 Obesity, diabetes, metabolic syndrome, and sedentary lifestyles have all become more common in recent decades, while smoking has decreased. These changes have greatly altered the exposure to risk factors for atherosclerosis.210,211

Gender and Age

The majority of the study population in this investigation was found to be between the ages of 50 and 59 (34%) and 30-39 (22%). The study population's mean age was 52.68 ± 12 years. Growing older is thought to be the biggest risk factor for CAD. The chance of developing AMI is eight times higher in people over 45.212

Males predominate in both groups when examining the sex distribution of individuals diagnosed with unstable angina and acute MI. In particular, 74.4% of patients with acute MI are male and 25.6% of patients are female. 36.4% of individuals with unstable angina are female, while 63.6% are male. In all, 28% of the patients are female and 72% are male, suggesting that men are more likely to suffer from these illnesses. In their 2006 study, Deborah et al. also discovered that men were more likely than women to have AMI.212 Similar to our analysis, a Spanish study by Antonia

et al. (2012) revealed that of 6209 patients with AMI, 75% were male and 25% were female (4:1).213

Type of chest pain

There is a notable difference in the distribution of types of chest pain between patients with Acute MI and Unstable Angina, with typical chest pain being far more common. 74.4% of individuals with acute MI had conventional chest pain, compared to 25.6% who have atypical chest pain. On the other hand, all patients (100%) with unstable angina report having conventional chest pain; no patient reports having atypical chest pain. In all, 20% of the patients experience unusual chest pain, compared to 80% who experience regular chest pain. The statistical significance of this difference is indicated by the p-value of 0.001. Similar findings were made by Albarran J. et al. (2002), who discovered that pain radiating to the left arm is substantially linked to AMI.214

Hypertension

Patients diagnosed with unstable angina and acute MI both frequently experience hypertension. 56.4% of patients with acute MI have hypertension, compared to 43.6% of individuals who do not. 45.5% of individuals with unstable angina had hypertension, compared to 54.5% who do not. Overall, 54% of the patients have hypertension and 46% do not, indicating that there is no discernible difference in the prevalence of hypertension between the two groups.

Diabetes

Patients with Acute MI and Unstable Angina are distributed similarly with regard to prior history of diabetes. 41% of individuals with acute MI have a history of diabetes, compared to 59% who do not. Of the patients suffering with Unstable Angina, 27.3% have a history of diabetes, whilst 72.7% do not. Overall, there is no discernible difference between the two diagnostic groups, with 62% of the patients not having a history of diabetes and 38% having one.

ECG findings

Of the individuals in the Acute MI group, 20.50% had NSTEMI, 23.10% had anterior alterations, 20.50% had anterolateral changes, and 35.90% had inferior changes. Not a single person in the group had a normal ECG. On the other hand, 100% of patients with unstable angina have a normal ECG. All told, 16% of the patients had anterolateral alterations, 28% had inferior changes, 16% had NSTEMI, and 22% had normal ECGs. Of the patients, 18% had anterior changes. A statistically significant difference in the ECG results between the two groups is shown by a p-value of less than 0.05. The 12-lead ECG has major limitations, such as the possibility of interpretation being impossible due to persistent pacemakers or LBBB, yet it is a crucial tool for the early diagnosis of acute MI, according to a 2003 study by Stephen et al. on ECG interpretations.215 The fact that the doctor's experience is necessary for interpreting the 12-lead ECG is another important element. ECG abnormalities are not always present in patients who develop myocardial necrosis. According to research by Nik Hisamuddin et al. (2011), 40% of AMI patients did not exhibit any diagnostic ECG alterations upon admission. Consequently, the diagnosis of MI is not ruled out by a normal ECG. 216

2D-Echo dysfunction

There are differences in the location of 2D-Echo dysfunction between patients with unstable angina and those with acute MI. 10.3% of patients with acute MI have dysfunction in both the diastolic and systolic phases, 35.9% have diastolic dysfunction, 15.4% have no dysfunction, and 38.5% have systolic dysfunction. 36.4% of patients with unstable angina have no malfunction, 63.6% have diastolic dysfunction, and none have systolic or both dysfunctions. In total, 42% of patients have diastolic dysfunction, 20% have no impairment, 30% have systolic dysfunction, and 8% of patients have both forms of dysfunction. A significant difference in the 2D-Echo

dysfunction findings between the two groups is indicated by a p-value of less than 0.05.

