Original Article

Pattern of serum cardiac troponin-I in symptomatic acute myocardial infarction patients in national institute of cardiovascular disease in Bangladesh

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Abstract

Troponin I (cTnI) isoform is cardiac muscle specific protein and shown to have several features as a preferred marker of myocardial injury. It rises early in acute myocardial infarction (AMI) and attains levels that are clearly separated from baseline values. It remains elevated for several days providing a long window for detection of cardiac injury. The objective of the study was to evaluate for the profile of cTnI level among symptomatic AMI patients. The study was conducted at National Institute of Cardiovascular Disease, Dhaka, Bangladesh from July 2007 to June 2008 and total 9552 patients with type 1 or type 2 MI were included. Blood Sample was taken within 3 days of symptoms and cTnI was measured by chemiluminescent immunometric assay method. cTnI was considered positive when the value was >1ng/ml and study population was divided as per age, sex and cTnI level. The mean (+ SD) age of all patients was 55(+ 12.8) years and majority was males (82.20%). Seasonal variation showed highest positive cases in winter. In case of circadian variation positive cTnI results were suggestive of morning peak of AMI. Positive results were obtained in 32.3% of Cases. cTnI is now considered as a better indicator of myocardial injury. Further study in depth is necessary to correlate with clinical symptoms and other diagnostic tests to make a complete profile of AMI according to the latest subtypes.

Key words: Acute myocardial infarction, acute coronary syndrome, cardiac troponin I

Introduction

Cardiovascular disease is a global health problem. Approximately one third of people in the world died of cardiovascular diseases. The greater proportion of deaths is due to coronary heart disease, of which myocardial infarction (MI) is a major manifestation.[1] Myocardial cell death can be recognized by the appearance in the blood of different proteins - myoglobin, cardiac troponin T and I, creatine kinase (CK), lactate dehydrogenase (LDH) and many others.[2] Cardiac specific troponins are useful not only because they come close to fulfilling many of the criteria for an ideal biologic marker, but also because they convey prognostic information and can help frame therapeutic decisions regarding patients with acute coronary syndromes.[3] Troponin, a molecule that binds to thin filament (actin) of striated muscle fibers, acts with intracellular calcium to control the interaction of the thin filament with the thick filament (myosin), thus regulating muscle contraction.[4] Given the nearly absolute specificity of cardiac troponins for myocardial tissue and their high sensitivity for even microscopic zones of myocardial necrosis, the American college of cardiology and European society of cardiology subsequently declared them to be the preferred biologic markers for diagnosing myocardial infarction.[5] They recommended that a single cut off point be chosen such that a myocardial infarction would be diagnosed if as a result of myocardial ischemia, cardiac troponin I or cardiac troponin T was detected at least once within 24 hours after the index clinical event at a level exceeding the 99th percentile of the values measured in a normal control population.[2,5] Clinical studies report several desirable features of cTnI as a marker of myocardial injury. [6, 7]

This study was designed to explore the pattern of cTnI tests in symptomatic AMI patients in NICVD in Bangladesh. All of these patients had criteria, which was attributed to clinical classification of MI and included Type1 (spontaneous MI related to ischemia due to a primary coronary event such as plaque erosion and/or rupture, fissuring or dissection) and Type 2 (MI secondary to ischemia due to either increased oxygen demand or decreased supply, e.g. coronary artery spasm, coronary embolism, arrhythmias, hypertension, or hypotension).[1]

Methods

This cross sectional study was conducted in the department of clinical biochemistry, NICVD, Dhaka, Bangladesh from July 2007 to June 2008. Total 9552 symptomatic AMI patients referred from emergency, indoor & outdoor were included. AMI was classified according to the criteria of expert consensus documents. MI Type 1 and Type 2 with chest pain with no confounding variables were included in this study.

Total study population was divided into two groups according to cTnI level. Biochemically positive- cTnI>1ng/ml (n= 3069) and biochemically negative: cTnI<1ng/ml (n= 6483). Again study population was divided into three groups according to age pattern - group A: age <40 years, group B: age 40- 50 years and group C: age > 50 years.

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Sample was taken from patients 4-6 hours to 24 hours after the onset of symptoms. Special precaution was taken for haemolysed, lipaemic and icteric serum. cTnI was measured quantatively by chemiluminescent immunometric assay (siemens medical solutions diagnostics, USA). The subjects were managed by cardiologists accordingly.

All statistical analyses were done using the SPSS version 12.0 for windows. Experimental values were expressed as percentage, median (range) and mean (SD). Statistical significance was considered to be indicated by a p value of less than 0.05 in all cases.

Results

Patients demography showed that among the 9552 patients, majority were male (82.20%). Patients' mean age was 55 (+12.5) years. A relatively younger patient (< 50 years) represents 42.22 % of all patients (Table-I).

Table-I: Demographic variables (N= 9552)

Parameters		N	Proportion
Sex	Male	7779	81.4%
	Female	1773	18.6%
Age (Years)	< 40	1274	13.34%
	40-50	2759	28.88%
	>50	5519	57.78%
Mean ± SD		55 ± 12.8	

Positive cases per month were 32.2 % on an average. Seasonal variation showed highest positive cases in winter. (Table-II)

Table-II: Monthly pattern of cTnI test

Months	Grouping based on cTnI	
	> 1ng/ml (%)	< 1ng/ml (%)
July'07 (n= 671)	25.78%	74.22 %
August'07 (n= 674)	30.75%	69.25%
September'07 (n= 824)	27.66%	72.34%
October'07 (n= 821)	30.20%	69.80%
November'07 (n = 960)	33.33%	66.67%
December'07 (n = 1044)	37.45%	62.55%
January'08 (n =1003)	32.70%	67.30%
February'08 (n= 331)	48.94%	59.06%
March'08 (n=550)	30.72%	69.28%
April'08 (n =765)	32.67%	67.33%
May'08 (n =841)	30.20%	69.80%
June'08 (n=978)	31.82%	68.18%
Total (N= 9552)	32.20%	67.80%

Average case per days was 26. More sample (43.45%) were received in morning in laboratory but more positive cases were found in the evening shift, that is 40% in day profile (Table-III).

