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Original Research Article

Sensitivity and specificity of cardiac troponin-T in diagnosis of acute myocardial infarction

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ABSTRACT

Background: Myocardial Infarction is the irreversible necrosis of the heart muscle secondary to prolong lack of oxygen supply. Troponin T is a structurally bound protein found in striated muscle cells. They have rapidly attained central role in diagnosis, prognostication and planning of therapeutic strategies in MI patients. The objective of this study was to evaluate the status of Troponin T in MI patients and its role in diagnosis compare to normal subjects.
Methods: The study was conducted at M. L .N. Medical College, Allahabad, Uttar Pradesh India. A total of 136 cases were included in our study. Out of these, 86 were patients of AMI and 50 were healthy controls. They were evaluated by measurement of various parameters including enzymatic markers such as CPK-MB, SGOT, LDH1, and LDH2 and non-enzymatic markers such as troponin-T and myoglobin. Apart from these, LDL, VLDL and HDL levels were also kept under evaluation.
Results: Troponin-T test was better than CPK-MB or SGOT in diagnosing myocardial infarction. In our study, sensitivity (67.3%) and specificity (73.8%) of troponin-T test was higher than CPK-MB (56.2% and 45.7%) and SGOT (34.2% and 58.3%) respectively. Troponin-T test was better than CPK-MB or SGOT after 2 hours of onset of myocardial infarction. Troponin- T and I: both kind of evaluations are available and are well evaluated. However troponin T estimation is more standardized and thus more popular. The positivity of troponin-T test also varied with area of infarct.
Conclusions: High LDL and VLDL were seen while at the same time HDL level was lowered. An Increase in the level of myoglobin (non-specific marker), Cardiac troponin I and T and among the enzymatic markers elevated levels of CPK-MB, LDH and SGOT were observed in patients of MI against the normal subjects. In case of LDH both LDH 1 and LDH 2 were observed and a flipped pattern was noted. Bedside troponin-T test is highly sensitive and specific in the diagnosis of acute myocardial infarction and can be used in emergency and ambulatory settings. Qualitative troponin-T test is reliable above serum level of ≥ 0.10 ng/ml.

Keywords: MI, TnT, CPK-MB, LDH

INTRODUCTION

Coronary artery disease is the commonest of the cardiac diseases leading to myocardial infarction, angina, sudden death, and many other complications. The complications after acute myocardial infarction are maximum in the first few hours and decrease with passage of time. Therefore, early diagnosis is important. During initial crucial period the diagnostic modalities are: ECG, which even if normal does not rule out myocardial infarction; other modalities being CPK-MB, SGOT, LDH, myoglobin (Mb), and troponin-T test. During initial period (up to 8 hours.), ECG may be nearly normal in cases of acute myocardial infarction at times. During this period, troponin-T test is

important since it usually becomes positive after 4 hours. At this time sensitivity and specificity of Troponin-T test are 100% and 86% respectively for detection of myocardial infarction.[1]

Considerable efforts have been made in recent years to improve the specificity and sensitivity of methods for diagnosing acute MI. Myoglobin is an early and sensitive marker of cardiac cell damage but lacks specificity.[2] The use of LDH isoenzyme 1 improves specificity in diagnosing AMI; however, these isoenzymes are not restricted to cardiac muscle tissue, and increases in their serum concentrations have been observed in non-cardiac conditions.[3] The contractile and regulatory proteins of the myocardium provide a useful diagnostic tool. Troponin-T (TnT) is part of the troponin complex in striated muscles, where it binds the troponin complex to tropomyosin. Although heart muscles and skeletal muscles both contain TnT, the amino acid sequence of the protein in the two types of muscle differs making it possible to raise antisera against cardiac-specific TnT.[4,5]

METHODS

Subjects were selected from those attending the medical outpatient department of S. R. N. Hospital, M. L. N. Medical College Allahabad Uttar Pradesh. A total of 136 patients of suspected myocardial infarction presented within 24 hours of onset of symptoms were enrolled. Out of these, 86 were acute myocardial infarction patients and 50 were healthy controls. After taking detailed history and performing a thorough clinical examination, patients were subjected to ECG, CPK-MB, SGOT and troponin-T test. A written informed consent was obtained from the patients. Approval for conducting the study was obtained from the institutional ethics committee of M. L. N. Medical College, Allahabad Uttar, Pradseh, India.

The patients were further evaluated by the measurement of low density lipoprotein (LDL), very low density lipoprotein (VLDL), high density lipoprotein (HDL), CPK-MB (creatine phosphokinase MB), LDH1 (Lactate Dehydrogenase 1), LDH2 (lactate dehydrogenase 2), and SGOT (serum glutamate oxaloacetate transaminase). The data was entered and analyze into Statistical packages for social science (SPSS version 22.0). Mean and standard deviation were analyzed for quantitative variables like LDL, VLDL, HDL, LDH1, LDH2, CPK-MB, SGOT, troponin-T. Independent sample t-test was used to compare mean of all the quantitative variables between the two groups of patients were considered significant.