2D-Echo RWMA findings.

The results of our study's 2D-Echo RWMA clearly distinguish individuals with Acute MI from those with Unstable Angina. Whereas 100% of the patients in the Acute MI group display RWMA, 100% of the patients with Unstable Angina do not. RWMA affects 78% of individuals overall; 22% do not. A significant difference in the presence of RWMA between the two diagnostic groups is shown by a p-value of less than 0.05.

AMI is managed based on a variety of clinical and laboratory findings, including biochemical markers, history, ECG, physical examination, and demographics. When MI is detected early, especially in high-risk patients, doctors may be able to start intensive medication therapy or early invasive management.217 Our findings imply that H-FABP might be more important for the early identification of MI. However, only automated techniques can be employed in industrialised countries because of the sensitivity needed for biomarker detection. However, most laboratories in developing nations cannot afford these since they are very costly and time-consuming. Therefore, in order to identify cTnT and H-FABP, we suggested bedside fast chromatographic immunoassay assays. For comparison, no measurements of myoglobin were made. In contrast to myoglobin, cardiac muscle has a larger concentration of H-FABP than skeletal muscle.218 This suggests that rather than myoglobin, H-FABP may be a better early indicator of myocyte damage. However, in order to compare with H-FABP, this study was designed using cTnT and CK-MB. Within three hours of presentation, Hs-FABP had a 76.92% sensitivity and a 100% specificity. 100% and 55%, respectively, are the PPV and NPV, with a significant p value (<0.0001).

Within three hours of presenting, troponin's sensitivity and specificity were 35.90% and 100%, respectively. PPV and NPV had significant p values of 100% and 30.56%, respectively. Between six and twelve hours after chest discomfort, the sensitivity and specificity of troponin were 84.60% and 100%, respectively. PPV and NPV have significant p values of 0.0001 and 40%, respectively.

Within three hours of presentation, the CKMB's sensitivity and specificity were 43.59% and 100%, respectively. PPV and NPV have significant p values of 100% and 33.33%, respectively. Within 6 to 12 hours of chest discomfort, the CKMB's sensitivity and specificity were 66.70% and 100%, respectively. 100% is the PPV and 23.53% is the NPV, with a non-significant p value. If cardiac myocyte necrosis is detected biochemically in the proper clinical context, acute MI is diagnosed. 219 The unacceptable low diagnostic sensitivity of all assessed indicators is the evident takeaway from Pentaghini et al.'s meticulous analysis. Upon patient admission, cardiac troponins T and I, CK-MB, and myoglobin had a significant failure rate in ruling out myocardial infarction. 220 just now, myoglobin is the most sensitive marker that has been researched to rule out early AMI. The best time to sample is just after the patient presents, about 4 hours later. It is not possible to utilise this marker alone, though, as it may overlook a fraction of hospitalised patients who had late infarctions. Both troponin T and CK-MB mass increase at around the same early rate. Six to twelve hours after admission, a second sample is analysed to obtain the maximum sensitivity of these two parameters. In contemporary cardiology practice, cardiac troponins are now widely used for both the diagnosis of acute MI and the risk assessment of patients with acute chest pain.219 The fact that cardiac troponins are released from injured myocytes very slowly is one of their main disadvantages.219 Comparably, our research supports the restriction on cTnT collection for patients presenting with acute ischemic-type chest discomfort at the time of admission. For acute

MI, the sensitivity of the first cTnT was 35.90%. The individuals (10%) who showed up within three hours of the onset of symptoms had the lowest sensitivity of the initial cTnT. Its sensitivity rose as the amount of time between the beginning of symptoms and admission increased, reaching 84.81% for those after 6–12 hours.

