



ACUTE MYOCARDIAL INFARCTION- A CROSS SECTIONAL STUDY OF BIO-MARKERS

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ABSTRACT

Acute myocardial infarction (AMI) is diagnosed with history of chest pain, ECG, enzyme bio markers. Many persons may not present with typical chest pain and have atypical presentations. Troponin-I is a polypeptide subunit of myofibrillar troponin complex. Troponin-I is present in both cardiac and skeletal muscles and that present in cardiac cell is known as cardiac specific protein Troponin-I. In cardiac tissue 97% of the protein is bound to myofibrills and 3% is found free in the cytosol of cardiomyocytes. An increase in the cardiac specific Troponin-I in the circulation is said to be a definitive marker of myocardial injury. The aim of the present study was to study the levels of various enzymatic markers in AMI and determine the efficacy of cTnI in terms of early detection when compared to that of the other know routine enzymatic markers of AMI. The present study included 50 cases with AMI and 40 control subjects. We observed that within TnI was found to increase as early as 3 hrs from the onset of myocardial injury

KEY WORDS: Acute Myocardial Infarction, biomarkers, Troponin-I.



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INTRODUCTION

Cardiac muscles are metabolically very demanding and cessation of blood supply even for short period can result in necrosis & there is no regeneration. Myocardial infarction refers to the irreversible damage to the myocardium. Myocardial infarction is mostly due to thrombotic occlusion of the coronary artery which has been previously narrowed by Atherosclerosis. ^[1,2] The occlusion of various coronary arteries is in the proportions of 3:2:1 in the left anterior descending, right coronary and left circumflex coronary artery respectively. ^[3] Acute myocardial infarction (AMI) is diagnosed with history of chest pain, ECG, enzyme bio markers. Many patients may have atypical presentations like there may not be the history of typical chest pain in diabetic autonomic neuropathy. India with a large number of people with diabetes mellitus (DM), there is the possibility of many patients being deceived by clinical symptoms & signs of MI. In nearly half of the patients ECG may be equivocal initially thereby delaying diagnosis & initiation of treatment. So we could rely on enzyme biomarkers which help to establish or exclude the diagnosis. Inadequate or complete cessation of oxygen supply to a part of the myocardium cause ischemic heart diseases ranging from mild angina to severe myocardial infarction depending upon the severity of the imbalance between oxygen supply and demand. The lack of oxygenation in turn, may produce a wide range of abnormalities in cardiac cell structure, function and metabolism leading to mechanical, electrical and biochemical disturbances in the affected part of the myocardium, which may be either permanent or transient depending on the duration of ischemia. From the affected cardiac myocyte the cytoplasmic cell constituents are extruded into the circulation which can be biochemically analyzed including the Regulatory proteins -Tropomyosin, Troponin T, Troponin C, Troponin I, Contractile protein myosin, Myoglobin, Cytoplasmic enzymes -Creatine kinase (CK), Aspartate amino transferases (AST), Lactate dehydrogenase (LDH). ^[4,5,6]

AIM & OBJECTIVES OF THE STUDY:

The aim of the present cross-sectional work was to study the level of enzymes cardiac troponin I (cTnI), CK, CK-MB, AST and LDH, in both normal controls and at 3 hours in those presenting with AMI. To determine the efficacy of cardiac TnI in terms of early detection AMI when compared to that of the other known routine enzymatic markers of MI.

MATERIALS AND METHODS

This was a cross-sectional study where ninety male subjects were chosen in the age group of 40-60 years. Out of them forty were normal healthy males and they formed the normal control group. Fifty of them were patients with AMI, admitted to the Cardiology Department of Government General Hospital formed the study group. Those individual with impaired renal/liver function or having clinical features of hyperlipidemia were excluded from the study. The study group consisted of fifty patients with ECG evidence of AMI. Subjects in the control group did not have any history of chronic ailment and were free from symptoms and clinical signs of coronary heart disease were chosen from the out-patient department. All the subjects were BMI (Body Mass Index) matched. Blood samples were collected by venipuncture within three hours of admission. About 5ml was allowed to clot and the serum was separated after centrifugation. The analysis of Total CK (creatin kinase- nac reagent – uv- kinetic method), CK-MB (creatin kinase- MB nac reagent – uv- kinetic method), LDH (uv- kinetic method), serum AST (modified IFCC method) was done immediately in semi-automated analyzer. The cardiac troponin I assay is based on enzyme immunoassay (ELISA) technology using horseradish peroxidase as a label. Statistical Analysis was done using Microsoft Excel 2007.

RESULTS AND DISCUSSION

The results are showed in table 1 as mean and SD unless otherwise specified. AMI is a state characterized by abnormalities between nutrient perfusion and myocardial oxygen consumption. The diagnosis of AMI was based on the patient's history, clinical signs and symptoms, electrocardiographic tracings and serum levels of cardiac biomarkers. World Health

Organization has recommended that the diagnosis of AMI be based on fulfillment of at least two of the following three criteria.

1. Clinical history of severe ischemic type of chest pain with duration of twenty minutes.
2. Changes on serial electrocardiograph tracings.
3. Initial rise and subsequent fall in serum levels of cardiac biomarkers.

