CORRELATION OF CARDIAC TROPONIN IN ACUTE MYOCARDIAL INFARCTION WITH LEFT VENTRICULAR DYSFUNCTION

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ABSTRACT

BACKGROUND

Ventricular function is the best predictor of death after an acute coronary syndrome. It serves as a marker of myocardial damage, provides information on systolic function as well as diagnosis and the prognosis.

The aim of the study is to relate cardiac troponin I with left ventricular dysfunction in acute Myocardial Infarction.

MATERIALS AND METHODS

This was a prospective observational study on 80 patients, aged between 20-80 years who were diagnosed with acute MI. Patient details, detailed history, and clinical features along with investigation report.

RESULTS

Overall, the 80 participants of the study had a mean age of 60 years. 17.5% of the cases were <50 years while the majority (82.5 %) were above 50 years of age. 67.5% were males and 32.5% were females. 59 patients (73.75%) had diabetes mellitus, 44(55%) had hypertension, 33(41.25%) gave history of alcohol consumption and 29 (36.25%) gave history of smoking habits. The mean durations of diabetes mellitus and hypertension in these subjects were 6.42 years and 5.1 years respectively. 78 out of the 80 cases included in the study had HbA1c levels of >6.5% signifying poor glycaemic status. 52 of the subjects (65%) had dyslipidaemia. Advancing age along with prevalence of diabetes mellitus was found to have a strong correlation for developing an acute MI. The mean value of trop I at presentation was 19.47 ng/ml, at 6 hours was 23.36 ng/ml, and at 24 hours was 38.33 ng/ml. The 24-hour mean value of Trop I was significantly higher. Nearly 58% of the patients presented with anterior wall MI and the remaining with inferior wall MI. There was no difference in mean values of Trop I at 6 hours and 24 hours between patients with IWMI or AWMI. Mean value of ejection fraction was 42.45%. There was no statistically significant difference between mean values of LVEF among anterior and inferior wall MI patients. 82.25% of patients with STEMI had LV dysfunction. In our study positive predictive value of trop I was 100.

CONCLUSION

Trop I estimation serves as a simple, inexpensive and easy method of identifying LV dysfunction in MI patients and aids in further assessment and management of patients requiring further intervention.

KEYWORDS

Cardiac Troponin, Acute Myocardial Infarction, Left Ventricular Dysfunction, Dyslipidaemia.

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BACKGROUND

Acute myocardial infarction (ST or non-ST elevation) remains a leading cause of morbidity and mortality worldwide despite considerable improvements in prognosis over the past decade. The prognosis mainly depends on the extent of damage to the myocardium which can be determined non-invasively by electrocardiography, imaging techniques or biochemical and serological tests.[1] These tests are aimed at knowing the extent of myocardial damage and helps predict the prognosis. Among the cardiac enzymes, elevation of cardiac troponin I is fundamental to the diagnosis of an acute myocardial infarction and is now accepted as a reliable biomarker for detecting myocardial damage.[2]

Studies have shown that in acute MI troponin I value closely relates to the infarct size and this further has an inverse correlation with left ventricular ejection fraction (detected by echocardiography).[3] It is also found that cardiac Troponin I has excellent sensitivity and is superior to creatine kinase MB (CK-MB) as an indicator of myocardial

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damage as it is uniquely located in the myocardium and its release closely relates to infarct size as previously mentioned. Troponin I estimation being a relatively inexpensive test can serve as a simple, quick and noninvasive method to identify LV dysfunction in patients with acute MI. Hence this study plans to analyse the relationship between peak troponin I level after MI with left ventricular systolic dysfunction. This can serve as a reasonable and affordable approach to not only diagnose patients with LV dysfunction but also to take them up for further management and intervention. Present study is done to relate cardiac troponin I with left ventricular dysfunction in acute Myocardial Infarction.

