Original Article

Biochemistry

Association of BMI with Elevated Values of CK-MB and cTnT in Acute Myocardial Infarction

1. Shazia Rashid 2. Uzma Faryal 3. Iram Fayyaz

1. Asstt. Prof. of Biochemistry, CMH Lahore Medical College, Lahore 2. Asstt. Prof. of Biochemistry, Women Medical College, Abbottabad 3. Assoc. Prof. of Biochemistry, CMH Lahore Medical College, Lahore

ABSTRACT

Objective: To determine the association of BMI with serum levels of cTnT & CK-MB isoenzyme in patients presented to hospital emergency with suspected myocardial infarction and in healthy individuals.

Study Design: Comparative cross sectional study.

Place and Duration of Study: This study was conducted at Post graduate medical institute, Lahore in collaboration with Punjab Institute of Cardiology Lahore from July 2010 to Dec 2010.

Materials and Methods: Serum concentration of CK-MB and Cardiac Troponin T were estimated in 80 patients of AMI (40-60 years of age both sexes) by Immunological UV assay and electrochemiluminescence immunoassay (ECLIA) respectively. 40 healthy controls were matched for age and sex.

Results: Low BMI was observed in patients with both sexes. The values of both CK-MB and cTnT were markedly raised in patients with acute myocardial infarction.

Conclusion: In the present study higher prevalence of risk factors and MI were seen in patients even with BMI < 23 kg/m^2.Therefore recognition and adoption of BMI cutoffs represent a major step forward in redefining the risk stratification among Pakistanis.

Key Words: BMI, CK-MB, cTnT, acute myocardial infarction.

INTRODUCTION

Cardiovascular disease is the leading cause of death worldwide[1]. According to a careful estimates nearly 100,000 individuals suffered from acute myocardial infarction in Pakistan, in 2002[2]. Risk factors for ischemic heart disease include older age, smoking, hypercholesterolemia, diabetes with or without insulin resistance and obesity[3,4,5,6].

Diagnosis of acute myocardial infarction has only recently incorporated the use of biomarkers of cardiac injury[7]. The role of cardiac markers in the diagnosis, risk stratification, and treatment of patients with chest pain has continued to evolve. In most patients, the initial electrocardiogram (ECG) is nondiagnostic. Despite increased vigilance on the part of emergency physicians and high admission rates to exclude acute myocardial infarction (AMI), the rate of missed myocardial infarction (MI) continues to hover at 1.5-2%. Blood testing for biomarkers of myocardial injury plays an increasingly important role for the evaluation and diagnosis of patients with chest pain. The guidelines for the diagnosis of myocardial infarction (MI) have recently changed and prominently incorporate the results of cardiac marker testing in the clinical definition of MI. Creatine kinase-MB (CK-MB), cardiac Troponin T (cTnT), cardiac Troponin I (cTnI), myoglobin, homocysteine and C-reactive protein (CRP) are all used for assessment of the suspected acute myocardial infarction (AMI). CK-MB, cTnT, and cTnI may also be used to identify and manage high-risk patients[8,9,10,11].

In early 1990s the diagnosis of MI depended heavily on the presence of an elevated CK-MB marker. However, the advent of troponin markers markedly increased the sensitivity and specificity for the diagnosis of cardiac injury and for that reason succeeded CK-MB as the gold standard for the diagnosis. A consensus guideline from the American College of Cardiology (ACC) and the European Society of Cardiology (ESC) has redefined AMI(40). According to these bodies, AMI is now defined as a typical rise and fall of biochemical markers (e.g., Troponin, CK-MB), associated with ischemic symptoms, new pathologic Q waves on ECG, ischemic ECG changes(ST-segment elevation or depression),coronary artery intervention or pathologic findings of AMI[12,13].

Patients with elevated cardiac Troponin levels but negative CK-MB who were formerly diagnosed with unstable angina or minor myocardial injury are now reclassified as non–ST-segment elevation MI (NSTEMI) even in the absence of diagnostic ECG changes[14].

CK-MB is both a sensitive and specific marker for myocardial infarction. CK-MB usually becomes abnormal three to four hours after an MI, peaks in 10–24 hours, and returns to normal within 72 hours[15,16, 17].

Cardiac Troponin T (cTnT) is a cardio-specific, highly sensitive marker for myocardial damage. Cardiac Troponin T increases approximately 3-4 hours after acute myocardial infarction (AMI) and may persist up

to two weeks thereafter[18,19]. In contrast to ST-elevation myocardial infarction (STEMI), the diagnosis of non-ST elevation myocardial infarction (NSTEMI) heavily relies on cardiac Troponin T[19]. It is reported that MI is diagnosed when blood levels of cTnT are above the 99th percentile of the reference limit together with evidence of myocardial ischemia[20].

