TROPONIN I LEVEL AND CARDIAC OUTCOMES IN PATIENTS WITH UNSTABLE ANGINA AND NON-ST-ELEVATED MYOCARDIAL INFARCTION ADMITTED IN NICVD, DHAKA, BANGLADESH

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Abstract:

Context: *Troponin I level is a sensitive serum marker that is closely related to the degree of myocardial damage, provides prognostic information in patients with UA/NSTEMI and can be measured rapidly. The aim of this study was to determine the relationship between troponin I level and different cardiac outcomes in patients with UA/NSTEMI admitted in National Institute of Cardiovascular Disease (NICVD), Dhaka, Bangladesh.*

Methods: *A descriptive longitudinal study was carried out in the Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, from May to October, 2008, to find out the relation between troponin I level and different Cardiac outcomes in patients with UA/NSTEMI.A total of 104 patients were included in this study with the help of inclusion and exclusion criteria. Data were collected on admission and on discharge for outcomes of the patients.*

Results: *During discharge half of the patients had 52(50%) UA and rest half 52(50%)had NSTEMI,15(14.4%)had cardiac arrhythmia, 6(5.8%)had cardiogenic shock,25(24%)had left ventricular failure and death 2(1.9%). Mean troponin I level was 15.5±45.6 ng/ml and 7.1 ±22.6 ng/ml in cardiac arrhythmia present and absent patients respectively. In cardiogenic shock patients had 10.0+10.3 ng/ml and 8.2±27.7 ng/ml in absent patients. In left ventricular failure patients had 19.1 ±39.4 ng/ml and 4.9±20.9 ng/ml in absent patients. In death cases troponinI level was 11.3±1.8 ng/ml and 8.3±27.3 ng/ml in live patients. The mean troponin I level was significantly ($p<0.05$) higher in left ventricular failure patients, but in other outcomes' patients it was higher but not statistically significant ($p > 0.05$).*

Conclusion: *Cardiac Troponin I elevations are associated with an increased adverse cardiac events in patients with UA/NSTEMI. With progressively higher levels of cardiac troponin I, the risk of mortality increases, presumably because the amount of myocardial necrosis increases. The use of cTnI in the immediate triage of patients with unstable angina appears warranted to identify those at greater risk for cardiac events. Elevated levels of this marker provide prognostic information beyond that supplied by the electrocardiogram at presentation.*

Key words*: Unstable angina, Non-ST-Elevated MI,Cardiac outcomes, troponin I, myocardial infarction.*

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Introduction:

'Acute coronary syndrome' (ACS) encompasses MI (STEMI and NSTEMI) and UA[1]. UA/ NSTEMI constitutes a clinical syndrome, that is usually, but not always, caused by atherosclerotic coronary artery disease (CAD) and increased risk of different cardiac outcomes, such as UA, NSTEMI, cardiac arrhythmia, cardiogenic shock, left ventricular failure and cardiac death[1]. UA / NSTEMI is defined by- i. rest angina ii. new onset (less than 2 months) severe angina iii. increasing angina (in

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intensity, duration and / or frequency) iv. ECG-ST-segment depression or prominent T-wave inversion and / or v. positive biomarkers of necrosis (e.g. Troponin) in the absence of ST segment elevation[1,2,3]. The basis of the conventional diagnosis of acute coronary syndrome originated from the consensus of the World Health Organization Agreement. This includes a clinical account of chest pain, ECG representation and serial changes in cardiac enzymes. This statement was further elaborated in the American Heart Association (AHA) Scientific statement (1996), which commented on the use of creatine kinase MB (CK-MB) as the preferred cardiac marker for AMI diagnoses[2,4].

In patients with chest pain at rest but no ST-segment elevation on the ECG, the diagnoses of UA and NSTEMI are usually considered together because they can not be distinguished clinically or angiographically. The discrimination between these conditions is usually made by testing for elevated levels of a serum cardiac marker that indicate myocardial necrosis. UA has no biomarker in circulation; usually transient, if any, ECG changes of ischaemia and NSTEMI has elevated biomarker. It is therefore desirable to identify a serum marker whose release bears a close relation to the degree of myocardial damage. Such a marker should be more sensitive than current markers, should provide prognostic information, and should be measurable in a time frame that permits treatment to minimize further necrosis[2,4].