Table 1
Mean & SD of Cardiac injury bio markers in cases & controls

MARKERS	GROUP	N	MEAN	SD	P-VALUE
Troponin – I (ng/ml)	Controls	40	0.019	0.030	t = 7.38
	Cases	50	4.22	4.03	P=0.001
Total-CK (U/L)	Controls	40	41.36	18.18	t = 30.72
	Cases	50	1058.21	233.20	P=0.001
CK-MB (U/L)	Controls	40	1.44	1.37	t = 13.35
	Cases	50	124.50	65.18	P=0.001
LDH (U/L)	Controls	40	134.39	12.65	t = 0.46
	Cases	50	133.04	14.67	P=0.65
AST (U/L)	Controls	40	23.11	4.24	t = 1.95
	Cases	50	25.047	5.33	P>0.06

N – number of subjects

Before an analysis on the results of the study group was started, it is essential to analyze reference values obtained in the study. The reference level obtained for Total CK, CK -MB, LDH, AST, Cardiac Tnl are 41.36 ± 18.18 , 1.44 ± 1.37 , 134.39 ± 12.65 , 23.11 ± 4.24 , 0.019 ± 0.030 . These levels were found to correlate well with the levels obtained by Christenson et al. [7]

Troponin C (TnC) has no potential as a cardiac marker, because its amino acid sequence in both skeletal and cardiac muscle is identical. Cardiac Troponin-T (TnT) is a polypeptide subunit of the myofibrillar regulating Troponin complex and is a unique myocardial protein. Cardiac Troponin I (TnI) is a monomer with a molecular mass of 24 kDa. It is an inhibitory polypeptide subunit of the myofibrillar regulating Troponin complex. TnI is uniquely located in the myocardium and is the most specific cardiac injury biomarker. Creatine Kinase-MB (CK-MB) an isoenzyme of CK is considered to be a more specific indicator of AMI and it has been recognized that the amount of enzyme released correlates with the size of the infarct CK-MB has the advantage over AST and LDH in that it is

not present in extra cardiac tissues. Aspartate amino transferase (AST) is moderately elevated in cirrhosis, skeletal muscle disease, after trauma or surgery, cholestatic jaundice, severe hemolytic anemia, hence not specific for MI. Total CK is markedly elevated in MI, muscular dystrophy, rhabdomyosis and a moderate elevation occur in muscular injury, after surgery, alcoholism. LDH is markedly increased in (more than 5 times the upper adult reference limit) in MI, circulatory failure with shock and hypoxia, acute leukemia, lymphomas; moderately increased in viral hepatitis, malignancy, skeletal muscle disease, pulmonary embolism. From the above enzyme biomarkers it is evident that TnT, TnI, CK-MB are more cardiac specific than the others in cardiac injury. The Pattern of elevation of cardiac markers in acute MI is shown in table 2⁽⁶⁾. Out of these TnI was found to increase as early as 3 hrs from the onset of myocardial injury/pain & clearly ahead in terms of onset time and cardiac specific. In this study we studied the different enzyme levels in AMI patients established by clinical signs & symptoms, ECG and normal healthy subjects.

Table 2
Pattern Of Cardiac Markers Elevation In Acute Myocardial Infarction

Marker	Time to Initial Elevation (hours)	Time to Peak Elevation (hours)	Time to Return to Normal (days)
MYOGLOBIN	1-4	6-10	1
CTn I	3-6	12-24	3-10
CTn T	4-6	24-48	7-14
CK-TOTAL	4-8	12-24	2-3
CK – MB	3-6	12-18	<1
AST	6-8	24-48	4-6
LDH	12-24	48-72	7-12

Of the various cardiac biomarkers, Cardiac Troponin I is a biomarker with high specificity and sensitivity for AMI. From the results of our study (Table 2) controls have Serum Cardiac Tn I levels with a value of 0.019 ± 0.030 ng/ml and cases with AMI with signs and symptoms and electrocardiograph findings suggestive of MI showed an increase of serum Cardiac Tn I with a value of 4.22 ± 4.03 ng/ml, which is highly significant with a p value of 0.001. Because of the high sensitivity and high specificity, cardiac troponin has become the cornerstone of diagnosis of MI. Many recent data utilizing contemporary assays and contemporary cutoffs suggest that use of other markers is rarely necessary because cardiac troponin as measured with current assays increases rapidly. With the criteria of 99th percentile and a rising pattern, 80% of acute MI were detected within 2 to 3 hours. [8,9]

CONCLUSION

AMI continues to be one of the most common causes for mortality and morbidity worldwide, and hence there is a need to diagnose the condition at an early stage for appropriate management. Approximately one third of the patients with AMI do not present with classical chest pain and non diagnostic electrocardiograph tracings are recorded in approximately half of the patients presenting to the emergency department with chest pain, therefore in the majority of patient clinician must obtain serum cardiac marker measurement to either establish or exclude the diagnosis of AMI. Assay for measuring serum levels of biomarker of cardiac injury, remain an important tool for diagnosing patient with suspected MI. Elevated serum levels of other commonly used biomarker are not specific for cardiac injury because these markers are present in other tissue types throughout the body.

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