Myocardial damage is extremely specific to CK-MB. However, because CK-MB takes longer to emerge in serum than cTnT, the first CK-MB has limited sensitivity. Actually, due to its brief half-life, CK-MB is most beneficial in the detection of re-infarction, as demonstrated by Kyung su Kim et al in 2011. 221

Before cardiac troponins were commonly used, several studies that used the World Health Organization's criteria of acute MI indicated that H-FABP was a useful early marker of the condition.pages 222-224 Using the current definition of acute MI, there is a lack of evidence on the diagnostic performance of admission H-FABP. A significant quantity of H-FABP is found in cardiac myocytes, while lower quantities are seen in skeletal muscle, kidney, some areas of the brain, lactating mammary glands, and the placenta. 201 Due to this, our research did not include individuals who had skeletal muscle injuries or renal issues. Initial research made use of antibodies that exhibited high degrees of cross-reactivity with different forms of FABP. Because of this, they might not have been as helpful in the clinic. In more recent research, non-cross-reactive monoclonal antibodies have been utilised.225 We included the Cardiodetect HFABP rapid test kit in our analysis. It is based on immunochromatography and employs two monoclonal antibodies, one of which is gold-labeled. By allowing for a quicker diagnosis without the requirement for automated biochemistry analyzers, immunochromatographic tests save both time and training. Because these tests are easy to administer, interpreting their results requires nothing in the way of training. Histofacial ABP The bulk of the rapid quality kits available today are cassette-based and

have dedicated areas for the blood sample and a clearing buffer, making them very user-friendly. The Cardiodetect H-FABP Kit, which is available on cassette and is much easier to use, has also been employed.

When acute chest discomfort manifests early, H-FABP (76.92%) has a higher sensitivity than cTnT (35.90%) and CK-MB (43.59%). H-FABP had a 100% acute MI specificity, which was comparable to cTnT's 100% and CK-MB's 100%. Within three hours of the start of chest discomfort, the H-FABP readings were substantially greater ($p<0.05$) than those of other biomarkers. Relative to troponin (57% sensitivity) and CKMB (42% sensitivity), H-FABP (96%) demonstrated 96% sensitivity within 3 hours in a 2007 research by Hatice Pasaoglu et al. H-FABP outperforms the initial cTnT in terms of sensitivity for patients seen within 4 hours, however it only met 71% of the criteria for acute MI (95% CI 60-80).

Previous studies have demonstrated varying degrees of specificity for acute MI using H-FABP, ranging from 49 to 86%. 226-224, 226-227 In our investigation, within the first three hours of AMI, the Cardio Detect test (H-FABP) has a higher NPV (55%) and is more sensitive than the Troponin T test (30.56%) and CK-MB (33.33%). Early in the course of ischemic chest pain, it can be utilised to rule out myocardial infarction. This was comparable to several investigations conducted abroad.222-224

The results of Nik Hisamuddin et al. (2011) observed CardioDetect H-FABP had a sensitivity and specificity of 62.5% and 100% at less than 4 hours after chest discomfort, compared to 50% and 80% for TnI and 37.5% and 80% for CKMB, respectively.218 In their investigation, the sensitivity of CKMB was 85.7%, whereas that of CardioDetect and cTnT was 100% at times of greater than 4 hours but less than 12 hours. These results were consistent with our own, which revealed that

the sensitivity of CK-MB (43.59%), cTnT (35.90%), and H-FABP (76.92%) H-FABP, cTnT, CK-MB, and ECG all had diagnostic accuracy of 82%, 50%, and 56%, respectively, demonstrating the superiority of Cardiodetect H-FABP as a tool for early (<3h) AMI detection.

STRENGTH AND LIMITATIONS

1.Comprehensive Analysis: It includes a thorough analysis of various factors, such as gender distribution, type of chest pain, hypertension, diabetes, ECG findings, 2D-Echo dysfunction, and biomarker levels. This comprehensive approach helps in understanding the multifaceted nature of ACS.

2.Comparison with Older Studies: The study draws comparisons with previous research, highlighting differences and similarities in ACS characteristics. This contextualizes the findings and underscores their significance.

3.Biomarker Evaluation: The detailed evaluation of biomarkers (H-FABP, cTnT, CK-MB) for early MI detection is a key strength. The study suggests the potential superiority of H-FABP for early diagnosis, which could influence clinical practice.

4.Sample Size and Population: The study's sample size is small or not representative of the broader population, the findings may not be generalizable. Specific demographic or regional biases could affect the applicability of the result**s.**

5.Lack of H-FABP values at 6-12 hours: The absence of H-FABP measurements at 6-12 hours after presentation misses evaluating its performance during when other markers like cTnT and CK-MB typically show increased sensitivity.