MATERIALS AND METHODS

This was a prospective observational study on 80 patients, aged between 20-80 years who were diagnosed with acute MI admitted at Father Muller Medical College Hospital, Mangalore.

Sample size was calculated using the formula:

Sample size N = Z2 p (1-p) /e2
(Where: Z= z score= (Z (1-α/2)) 2 = (1.96)2
1+ (Z2 p(1-p)/e2N) σ =population standard deviation=1
α= confidence interval (5%).
d= precision= 0.3)

Sample size was calculated as 80. The study was carried out over a period of 18 months starting from November 2016. Informed consent was taken from the individuals prior to including them in the study. Patient details, detailed history, clinical features along with investigation report were documented in a preformatted sheet.

Inclusion Criteria

Patients admitted with diagnosis of acute coronary syndrome belonging to age group 20-80 years.

Exclusion Criteria

Patients with history of MI in the past, Valvular heart diseases and congenital heart diseases.

Standard demographic data (age, gender, date and time of admission), presence of co-morbidities (diabetes mellitus, hypertension, dyslipidaemia) and substance abuse (alcohol intake and smoking), thorough clinical examination findings, assessment of troponin I level and echocardiographic findings were entered in the preformed data sheet.

Echocardiography

Left ventricular ejection fraction was assessed by modified Simpson's method from apical two chamber and four chamber values. Two chamber view by 2D echocardiography was obtained using GE echocardiography machine with patient lying in the left lateral decubitus position and supine position by Philips DXI. The findings were analysed and correlated.

Collected data was analysed by frequency, percentage, mean, standard deviation, Karl- Pearson correlation coefficient, t-test and chi-square test using SPSS 21.0 for Windows.

RESULTS

Overall, the 80 participants of the study had a mean age of 60 years, mean HbA1c of 8.9% and mean duration of diabetes of 6.4 years.

Demographic Categories	Characteristics	Male	Female	Total (%)
Age Group	40 and below	3	0	3
	41 – 50	10	1	11
	51 – 60	18	10	28
	61 – 70	16	9	25
	Above 70	7	6	13
Total		**54**	**26**	**80**
Prevalence of Diabetes and hypertension				
Diabetes mellitus		38	21	59(73.75%)
Hypertension		28	16	44(55%)
Alcohol intake		33	0	33(41.25%)
Smoking history		29	0	29(36.25%)

Table 1. Distribution of Patients by Age and Sex

17.5% of the cases were <50 years while the majority (82.5 %) were above 50 years of age.

Out of these 67.5% were males and the remaining 32.5% were females.

The patients presenting with MI were assessed for their medical history and it was found that 59 (73.75%) had Diabetes mellitus, 44(55%) had hypertension, 33(41.25%) admitted alcohol consumption and 29 (36.25%) gave history of smoking habits.

Risk factor		Male	Female	Total	X2	P value
Diabetes mellitus	Present	38	21	59	0.98	0.322
	Absent	16	5	21		
Duration of DM	0-5 yrs.	34	14	48	0.607	0.435
	>5 yrs.	20	12	32		
Hypertension	Present	28	16	44	0.665	0.414
	Absent	26	10	36		
Duration of HTN	0-5 yrs.	39	16	55	0.932	0.334
	>5 yrs.	15	10	25		
Smoking history	Present	29	0	29	18.61	0.00001
	Absent	25	26	51		
Dyslipidaemia	Present	34	18	52	0.303	0.581
	Absent	20	8	28		
HbA1c levels	<6.5%	2	0	2	17.05	p<0.0001
	>6.5%	52	26	78		

Table 2. Correlation of Risk Factors for MI with Gender of Cases

The mean duration of Diabetes mellitus and hypertension in these subjects were 6.42 years and 5.1 years respectively.