RESULTS

The study included 86 patients of Acute MI and 50 healthy controls. The average age of the patients was 51±6 years (Ranging from 34 to 75). Comparison of serum biochemical marker between MI patients and healthy groups is presented in table 1, 2 and 3. The values of all these biochemical study parameters except HDL were elevated in acute MI patients as compared to healthy control group and the differences were found to be statistically significant. Only HDL was negatively correlated with acute myocardial infarction. Troponin-T and other serum biochemical parameters such as CPK-MB, LDL, VLDL and LDH were positively correlated with acute MI. In the present study, the sensitivity and specificity of troponin-T test was highest in comparison to CPK-MB and SGOT in the diagnosis of acute myocardial infarction (Table 1).

Table 1: Sensitivity and specificity of troponin-T, CPK-MB, and SGOT in the diagnosis of myocardial infarction.

	Troponin-T test	CPK-MB	SGOT
Sensitivity	67.3%	56.2%	34.2%
Specificity	73.8%	45.7%	58.3%

When we compared troponin-T test positivity in relation to CPK-MB, it was noted that positivity of CPK-MB was higher only during initial 0-2 hours after the onset of myocardial infarction. Thus troponin-T test was slightly inferior to CPK-MB in the diagnosis of acute myocardial infarction in first two hours after onset of myocardial infarction (28% positivity in comparison to 48%) (Table 2).

Table 2: Troponin-T, CPK-MB, and SGOT positivity in relation to time from the onset of myocardial infarction.

Time	Troponin-T	CPK-MB	SGOT
0-2 hours	28%	48%	28%
2-4 hours	63%	49%	17%
4-6 hours	100%	60%	60%
6-8 hours	65%	65%	39%
8-10 hours	76%	71%	50%
10-12 hours	100%	73%	43%
>12 hours	100%	100%	100%

Table 3: HDL, LDL, VLDL, LDH1 and LDH2 levels.

Study variables	Healthy control subjects n = 50	Acute MI Subjects n = 86	t-Values
HDL (mg/dl)	48.45±6.14	34.27±7.02	3.287**
LDL (mg/dl)	114.1±20.20	158.7±39.3	7.364**
VLDL (mg/dl)	28.58±4.09	45.89±11.3	2.135*
LDH1(U/L)	46.7±0.60	81.3±0.29	6.842**
LDH2(U/L)	78.9±0.56	76.5±0.30	1.052^{NS}

* Significant at P<0.01, ** significant at P<0.001, NS Not Significant.

In the current study, level of VLDL, LDL and LDH were elevated and a flipped pattern is seen in case of LDH (LDH1:LDH2 = 1.06) in MI patients as compare to

healthy subjects (0.59). While the HDL level were lowered (Table 3).

DISCUSSION

ECG diagnosis of myocardial infarction may not be evident during initials hours at all the times and it is always essential to diagnose myocardial infarction earlier for timely therapeutic intervention. CPK-MB appears in blood early but its sensitivity is lower than troponin-T test during early hours and troponin-T test is a better method to detect myocardial infarction earlier.[6]

In this study sensitivity (64.7%) and specificity (71.4%) of troponin-T test was higher in comparison with the other enzymes like CPK-MB and SGOT (Table-1). The sensitivity of troponin-T test was found to be 100% in the studies done by Francois and Katus.[1,7] While the specificities in those studies were 86% and 78% respectively, even the higher specificity of troponin-T test of 91.9% were reported by Apple.[8] In this study we found that, level of VLDL, LDL and LDH were elevated in acute MI patients and whereas HDL lower in these patients as compare to healthy control and the results were statistically significant. The sensitivity of troponin-T test was 100% after 10 hours of myocardial infarction but before 10 hours it ranges from 27-75% with the exception of peak at 4-6 hours. While CPK-MB sensitivity is lower than troponin-T test sensitivity except in early 0-2 hours (Table 2).

Thus, CPK-MB showed better results in first 2 hours, after which troponin-T test was better than CPK-MB or SGOT upto 10-12 hours and after 12 hours all the tests showed 100% positivity; whereas Smita et al found peak positivity of CPK-MB at 18 hours and of SGOT at 24 hours after the onset of myocardial infarction.[9] Thus, troponin-T test was better than CPK-MB during the crucial 1-6 hours since this is the time when the active therapeutic intervention can be planned.[10] Qualitative troponin-T positivity occurs when levels of serum cardiac troponin-T $\geq$ 0.10 ng/ml, as compared to quantitative troponin-T which may have concordance of 92%.[11] Results of this study indicate that cardiac troponin-T today offer clinicians a valuable tool for diagnosis of myocardial infarction with their relatively high sensitivity and specificity.

CONCLUSION

This study concludes, Cardiac troponin-T have assumed important role in risk stratification of patients presenting in emergency room with acute chest pain. In the last fifteen years we have gained confidence in their clinical utility as markers of myocardial necrosis which is generally due to ischemia. They are more sensitive and specific than conventional markers like SGOT, CK-MB and LDH. Both quantitative and qualitative assays are available. Accurate diagnosis of acute MI would facilitate the choice of appropriate therapy and the degree of care, resulting in more efficient and economic use of the critical care facility.

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