MATERIALS AND METHODS

This Comparative cross sectional study was conducted at Post graduate medical institute, Lahore in collaboration with Punjab Institute of Cardiology Lahore. Troponin T and CK-MB were measured in 80 patients of AMI (40-60 years of age both sexes).40 healthy controls were matched for age and sex. Patients with diabetes mellitus, renal disease or muscle dystrophy were excluded. Serum concentration of CK-MB and Cardiac Troponin T(cTnT) were estimated by Immunological UV assay and electrochemi-luminescence immunoassay (ECLIA) respectively. The data was analyzed using SPSS 17 (Statistical Package For Social Sciences). P-value of <0.05 was considered statistically significant.

RESULTS

Study found that there are two groups of patients of AMI on the basis of raised cardiac markers; i.e. CK-MB and cTnT. In 32 male (group A) and 16 female patients (group A1), the level of cTnT was raised a few hundreds, while in 20 male (group B) and 12 female patients (group B1) cTnT may be raised as much as 2-5 thousands.

Table No.1: Relationship of age, BMI, CK-MB and cTnT in male and female patients of group A and A1 and their controls.

No of cases in parenthesis

Values are expressed as mean±SD

Variables	Male patients (32)	Male controls (24)	Female patients (20)	Female controls (16)
Age (years)	54.41± 9.94	51.29± 2.46	58.00± 6.83	49.44± 4.84
BMI	23.28± 2.07	23.33± 2.46	23.45± 2.54	23.69± 1.96
CK-MB (U/L)	73.34± 54.04**	9.79± 5.24	67.25± 53.91**	10.69± 5.78
cTnT (Pg/ml)	255.95± 162.50**	20.54± 11.10	282.52± 214.95**	21.46± 10.14

****P<0.005 = Highly significant difference**

In group A and A1 the mean age is 54-58 years and duration of chest pain is in a range of 6-7 hours. Their demographic characteristics showed a low BMI, sedentary life style, positive smoking history. Significant rise of serum CK-MB and cTnT are also noted.

In group B and B1, with unusual raised cardiac markers; CK-MB and cTnT, the mean age is more, being, 55-60 years and duration of chest pain is less in a range of 3-4 hours. Their demographic characteristics are similar to the first group. However an unusual rise of serum CK-MB and especially cTnT is noted.

Table No.2: Relationship of age, BMI, CK-MB and cTnT in male and female patients of group B and B1 and their controls.

No of cases in parenthesis

Values are expressed as mean ±SD

Variables	Male patients (16)	Male controls (24)	Female patients (12)	Female controls (16)
Age (years)	55.81± 10.63	51.29± 2.46	60.08± 6.01	49.44± 4.84
BMI	22.69± 2.75	23.33± 2.46	21.75± 3.08	23.69± 1.96
CK-MB (U/L)	130.44± 107.39**	9.79± 5.24	87.67± 59.96**	10.69± 5.78
cTnT (Pg/ml)	2870.06± 2461.43**	20.54± 11.10	2007.25± 1335.23**	21.46± 10.14

**P<0.005 = Highly significant difference.

DISCUSSION

Relationship of age, BMI and life style in male and female patients and their controls was also noted. An inverse relationship between low BMI and sedentary life style was observed. This is well in line with the different studies. These studies observed that the BMI of patients with AMI is < 23 kg/m^2 . [21,22] Their study reported that low BMI was found to be an independent risk factor for MI. This could be explained by the fact that low BMI might have induced endothelial impairment in such populations[23]. However a study found that body mass index of 28.5 or more had a significantly higher incidence of acute myocardial infarction. Study also found that body mass index did not contribute significantly to the risk of acute myocardial infarction in women[24].

Recently it is reported that BMI alone cannot be considered as an independent risk factor, as the study population had low BMI but had one or more modifiable risk factors[25].

CONCLUSION

Higher prevalence of risk factors and MI were seen in patients even with BMI < 23 kg/m^2. These observations clearly support the recent WHO initiatives and its debates, to revise the normal limits of BMI. Hence, it would be advisable to redefine the BMI ≥ 23 kg/m^2 as overweight and BMI ≥ 25 kg/m^2 as obese for Pakistani population. Screening measures for risk factors of MI may be initiated for people with BMI ≥ 21 kg/m^2.

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Address for Corresponding Author:
Dr. Shazia Rashid,
Assistant Professor of Biochemistry,
CMH Lahore Medical College, Lahore.
Email: shazia.rashid9@gmail.com
Contact No: 03233806847