

# A Cross Sectional Study to Compare the Specificity of Creatine Kinase – MB (CK – MB), Cardiac Troponin T (CTnT) and Cardiac Troponin I (CTnI) to Rule in Acute Myocardial Infarction

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## Abstract

**Background:** Distinguishing whether a patient presenting with chest pain has acute myocardial infarction (AMI) or non-cardiac problem is at times difficult. Ruling out AMI requires a test with high diagnostic sensitivity, whereas ruling in AMI requires a test with high diagnostic specificity. This study was planned with the aims and objectives to find out the better marker for the identification of acute myocardial infarction.

**Methods:** The study population consisted of 70 patients. Patients from both sexes, with clinical history of typical chest pain for more than 30 minutes in duration with evidence of acute changes of myocardial infarction on ECG were included in the study. This study was conducted to compare the sensitivity of creatine kinase – MB (CK – MB), cardiac troponin T (CTnT) and cardiac troponin I (CTnI) for detection of AMI. Data analysis was performed with Statistical Package for Social Sciences 11.5 (SPSS 11.5).

**Results:** The sensitivity of CK – MB was 100% and 17.78% as compared to CTnT and CTnI respectively. The sensitivity of CTnT was 46.67% and 38.10% as compared to CK-MB and CTnI respectively while the sensitivity of CTnI was 100% as compared to both CK – MB and CTnT.

**Conclusion:** It is concluded that CTnI is the preferred, dependable and cost effective serum markers for detection of AMI as compared to CTnT and CK-MB.

**Keywords:** Acute myocardial infarction (AMI), creatine kinase – MB (CK – MB), cardiac troponin T (CTnT) and cardiac troponin I (CTnI).

## Introduction

Coronary artery disease (CAD) is a leading cause of mortality and morbidity. Approximately 20 – 23% of patients presenting at emergency cardiology case with chest pain have coronary disease.<sup>1</sup> An early diagnosis of myocardial infarction facilitates rapid decision making and treatment and therefore improves the outcome in patients presenting with symptoms of chest pain.<sup>2</sup>

Distinguishing whether a patient presenting with chest pain has acute myocardial infarction (AMI) or non-cardiac problem is at times difficult.<sup>3</sup> The ability to rapidly identify myocardial ischaemia or infarction

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in patients in the emergency department has important implications for patient management.<sup>4</sup> Ruling out AMI requires a test with high diagnostic sensitivity, whereas ruling in AMI requires a test with high diagnostic specificity.<sup>5</sup>

The primary function of measuring cardiac markers in blood is to detect the presence of myocardial injury.<sup>6</sup> After AMI, cardiac enzymes and proteins are released into the plasma and are used as biochemical markers of cardiac muscle injury.<sup>7</sup>

The ideal markers of myocardial injury would provide early diagnosis.<sup>5</sup> This study was planned to find out the better marker for the identification of acute myocardial infarction.

### Aims and Objectives

The aim of this study was to compare the diagnostic specificity of Creatine Kinase – MB, Cardiac Troponin T and Cardiac Troponin I as preferred serum marker to rule in acute myocardial infarction.

### Material and Methods

This cross – sectional study was conducted at emergency department of Punjab Institute of Cardiology, Lahore from 15<sup>th</sup> May, 2008 to 15<sup>th</sup> July, 2008. The study population consisted of 70 patients. Diagnosed

cases of AMI<sup>8</sup> from both sexes, with clinical history of typical chest pain for more than 30 minutes with evidence of acute changes of myocardial infarction on ECG were included. All the patients / relatives signed the informed consent form. The patients with history of previous myocardial infarction, chronic renal failure, muscle injury, surgery, muscle disease etc. were excluded.

Ten ml of venous blood was drawn at the time of admission. After centrifugation, the serum was preserved at -20°C. The serum was analysed for CTnI by solid – phase, chemiluminescent immunometric assay,<sup>9</sup> with Immulite supplied by DPC (Siemens). The CTnT was analyzed by electrochemiluminescence immunoassay (ECLIA) based upon sandwich principle<sup>10</sup> with Elecsys 2010 analyzer supplied by Roche. The serum was also analyzed for CK – MB by immune – inhibition method,<sup>11</sup> with CK – MB liquid UV supplied by HUMAN, GERMANY on Vitalab Selectra E Netherland.

