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Role of cardiac enzymes in early diagnosis of myocardial infarction in tertiary care hospital in South India

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ABSTRACT

Background: In recent years cardiac troponin (cT) has revolutionized the diagnosis and management acute myocardial infarction (AMI). But in India most of tertiary care hospitals are depending on creatinine kinase (CK), CK-MB and asparte transaminase (AST) for the diagnosis of AMI due to unavailability of cT or due to high cost. In the present study we measured CPK, CK-MB and AST in patients with acute chest pain and in healthy controls to evaluate the usefulness of above cardiac enzymes in early diagnosis and management of AMI in tertiary care hospital in south India. **Methods**: Blood samples from 75 patients with acute chest pain were obtained immediately after admission and after 24 hours and analyzed for CK, CK-MB and AST using automated analyzer. These patients were grouped into group I (n=50) with ECG and cardiac marker proven AMI and group II (n=25) patients with non specific ECG changes without having any rise in cardiac markers (non cardiac chest pain). Blood samples were also obtained from healthy controls and analyzed for above parameters. **Results**: We found significant increase in CK, CK-MB, AST ($p < 0.001$) in group I patients compared to healthy controls and group II patients at admission. There was significant increase in CK, CK-MB, AST ($p < 0.001$) in group I patients 24 hours after admission compared to group II cases and also group I patients at admission. CK-MB levels correlated positively with CK and AST levels on admission as well as 24 hours after admission. According to our study CK- MB has got sensitivity 84% and specificity of 100%. **Conclusions**: CK-MB can be used as an effective marker in diagnosing AMI in hospitals in India where use of cT is not possible to due to unavailability, factor of affordability, and sometimes to the reduce cost burden on patients.

KEYWORDS

Cardiac troponin;
Acute myocardial infarction;
CK-MB.

INTRODUCTION

Acute myocardial infarction(AMI) happens to be a prime killer in Western world[1]. Indians are four times more prone to AMI as compared to other countries due to combination of genetic and life style factors that promote metabolic dysfunction. Early diagnosis and management of AMI is imperative in prevention of mortality and morbidity in these patients[2,3]. Most diagnostic investigations are based on, alteration in electrical activity of heart i.e electrocardiogram (ECG) and structural damage of cardiac myocytes resulted due to ischemic injury to sub cellular organelles with massive efflux of cardiac muscle enzymes like creatine kinase(CK), creatinine kinase MB isoform (CK-MB), Aspartate transaminase (AST) and cardiac specific troponins (cT)[4].

Serum total CK activity and CK-MB estimations were used for diagnosis of AMI for past few decades and their concentrations in serum rise in parallel to extent of myocardial injury. The characteristic pattern of rise in serum cardiac enzymes is, they start to increase 4-6 hours after injury, reaching peak concentrations after 12-24 hours and returning to baseline after 48-72 hrs[5]. The introduction of cardiac troponins has been so convincing that it has emerged as preferred biomarker for use in the diagnosis and management of AMI[6]. Previous studies have suggested that troponin is superior to CK-MB as the diagnostic marker for AMI. On the other hand previous publications report that CK-MB is the most appropriate test for diagnosis of AMI[7,8].

In India cardiac troponins are not very frequently used in the diagnosis and management of AMI due to its unavailability of methods and proper equipment to measure it, in most of peripheral health care centers and other important issue is high cost involved in determining it. CK, CK-MB, AST are used as important markers in majority of hospitals due to its easy availability of kits based on simple colorimetric method and also their cheaper price. In the present study we have measured CK, CK-MB and AST in acute chest pain patients in tertiary care hospital to look for its role in early diagnosis of AMI in patients with acute chest pain and also to check for its sensitivity and specificity.

MATERIALS AND METHODS

Subjects and samples

The study was carried out in the department of biochemistry, JJM Medical College, Davangere, India. The study group consisted of 75 patients with acute chest pain and twenty five age and sex matched healthy controls. Mean age and sex of patients was 55 ± 11 years, and 55 males/ 20 females, and that of controls 47 ± 15 years, and 16 males/09 females, respectively. Patients were recruited from Bapuji and Chigateri government hospitals, which were brought to emergency room with history of chest pain within last six hours of onset. They were diagnosed to have AMI according to clinical criteria, chest pain which lasted for up to 3 hours, ECG changes (ST elevation of 2mm or more in at least two leads) with elevated cardiac markers. These patients were grouped into group I (n=50) with ECG and cardiac marker proven AMI and group II (n=25) patients with non specific ECG changes without having any rise in cardiac markers (non cardiac chest pain).