78 out of the 80 cases included in the study had HbA1c levels of >6.5% signifying poor glycemic status. Dyslipidemia was assessed using criteria of

Triglycerides>150 mg/dL, HDL<40 mg/dL in males and <50 mg/dL in females, or LDL of >100 mg/dL. Based on these values it was found that 52 of the subjects (65%) had dyslipidemia.

Among diabetic and nondiabetic patients. Advancing age along with prevalence of diabetes mellitus was found to have a strong correlation for developing an acute MI. (p<0.0001). The mean HbA1c level was found to be 8.9% and higher values were found in 78 out of 80 cases.

	AWMI (n=46)	IWMI (n=34)	P Value
Age	59.02	61.62	0.996
HbA1c	8.87	8.94	0.344
CKMB	54.11	47.42	0.912
Trop I (At presentation)	21.7	16.61	0.633
Trop I (at 6 hours)	23.77	22.84	0.874
Trop I (at 24 hours)	39.68	36.60	0.457
RBS	281.73	257.25	0.474
FBS	204.24	195.11	0.34
Total Cholesterol	212.02	210.28	0.934
S. HDL	40.82	41.17	0.855
S. LDL	144.42	130.08	0.756
S. Triglycerides	158.84	160.77	0.356

Table 3. Comparison of Parameters (Mean Values) in AWMI and IWMI

Nearly 46(58%) of the patients presented with anterior wall MI and the remaining with inferior wall 34(42%) MI. The mean value of trop I at presentation was 19.47 ng/ml, at 6 hours was 2.36 ng/ml, and at 24 hours was 38.33 ng/ml. The 24 hour mean value of Trop I was significantly higher. (p<0.001). There was no difference in mean values of Trop I at 6 hours and 24 hours between patients with IWMI or AWMI.

	AWMI	IWMI	P value
LVEF	42.28	42.65	0.389
LVESD	29.28	31.34	0.632
LVEDD	41.37	43.8	0.134

Table 4. Comparison of Left Ventricular Parameters in AWMI and IWMI

Mean value of ejection fraction was 42.45%. There was no statistically significant difference between mean values of LVEF among anterior and inferior wall MI patients.

Ejection Fraction	N (%)	Trop I (ng/ml)
<50%	65(81.25%)	42.51
>50%	15(18.75%)	20.24

Table 5. Mean Trop I Levels (24 hrs.) in Relation to Ejection Fraction

81.25% of patients with STEMI had LV dysfunction. The Troponin I levels were high among patients with LVEF <50%. This difference was found to be statistically significant with p<0.001. The mean value of Trop I was found to increase as EF was decreasing. Thus, the mean values of Troponin I were seen to be much higher in patients in whom EF was less than 50%.

Cardiac Enzyme	Pearson Correlation	P value
Trop I at 6 hours	-0.612	0.02
Trop I at 24 hours	-0.571	0.013

Table 6. Correlation of Trop I and Ejection Fraction

The Pearson's correlation coefficient was found to be 0.02 and 0.013 which is significant at 6 hours and 24 hours respectively. Positive predictive value of trop I was 100%.

DISCUSSION

Cardiac Troponin I is a very reliable biomarker for detection of myocardial damage. Previous studies have indicated that Trop I is directly related to myocardial tissue damage and hence inversely related to the left ventricular ejection fraction. Literature shows that in patients with STEMI in whom ejection fraction is reduced, Trop I can serve as a good and reliable indicator of LV dysfunction. However, the relation between these parameters has been rarely studied in the past. Therefore, in our study we assessed the Left ventricular ejection fraction and Trop I levels in patients with ST segment elevation.

Overall, the 80 participants of the study had a mean age of 60 years. 17.5% of the cases were <50 years while the majority (82.5 %) were above 50 years of age. Out of these 67.5% were males and the remaining 32.5% were females. Mean HbA1c among the subjects was 8.9% and mean duration of diabetes 6.4 years, indicating poor glycemic control as a contributory factor for development of MI. The no. of male patients presenting with chest pain were more than female and M:F ratio was 2:1. In similar study Ahmad MI et al[4] and Vincet et al, this observation was in consonance with the fact that the incidence of myocardial infarction is more in male than in the female and there are certain risk factors which are more commonly seen in males (smoking, alcohol intake).