Since the conventional serum cardiac marker, CK-MB is not an ideal marker because it lacks tissue specificity, has poor stoichiometric correlation with the extent of myocardial damage and is only detectable in the circulation in a relatively short timeframe, there is a need for more sensitive and cardiac specific markers of myocardial necrosis[2,4]. Cardiac troponin I is a regulatory protein which has a high sensitivity and specificity for cardiac injury due to a unique 31 amino acid sequence at its N-terminal end that provides high potential for obtaining cardiac specific antibodies. It is specific for heart muscle and the antibodies used in the immunoassay do not react with other troponins[5-8]. It has a higher discriminator value because of its 13-fold greater concentration in heart muscle then CK-MB[2,6]. It is not present in the healthy people without acute ischaemic syndromes[2,8]. Troponin I is detectable in serum at 4 hours or more post injury and remain elevated for 7 to 10 days[2,8]. The lower level reference positive value for troponin I in serum is not firmly established. This is primarily due to lack of standardization of the procedure for measuring troponin I and limited size of population studied. A positive test value of 0.6 ng/ml is recommended by the manufacturer (Dade-Behring, Deerfield, III). Zaninotto and others determined a positive value of 1.0 ng/ml for the diagnosis of AMI[2,8]. Few studies suggest that increasing level of troponin I indicates more myocardial damage which is associated with poor cardiac outcomes[2-4,9].

In this study, we will find a relationship between troponin I level and different cardiac outcomes in the period of time from admission to discharge. Troponin I level will differentiate NSTEMI from UA which will help to diagnose AMI cases that can not be diagnosed by ECG and to take necessary measures to save the patients as early as possible.

Methods:

A descriptive longitudinal study was carried out in the Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, from May to October, 2008, to find out the relation between troponin I level and different cardiac outcomes in patients with UA/NSTEMI.

A total of 104 patients were included in this study with the help of inclusion and exclusion criteria. Data were collected on admission and again on discharge for outcomes of the patients. Troponin I was done for all the selected patients using the same batch of reagents and same laboratory i.e. Department of Biochemistry, NICVD, Dhaka, by using IMMULITE Automated Immunoassay System. Troponin I level of 1.0 ng/ml had been taken as a reference value. With this reference level 52 patients were diagnosed as unstable angina and 52 patients were diagnosed as NSTEMI. The mean cTnI level was 8.32±27.02 ng/ml, ranged from <0.200 to 180.000 ng/ml. Among the NSTEMI patients most (26.9%) of the patients had cTnI level 1.000-5.000 ng/ml, 12.5% had >5.000-10.000 ng/ml, 1.9% had >10.0000-15.000 ng/ml, 1.0% had >15.000-20.000 ng/ml and 7.7% had >20.000 ng/ml.

Results:

Among the cardiac outcomes 14.4% patients had cardiac arrythmia, 5.8% had cardiogenic shock, 24.0% had left ventricular failure and 1.9% of patients were dead.

Table I

Outcomes of the patients during discharged (n=104)

Outcomes during discharged	Frequency	Percent
UA	52	50.0
NSTEMI	52	50.0
Cardiac arrhythmia	15	14.4
Cardiogenic shock	6	5.8
Left Ventricular failure	25	24.0
Death	2	1.9

In this study, it was found that during discharge, cardiac arrythmia was 3.8% and 25.0% in UA and NSTEMI patients respectively. Cardiogenic shock was 1.9% in UA and 9.6% in NSTEMI patients, left ventricular failure was 5.8% in UA and 42.3% in NSTEMI patients. Death was found 3.8% in NSTEMI patients but not found in UA. Cardiac arrhythmia and left ventricular failure were significantly ($p<0.05$) higher in NSTEMI patients and others were not significant ($p>0.05$) but higher in NSTEMI than UA.

In this study, it was found that the mean cTnI level was 15.5±45.6 ng/ml and 7.1±22.6 ng/ml in having and having no cardiac arrhythmia respectively. In cardiogenic shock patients had cTnI level 10.0±10.3 ng/ml and 8.2±27.7 ng/ml in patients without shock. In LVF patients had cTnI level 17.1±39.4 ng/ml and 4.9 ± 20.9 ng/ml in LVF absent patients. In death cases it was 11.3±1.8 ng/ml and 8.3 ± 27.3 ng/ml in alive patients. The mean troponin I level was significantly ($p<0.05$) higher in LVF patients, and were higher in cardiac arrhythmia, cardiogenic shock and death patients but not statistically significant ($p>0.05$).