Informed consent was obtained from all the sub-

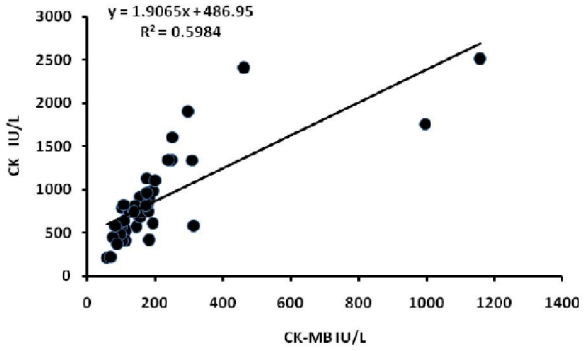

Figure 1 : Correlation between CK-MB and CK in AMI patients 24 hours after admission

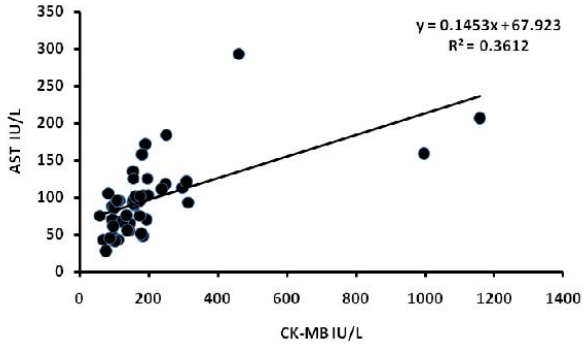

Figure 2 : Correlation between CK-MB and AST in AMI patients 24 hours after admission

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TABLE 1 : Creatinine kinase, CK-MB and AST levels in healthy controls and myocardial infarction patients at admission after 24 hours (Values expressed in mean ± SD)

	Controls (n=25)	Group I(n=50)		Group II(n=25)	
		On admission	After 24 hours	admission	24 hours
CK(U/L)	108±27	427±476**	843±501#	120±32	126±33
CK-MB(U/L)	17±2	106±161**	200±196#	21±3	20±4
AST(U/L)	24±5	55±52**	94±48#	36±5	38±6

**p< 0.001 compared to healthy controls and group II cases on admission. #p<0.001 compared to AMI on admission and group II cases after 24 hours

jects involved and ethical clearance was obtained from institutional ethical clearance committee. Blood samples were drawn into plain vacutainers from the antecubital veins of all patients immediately after admission and 24 hours after admission. Similarly, samples were also obtained from age and sex matched healthy controls. Total CK, CK-MB, and AST levels were measured in all the obtained samples after proper processing.

Reagent kits for CK, CK-MB and AST were obtained from Merck. Cardiac enzymes CK, CK-MB and AST were measured using enzymatic assay using Ciba Corning 550 Express automated analyzer[9-11].

Statistical analysis

The results were expressed as mean ± standard error of mean (SEM). A $p<0.05$ was considered statistically significant. Statistical analysis was performed using the statistical package for social sciences (SPSS-16, Chicago, USA). One way analysis of variance (ANNOVA) was used to compare the mean values in three groups, followed by multiple comparison post hoc tests. Pearson correlation was applied to correlate between the parameters. Sensitivity and specificity were calculated using respective formulas.

RESULTS

We found significant increase in CK, CK-MB, AST ($p< 0.001$) in group I patients compared to healthy controls and group II patients at admission. There was significant increase in CPK, CK-MB, AST ($p< 0.001$) in group I patients, 24 hours after admission compared to group II cases and also group I patients at admission. As depicted in figure 1, CK-MB levels correlated positively with CK ($r=0.601$, $p<0.001$) and AST ($r=0.810$, $p<0.001$) (Figure 2) levels on admission as well as 24 hours after admission. According to our study CK- MB has got sensitivity 84% and specificity of 100%.

TABLE 2 : Cardiac biomarkers and ECG findings at admission

	CK-MB +ve	CK-MB –ve	ECG + ve	ECG –ve
GroupI (n=50)	42	8	50	0
GroupII (n=25)	0	25	25 Nonspecific ECG changes	0

DISCUSSION

In line with previous studies we found significant rise in cardiac enzymes CK, CK-MB, AST in AMI patients immediately after admission compared to controls. After infarction, enzymes originating from the cytosol of myocardial tissue are detected dice to increased activity in the blood[12]. CK-MB being the early marker of myocardial necrosis along with cT, it starts to increase 4-6 hours after injury, reaching peak concentrations after 12-24 hours after ischemic event and returning to baseline after 48-72 hrs[5]. In our study, we have found CK-MB levels were elevated at admission in 84% of ECG proven AMI patients whereas after 24 hours all patients had elevated levels of CK-MB. Out of 75 patients with acute chest pain 33% patients were diagnosed as non cardiac chest pain with help of serial cardiac enzymes measurements at the time of admission and repeat measurement at 24 hours after admission.

We have found, positive correlation between the CK-MB, CK and AST, this probably indicates, CK-MB being isoform of CK, elevation of both these enzymes occurs in tandem. AST being mitochondrial enzyme and gets elevated in AMI and its elevation correlates with extent of myocardial damage.

We have found, CK-MB has got specificity of 100% and sensitivity of 84%. Lott et al summarized diagnostic efficiency of CK-MB from 1973-1980 and found to have average specificity and sensitivity of 96% and 85% respectively. In agreement with Lott et al our findings were also support the diagnostic efficiency of CK-MB in diagnosing AMI[13]. Gupta et al and Basu et al compared the CK-MB versus troponins in Indian population and observed that CK-MB is a more sensitive marker and has better diagnostic efficiency for di-

agnosis of AMI as compared to cT, especially during the initial hours following an episode of AMI. They speculated that there may be difference in amino acid constitution of Indian cardiac troponins in comparison to western population[2,14].

In conclusion our study also suggests CK-MB has got better sensitivity and specificity in diagnosing AMI in Indian population. It has also got advantage over cardiac troponins due to unavailability and higher cost in determining it.

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