The risk factors such as Diabetes mellitus, hypertension, history of alcohol consumption and smoking habits were found to be higher in the male subjects of our study and hence STEMI may be linked to these risk factors. The most common risk factor was dyslipidaemia and this finding has been substantiated by Bodi V et al and Somani D et al in the past.[5,6] Advancing age along with prevalence of Diabetes mellitus was found to have a strong correlation for developing an acute MI (p<0.001), similar observation was reported by Deepak et al. (54%) in his study. HTN were observed in 25% of STEMI Patients in the present study; however Deepak et al. found slightly higher percentage at 32%.[5]

Troponin I

The 24-hour mean value of Trop I was significantly higher

than that estimated at presentation. Mean trop I at presentation was 19.47 ng/ml and at 6 hours was 23.36 ng/ml. When these values were correlated with LVEF and left ventricular dysfunction there was found to be a strong negative correlation i.e. the mean value of Trop I was found to increase as EF was decreasing. Thus, the positive predictive value of Trop I was found to be 100% in our study which is similar to the finding by Somani et al and Bodi V et al where it was 100% and 84% respectively.[5,6]

The mean values of Troponin I were seen to be much higher in patients in whom EF was less than 50% and this difference was found to be statistically significant with $p<0.001$.

Myocardial Infarction

Nearly 58% of the patients presented with anterior wall MI and the remaining with inferior wall MI. However, no significant differences were noted among the two types of MI in any of the parameters such as mean values of Trop I at 6 hours and 24 hours, age, HbA1c, RBS, FBS or Serum cholesterol levels (TC, S.LDL, S.HDL, S.TAG). The only difference noted between the two groups was in terms of values of LVESD and LVEDD, which were lower in the IWMI group. But this difference was not statistically significant.

LV Dysfunction

In our study 82.25% of patients with STEMI had LV dysfunction. This value was higher compared to Bodi V et al (33.3%) and Somani et al (48%) 82.25% of patients with STEMI had LV dysfunction.[5,6]

Ejection Fraction

Mean value of ejection fraction was 42.45%. There was no statistically significant difference between mean values of LVEF among anterior and inferior wall MI patients.

cTnI has practical advantages over other markers in the assessment of left ventricular ejection fraction. After acute infarction, cTnI has a peak value at 12 hours from the onset of pain. The plateau phase of cTnI, however, lasts upto 48 hours, and represents an integrated estimate of myocyte necrosis.[7,8] The peak value will therefore be missed in samples taken 12-48 hours after admission, but there is a large time window. This makes repeated sampling unnecessary, and represents a cost and time-effective method of diagnosis and quantification (Figures 2 and 3). This is in contrast to creatine kinase-MB or myoglobin, for which multiple measurements are required to identify the peak value and whose values are affected by thrombolysis.[9,10] This marker offers a simple, inexpensive, quick noninvasive method of identifying such patients. Estimation of troponin I can also be used to identify those patients who may benefit from other treatments, for example, ACE inhibitors.

CONCLUSION

Based on the findings of our study, it is clear that Trop I is a simple, reliable, quick and less expensive test to identify left ventricular dysfunction among MI patients. The release of Trop I in the body closely correlates with the size of myocardial infarct and can thus reliably predict LV dysfunction among STEMI patients. Trop I thus has a practical advantage over other biochemical markers in assessment of myocardial infarction as it peaks around 12 hours after onset of chest pain and maintains a plateau phase upto 24-48 hours and it does not require multiple sampling as verified in our study.

Thus, Trop I estimation serves as a simple, inexpensive and easy method of identifying LV dysfunction in MI patients and aids in further assessment and management of patients requiring further intervention.

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