### Statistical Analysis

The data was analyzed by SPSS 11.5 (Statistical package for social sciences). All qualitative variables were presented in the form of percentages and quantitative variables in the form of Mean ± S.E along with S.D

HTN, DM and IHD	
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**Table 1:** Baseline characteristics of study population.

Variable	Number	Range	Mean ± SD
Total number	70	---	---
Male	58 (82.9%)	---	---
Female	12 (17.1%)	---	---
Age (years)		28 – 70	53.7 ± 10.3
Duration of chest pain			
Within 4 hours	29 (41.4%)	---	---
After 4 hours	41 (58.6%)		
Smokers	47 (67.14%)	---	---
Association of			
Hypertension (HTN)	27(38.57%)		
Diabetes mellitus (DM)	6 (8.57%)	---	---
HTN and DM	10 (14.28%)		
Nil	27 (38.57%)		
Familial evidence of	40 (57.14%)	---	---

and range. Chi-square and Fisher's Exact test were also applied. Results were considered significant when p-value was less than 5%.

## Results

A total of 70 patients were examined in this study. Baseline characteristics of the study population at the time of admission are provided in Table 1.

Among the 70 patients included in study, the biochemical findings are given in table 2.

The specificity of these biomarkers was assessed by applying a marker – specific cutoff value and consecutively calculating the corresponding values from a two – by – two factorial design and is presented in table 3.

**Table 2:** Biochemical findings of study population.

Variable (Critical Value)	Less Than	More Than
CK – MB (25 U/L)	45 (64.3%)	25 (35.7%)
CTnT (0.01 ng/ml)	21 (30%)	49 (70%)
CTnI (0.2 ng/ml)	8 (11.4%)	62 (88.6)

**Table 3:** Diagnostic Specificity of CK – MB, CTnT and CTnI.

Specificity of	Status
CK – MB Vs. CTnT	100%
CK – MB Vs. CTnI	17.78%
CTnT Vs. CK – MB	46.67%
CTnT Vs. CTnI	38.10%
CTnI Vs. CK – MB	100%
CTnI Vs. CTnT	100%

## Discussion

The primary function of measuring cardiac markers in blood is to detect the presence of myocardial injury. Among the seventy cases included in this study 88.6% cases had CTnI concentration more than the limit value while 11.4% cases had CTnI less than the limit value. This observation regarding CTnI is in contrast to the observations made by Matelzky et al (2000)<sup>12</sup> and Kontos et al (1999)<sup>13</sup> in their studies (49% and 39%) due to the use of different analyzers with different upper limit of normal values. The value of CTnI

in our study is in accordance with the observation made by Chiu et al (1999)<sup>14</sup> with a positive value of 80.8% cases when the blood was taken and analyzed in the interval 4 – 8 hours after the onset of chest pain.

The concentration of CTnT was more than the limit value in 70% cases and below the limit value in 30% cases in this study. This observation differs from the values (55%) mentioned by McCann et al (2008)<sup>15</sup> due to less duration of chest pain (within 4 hours). Johnson et al (1999)<sup>16</sup> have mentioned elevated levels of CTnT in 99% of AMI cases who presented to the emergency department within 24 hours of chest pain onset. The observation made by Majeed et al (2002)<sup>7</sup> that CTnT is an early indicator of AMI and is superior to CK – MB in diagnosis of AMI also complements this study.

The serum was analyzed for CK – MB concentration. The concentration of CK – MB was more than the limit value in 35.7% cases and 64.3% cases had CK – MB value less than the limit value in this study. The observation regarding CK – MB concentration (81.5%) is different from the observation made by Meier et al (2002);<sup>9</sup> due to CK – MB analysis with microparticle enzyme immunoassay with consideration of positive value for comparatively lower value (CK – MB 6  $\mu$ /L).

## Conclusion

It is concluded that CTnI is the preferred, dependable and cost effective serum markers for detection of AMI as compared to CTnT and CK – MB.

## Recommendations

- This study enrolled a relatively small number of cases. Thus this study findings need to be confirmed in future by larger investigations groups.
- Bedside whole blood assays for the assessment of CTnT and CTnI should be available in emergency departments to obtain rapid information about these markers.

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