Summary

- Sex distribution among patients with Acute MI and Unstable Angina showed a male predominance. For Acute MI, 25.6% were female and 74.4% were male. For Unstable Angina, 36.4% were female and 63.6% were male. Overall, 28% were female and 72% were male, indicating a higher prevalence in males.

- Chest pain type distribution:
    - Acute MI: 25.6% experienced atypical chest pain, 74.4% had typical chest pain.
    - Unstable Angina: 100% reported typical chest pain, 0% experienced atypical chest pain.
    - Overall: 20% had atypical chest pain, 80% had typical chest pain. The p-value of 0.001 indicates a statistically significant difference.

- Hypertension prevalence:
    - Acute MI: 43.6% did not have hypertension, 56.4% had hypertension.
    - Unstable Angina: 54.5% did not have hypertension, 45.5% had hypertension.
    - Overall: 46% did not have hypertension, 54% had hypertension, showing no significant difference between the two groups.

- Past history of diabetes:
    - Acute MI: 59% did not have diabetes, 41% did.
    - Unstable Angina: 72.7% did not have diabetes, 27.3% did.
    - Overall: 62% did not have diabetes, 38% did, indicating no significant difference between the groups.

- ECG findings:
    - Acute MI: 23.10% have anterior changes, 20.50% have anterolateral changes, and 35.90% have inferior changes, 20.50% had NSTEMI with none having a normal ECG. Unstable Angina: 100% had normal ECG.
    - Overall, 18% of the patients have anterior ECG changes, 16% have anterolateral changes, 28% have inferior changes,16% had NSTEMI and 22% have normal ECGs..

- 2D-Echo dysfunction:
    - Acute MI: 10.3% had both systolic and diastolic dysfunction, 35.9% diastolic dysfunction, 15.4% no dysfunction, 38.5% systolic dysfunction.
    - Unstable Angina: 63.6% had diastolic dysfunction, 36.4% no dysfunction, 0% systolic or both dysfunctions.

    - Overall: 8% had both dysfunctions, 42% diastolic dysfunction, 20% no dysfunction, 30% systolic dysfunction.

- 2D-Echo RWMA findings:
    - Acute MI: 100% had RWMA.
    - Unstable Angina: 100% had no RWMA.
    - Overall: 78% had RWMA, 22% did not.

- Hs-FABP sensitivity and specificity:
    - Within 3 hours of Presentation: Sensitivity 76.92%, specificity 100%, PPV 100%, NPV 55%

- Troponin sensitivity and specificity:
    - Within 3 hours of presentation: Sensitivity 35.90 %, specificity 100%, PPV 100%, NPV 30.56%,
    - Between 6-12 hours of presentattion: Sensitivity 84.60%, specificity 100%, PPV 100%, NPV 40%,

- CKMB sensitivity and specificity:
    - Within 3 hours of presentation: Sensitivity 43.59%, specificity 100%, PPV 100%, NPV 33.33%, non-significant p-value.
    - Between 6-12 hours of presentation: Sensitivity 66.70%, specificity 100%, PPV 100%, NPV 23.53%, non-significant p-value.

Conclusion

In conclusion, our study provides valuable insights into the demographic characteristics, risk factors, diagnostic modalities, and biomarkers associated with AMI and unstable angina. The findings underscore the importance of comprehensive risk assessment, timely diagnosis, and

appropriate management strategies in improving outcomes for patients with acute coronary syndromes. Further research and validation of H-FABP as a diagnostic marker for AMI are warranted to enhance its clinical utility and integration into routine practice.