Table II

Different types of outcomes in patients with UA and NSTEMI (n=104)

	UA (n=52)		NSTEMI (n=52)		p value
	n	%	n	%	
Cardiac arrhythmia					
Present	2	3.8	13	25.0	[a]0.002[S]
Absent	50	96.2	39	75.0	
Carcinogenic shock					
Present	1	1.9	5	9.6	[b]0.102[NS]
Absent	51	98.1	47	90.4	
Left Ventricular failure					
Present	3	5.8	22	42.3	[a]0.001[S]
Absent	49	94.2	30	57.7	
Death					
yes	0	0.0	2	3.8	[b]0.247[NS]
No	52	100.0	50	96.2	

[a]p value reached from chi-square test
[b]p value reached from fisher exact test
NS=not significant ($p>0.05$)
S= significant ($p<0.05$)
n = number of patients
% = percentage of patients

Table III

Mean Troponin I level of the different outcomes of the patients with UA/NSTEMI (n=104)

	Present Mean±SD	Absent Mean±SD	p value
Cardiac arrhythmia	15.5±45.6	7.1±22.6 8.2±27.7	0.269 [NS]
Cardiogenic shock	10.0±10.3	4.9±20.9	0.873[NS]
Left Ventricular failure	19.1±39.4	8.3±27.3	0.021[S]
Death	11.3±1.8		0.878[NS]

p value reached from unpaired t test
NS=not significant ($p>0.05$)
S= significant ($p<0.05$)

Discussion:

This descriptive study was carried out to determine the relationship between troponin I level and different cardiac outcomes in patients with UA/NSTEMI.

Regarding the Troponin I level it was observed in this study that half (50.0%) of the patients had unstable angina and rest half (50.0%) of the patients had NSTEMI. The mean troponin I level was 8.32±27.02 ng/ml ranged from 0.200-180.000 ng/ml. Among the NSTEMI patient most 26.9% of the patients had troponin I level 1.000-5.000 ng/ml, 12.5% had >5.000-10.000 ng/ml, 1.9% had >10.000-15.000 ng/ml, 1.0% had >15.000 -20.000 ng/ml and 7.7% had >20.000 ng/ml. Almost similar findings observed by Antman et al. (1996)[2]. On the other hand Zairis et al. (2005)[11] mentioned in their study that Cardiac troppnin I, median (25^{th}, 75^{th} percentiie) were 2.9 (1.7, 4.7), which is closer with the present study.

During discharge 14.4% patients had cardiac arrhythmia, 5.8% had cardiogenic shock, 24.0% had left ventricular failure and two patients (1.9%) were dead. Apple et al. (1998)[12] had shown that high peak cTnI level was associated with poor left ventricular function, which is consistent with this study.

In this study it was found during discharge, cardiac arrhythmia was 3.8% and 25.0% in UA and NSTEMI patients respectively. Cardiogenic shock was 1.9% in UA and 9.6% in NSTEMI patients. Left ventricular failure was 5.8% in UA and 42.3% in NSTEMI patients. Death was found 3.8% in NSTEMI patients but not found in UA. Cardiac arrhythmia and Left ventricular failure were significantly ($p<0.05$) higher in NSTEMI patients and others were not significant ($p>0.05$). Morrow et al. (2000)[10] observed angina 57.1% and Myocardial infraction 31.7% and they also found 3.6% death in their study. Heidenreich et al. (2001)[9] observed mortality 5.2% in patients with positive troponin. Winter et al. (1999)[2] observed 8 cardiac death, 3 recurrent AMI and 4 recurrent admission due to unstable angina pectoris among 150 patients, which are comparable with the current study.

In the present study it was found that the mean troponin I level was 15.5+45.6 ng/ml and 7.1±22.6 ng/ml in cardiac arrhythmia present and absent patients respectively. In cardiogenic shock patients had I0.0±10.3ng/ml and 8.2±27.7 ng/ml in absent patients. In left ventricular failure patients had 19.1±39.4 ng/ml and 4.9±20.9 ng/ml in absent patients. In death cases troponin I level was 11.3±1.8 ng/ml and 8.3+27.3 ng/ml in live patients. The mean troponin I level was significantly ($p<0.05$) higher in left ventricular failure patients and were higher in cardiac arrhythmia, Cardiogenic shock and death patients but not statistically significant ($p>0.05$).

Conclusion:

Cardiac Troponin I elevations are associated with an increased adverse cardiac events in patients with UA/NSTEMI. With progressively higher levels of cardiac troponin I, the risk of mortality increases, presumably because the amount of myocardial necrosis increases. The use of cTnI in the immediate triage of patients with unstable angina appears warranted to identify those at greater risk for cardiac events. Elevated levels of this marker provide prognostic information beyond that supplied by the electrocardiogram at presentation.

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