Table-III: Day profile of received samples

Daily variation	Number of (+ ve) cases (%)	Number of (– ve) cases(%)
Morning n=4150 (43.45%)	(35%) n=1453	(65%) n=2697
Evening n=2967 (31.06%)	(40%) n=1187	(60%) n=1780
Night n= 2435 (25.49%)	(25%) n=609	(75%) n=1826

Distribution of cTnI results according to gender showed that more positive cases were found in male than that of female (31.17 % vs 24.76 %) (Table-IV).

Table-IV: Distribution of cTnI in different sex

Sex	cTnI > 1ng/ml	cTnI < 1ng/ml
Male	n = 2612 (31.17%)	n = 5167 (68.83%)
Female	n = 439 (24.67%)	n= 1334 (75.24%)

Study population was divided into three groups - group A : (<40 years), group B : (40-50 years) and group C: (> 50 years). Most cases as well as +ve cases were found in Group C (57.78 %). (Table-V)

Table-V: Distribution of cTnI in different age group (N= 9552)

Age group	cTnI	
	+ve	-ve
group A n = 1274 (13.34%)	n = 357 (28.05%)	n=917 (71.95%)
group B n = 2759 (28.88%)	n = 807 (29.28%)	n=1952 (70.72%)
group C n = 5519 (59.78%)	n = 1905 (34.56%)	n=3614 (65.4 4%)

Group A: < 40 years, Group B: 40-50 year, Group C: > 50 year

Most of the tests was referred from indoor (88.94 %) and indoor cases showed highest positive result (34.38 %).

Discussion

The evolution of the definition of acute myocardial infarction tells a fascinating story of medical progress. Between the publication of the initial World Health organization's classification in 1979,[8] and published by the redefinition committee of the American College of cardiology, American Heart Association, and European Society of cardiology in 2000, much of our diagnostic reasoning changed.[5] Biochemistry now takes centre stage, and the measurement of cardiac troponins has substantially increased diagnostic sensitivity.[9]

This study revealed that the majorities were male and mean age of the patients were around 55 years. This is in agreement with the findings in several early studies[10-13] and trials[14] in USA. The recent COURAGE (clinical outcomes utilizing revascularization and aggressive drug evaluation) Trial[15] in USA shows the mean age of AMI patients was 62+5 years. Another recent study compared the acute coronary syndrome (ACS) between South Asians and Caucasians. It showed that Asian were at least 10 years younger to the Caucasians at the time of presentation of ACS.[15] In Pakistan there is an observation from a study that up to 28 % of the patients belong to the age group of 40-45 years.[16] In a study done in India.[17,18] 20 % of the patients were 40 years or below in age. In this study 42.22% tests were performed in patients of <50 years of age of which 28.86 % tests were biochemicaly positive. Slightly less than half of the symptomatic AMI patients belonged to relatively younger age group (<50 years). The influence of environmental factors on the onset and course of cardiovascular events is not well understood. Studies from European[18,19] and Asian[20-22] countries have observed an increase in death rates from AMI in the winter. It is hypothesized that exposure to winter weather conditions may induce physiologic stress including sympathetic activation, hypercoagulability and infection that increased the incidence or case fatality of AMI.[18] It has also been shown that serum cholesterol, C-reactive protein, blood pressure, fibrinogen, and factor VII activity are all higher in the winter.[23-25] Elevation of these parameters may contribute to an increased tendency toward arterial thrombosis and a higher winter incidence of acute coronary syndromes.[26,27]

In day profile finding of maximum positive cases found in the evening indicates majority AMI occurs in the morning. As in this profile sample was taken after 4-5 hours of the onset of symptoms. The samples received after 12pm, usually delivered report after 2pm that is in the evening shift. A new approach to identification of the triggering mechanisms of acute myocardial infarction has been provided by the observation that the disease occurs more frequently during the morning hours compared to other times of day. This circadian variation results primarily from an increased relative risk during the initial 2-3 hours after awakening and arising. The possible underlying mechanisms responsible for the circadian pattern of myocardial infarction include acute variations of blood pressure, heart rate, platelet aggregability and fibrinolytic activity, leading to an increased risk of plaque rupture and intracoronary thrombosis.[28] The morning peak, which has also been described for nonfatal myocardial infarction and transient myocardial ischemia.[22,29-31]

The use of the cardiac biomarker troponin,, which is considerably more sensitive and specific for heart damage than total CK or its isoform, CK- MB.[10,32] Some confusion over terminology remains. For example, the phrase "troponin leak" is often used to describe cases in which serum troponin levels rise but there is no MI. However, most experts believe that a rise and fall in troponin is due to true myocardial cell death. Troponin is better then CK but not perfect.[33] The limitation of this study is that only one sample per patient had been taken. On the other hand troponin is often elevated in plasma in conditions other than overt ischemic heart disease.[34,35] In this study only symptomatic Type- I and Type-2 AMI patients were included. Biochemical findings were not correlated to ECG, Echo, or angiographic findings. Only by doing cTnI the clinical diagnosis of AMI was not confirmed.

In spite of the limitations highlighted about, it seems still reasonable to draw some conclusion about the profile of cTnI in symptomatic AMI patients in Bangladesh.

From this study it can be concluded that AMI occurs in subjects with the age of around 55 years with male predominance, and also incidence of AMI is more frequent in winter season with morning predilection.

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