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ANEXURE-1 PROFORMA

NAME	
AGE	
SEX	
IP NO.	
ADDRESS	
OCCUPATION	

COMPLAINTS AT PRESENTATION	
PAST HISTORY	
FAMILY HISTORY	
PERSONAL HISTORY ALCOHOLIC/SMOKER /TOBACCO CHEWER	
TREATMENT HISTORY	

VITALS	
PULSE RATE	
BLOOD PRESSURE	
O2 SATURATION	
RESPIRATORY RATE	
TEMPERATURE	

SIGNIFICANT FINDING ON PHYSICAL EXAMINATION	

SYSTEMIC EXAMINATION	
CARDIOVASCULAR	
RESPIRATORY	
PER ABDOMEN	
NERVOUS SYSTEM	

INVESTIGATIONS	AT PRESENTATION	6-12 AFTER ONSET OF SYMPTOMS
ECG		
H-FABP		
TROPONIN-T		
CKMB		

ANEXURE-2
KAHERs JNMC
BELAGAVI
INFORMED CONSENT FORM

"Role of novel biomarker heart type fatty acid-binding protein (H-FABP) in diagnosis of acute coronary syndrome in emergency department ".A One Year Cross Sectional Study In Kles Dr. Prabhakar Kore Hospital & Mrc, Belgaum."

Name of Student/Principal Investigator: REG NO: BG0121007
Name of Guide/Co Investigators:**Dr** _____

Objective: To establish the role heart type fatty acid binding protein in early diagnosis of acute coronary syndrome in emergency department of Kles Dr. Prabhakar Kore Hospital & Mrc, Belgaum.

Introduction:H-FABP the novel biomarker, because of its early appearance in the blood stream and due to its superior sensitivity and specificity compared to Troponin I and CK-MB can be used in the early diagnosis of acute coronary syndrome.

Explanation of procedure: Patients of age 18 and older with chest pain and ecg changes suggestive of acute coronary syndrome will be included in the study.
Twelve-lead ECGs taken in first 10 minutes of admission and blood samples taken from antecubital vein in first 30 minutes for H-FABP. Evaluation and the final diagnosis of patients were done according to ACC/ESC guidelines.
The H-FABP bedside test used in this study is a rapid chromatographic immunotest designed for qualitative determination of H-FABP.

Withdrawal from participation in the study: Participation in this study is voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.
Possible benefits from participating in the study: You will/will not have nor get any benefits by participating in this study. The data gathered will help the population at large.
Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person from identifying you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.
Financial incentives: You will not receive any payment for participating in this study.
Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purposes and or presented to scientific groups. However, your identity will never be revealed.
Questions: In case of any questions with regard to this study, you are free to contact:
REGISTER NUMBER: BG0121007 If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.
Legal rights: By signing this consent form, we are not waving any of your legal rights.

CONSENT STATEMENT

I am making a voluntary decision to participate in the study "Role of novel biomarker heart type fatty acid-binding protein (H-FABP) in diagnosis of acute coronary syndrome in emergency department ".A One Year Cross Sectional Study In Kles Dr. Prabhakar Kore Hospital & Mrc, Belgaum."My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that I understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

ANEXURE-3 MASTER CHART

KEY TO MASTER CHART:

YRS - YEARS
M - MALE
F - FEMALE
MI - MYOCARDIAL INFARCTION
CP - CHEST PAIN
T2DM- TYPE 2 DIABETES MELLITUS
HTN - HYPERTENSION
TROP T- TROPONIN T
CKMB - CREATINE PHOSPHOKINASE-MB
HFABP- HEART TYPE FATTY ACID BINDING PROTEIN
RWMA- REGIONAL WALL MOTION ABNORMALITY

Sr. No.	Ip Number	Name	Age(yrs)	Age group	Sex	Diagnosis	C.P.	T2DM	HTN	ECG	Trop T at presentation(≥0.1ng/L)	Trop T 6-12 hrs (≥0.1ng/L)	CKMB at presentation(≥25IU/L)	CKMB 6 -12 hr(≥25IU/L)	H FABP at presentation	2D-Echo dysfunction	2D-Echo RWMA
1	10003446	Gopal Rao Salve	77	70 to 79 yrs	M	Acute MI	Typical	Yes	Yes	Inferior	positive	positive	positive	positive	positive	Systolic	Yes
2	10038578	Ashok muchandi	50	50 to 59 yrs	M	Unstable angina	Typical	No	Yes	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	No	No
3	10041750	Muttappa Kannaki	45	40 to 49 yrs	M	Acute MI	Typical	No	No	Inferior	Negative	positive	Negative	negative	positive	Systolic	Yes
4	10056104	Roopa birje	35	30 to 39 yrs	F	Acute MI	Typical	No	No	Anterior	Negative	positive	Negative	positive	NEGATIVE	Systolic	Yes
5	10052016	Santosh kushte	49	40 to 49 yrs	M	Acute MI	Typical	No	Yes	Inferior	positive	positive	positive	positive	positive	Diastolic	Yes
6	10056412	Rayavwva gujanal	58	50 to 59 yrs	F	Unstable angina	Typical	Yes	No	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
7	10006044	Farida Shaikh	43	40 to 49 yrs	F	Acute MI	Typical	Yes	Yes	Anterior	Negative	positive	Positive	positive	NEGATIVE	Systolic	Yes
8	10004447	Dinesh sukhlal	43	40 to 49 yrs	M	Acute MI	Typical	No	No	Inferior	Negative	positive	Negative	negative	positive	Systolic	Yes
9	10041225	Naresh Gawade	32	30 to 39 yrs	M	Acute MI	Atypical	No	Yes	Inferior	positive	positive	positive	positive	positive	Diastolic	Yes
10	10007570	Balappa Majantri	59	50 to 59 yrs	M	Unstable angina	Typical	No	No	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
11	10004473	Deepak patil	36	30 to 39 yrs	M	Acute MI	Typical	No	No	Anterior	Negative	positive	Negative	negative	positive	Diastolic	Yes
12	10014842	Ayub Sayyed	44	40 to 49 yrs	M	Acute MI	Typical	No	Yes	Inferior	Positive	Negative	Positive	negative	positive	Systolic	Yes
13	10040758	Yallavva bhovi	56	50 to 59 yrs	F	Unstable angina	Typical	No	No	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	No	No
14	10041529	Rajaram patil	45	40 to 49 yrs	M	Acute MI	Typical	No	No	Inferior	Negative	positive	Negative	positive	positive	Diastolic	Yes
15	10049992	Rameshchandra oulkar	39	30 to 39 yrs	M	Acute MI	Typical	Yes	No	Inferior	Negative	Negative	Negative	negative	positive	Systolic	Yes
16	10013599	Suresh Kadam	38	30 to 39 yrs	M	Acute MI	Atypical	No	Yes	Inferior	Negative	positive	Negative	positive	positive	Systolic	Yes
17	10056099	Umesh baligar	58	50 to 59 yrs	M	Unstable angina	Typical	Yes	Yes	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
18	10043789	Nirmala guravennavar	40	40 to 49 yrs	F	Acute MI	Typical	No	No	NSTEMI	Negative	positive	Negative	positive	positive	Systolic	Yes
19	10036646	Gomu Chavan	38	30 to 39 yrs	M	Acute MI	Atypical	No	Yes	Anterolateral	Negative	positive	Negative	positive	positive	Both	Yes
20	10051695	Irappa naik	58	50 to 59 yrs	M	Acute MI	Typical	Yes	Yes	Anterior	Positive	positive	Positive	negative	positive	Diastolic	Yes
21	10052162	Bharamavva Mannikeri	53	50 to 59 yrs	F	Unstable angina	Typical	No	No	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	No	No
22	10052915	Laxmi kalal	55	50 to 59 yrs	F	Acute MI	Typical	No	Yes	Inferior	Negative	Negative	Negative	negative	positive	Systolic	Yes
23	10004692	Mangalsule Basavani	55	50 to 59 yrs	M	Acute MI	Typical	Yes	Yes	Anterolateral	Positive	positive	Positive	positive	positive	Diastolic	Yes
24	10003425	Bokamarakar tukaram	33	30 to 39 yrs	M	Acute MI	Typical	ND	No	Anterior	positive	positive	Positive	positive	positive	Systolic	Yes
25	10003739	Dhangar h bandu	53	50 to 59 yrs	M	Unstable angina	Typical	No	No	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
26	10051966	Dhanashree rajekar	39	30 to 39 yrs	F	Acute MI	Atypical	Yes	Yes	Anterolateral	Negative	positive	Negative	positive	positive	Systolic	Yes
27	10032411	Sadashiv Khot	56	50 to 59 yrs	M	Acute MI	Typical	Yes	Yes	NSTEMI	Negative	positive	Negative	negative	positive	Systolic	Yes
28	10004467	Prabhakar banakar	57	50 to 59 yrs	M	Unstable angina	Typical	No	Yes	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
29	10013644	Basavaraj jakati	58	50 to 59 yrs	M	Acute MI	Typical	No	Yes	Anterolateral	Positive	positive	Positive	positive	positive	Diastolic	Yes
30	10036609	Anil siddannavar	55	50 to 59 yrs	M	Acute MI	Typical	No	Yes	Anterior	Positive	positive	Positive	positive	positive	Diastolic	Yes
31	10050569	Rajendra kadolkar	56	50 to 59 yrs	M	Acute MI	Typical	No	No	Inferior	Negative	Negative	Negative	negative	positive	No	Yes
32	10049487	Mahadevi heggeri	62	60 to 69 yrs	F	Acute MI	Typical	No	Yes	Anterolateral	Positive	positive	Positive	positive	positive	No	Yes
33	10040354	Asha subadare	63	60 to 69 yrs	F	Acute MI	Atypical	Yes	Yes	NSTEMI	Negative	Negative	Negative	negative	positive	No	Yes
34	10008107	Sidram navi	64	60 to 69 yrs	M	Acute MI	Typical	No	No	Anterior	Negative	positive	Negative	positive	positive	Diastolic	Yes
35	10008491	Tatyasaheb Malapure	67	60 to 69 yrs	M	Acute MI	Atypical	No	No	Anterolateral	Positive	positive	Positive	positive	NEGATIVE	Diastolic	Yes
36	10008503	Javeed Patwegar	66	60 to 69 yrs	M	Acute MI	Typical	Yes	No	Anterior	positive	positive	positive	positive	NEGATIVE	Both	Yes
37	10008735	Bhimappa h pujer	65	60 to 69 yrs	M	Acute MI	Typical	Yes	Yes	Inferior	Negative	positive	Negative	positive	NEGATIVE	No	Yes
38	10003438	Smita N Ramesh	64	60 to 69 yrs	F	Acute MI	Atypical	Yes	No	NSTEMI	Negative	positive	Negative	negative	positive	No	Yes
39	10003709	chandekar s Govind	77	70 to 79 yrs	M	Acute MI	Typical	Yes	Yes	NSTEMI	Positive	positive	Positive	positive	positive	Systolic	Yes
40	10003943	Surekar m Isavr	76	70 to 79 yrs	M	Acute MI	Typical	Yes	No	Inferior	Negative	positive	Negative	negative	positive	Diastolic	Yes
41	10008755	Rudravva Chandaragi	78	70 to 79 yrs	F	Acute MI	Typical	No	Yes	Anterior	Positive	positive	Positive	positive	positive	Diastolic	Yes
42	10036051	Rachappa rajur	80	80 to 90 yrs	M	Acute MI	Atypical	Yes	Yes	NSTEMI	Negative	positive	Negative	positive	NEGATIVE	Both	Yes
43	10041128	Sangappa kanthikar	48	40 to 49 yrs	M	Acute MI	Typical	No	Yes	NSTEMI	Negative	positive	Negative	positive	NEGATIVE	Systolic	Yes
44	10055399	Mallikarjun umarani	57	50 to 59 yrs	M	Unstable angina	Typical	No	Yes	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
45	10051989	leeladevi naheta	55	50 to 59 yrs	F	Unstable angina	Typical	No	No	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	No	No
46	10008873	Gouravva Goudar	63	60 to 69 yrs	F	Acute MI	Atypical	Yes	Yes	Inferior	Negative	Negative	Negative	negative	positive	No	Yes
47	10003973	Tulasa b janaki	64	60 to 69 yrs	M	Acute MI	Typical	No	No	NSTEMI	Negative	positive	Positive	positive	NEGATIVE	Diastolic	Yes
48	10041883	Balchandra dasaka	67	60 to 69 yrs	M	Acute MI	Atypical	No	No	Anterolateral	Negative	positive	Negative	positive	positive	Diastolic	Yes
49	10036399	Somashekhar Sheelavant	57	50 to 59 yrs	M	Unstable angina	Typical	Yes	Yes	NORMAL	Negative	Negative	Negative	negative	NEGATIVE	Diastolic	No
50	10002561	Salim Nadaf	38	30 to 39 yrs	M	Acute MI	Typical	Yes	No	Anterolateral	Negative	positive	Positive	positive	NEGATIVE	Both	Yes