SHORT COMMUNICATION

CAN RAPID TROPONIN T BE USED AS A SINGLE RELIABLE TEST IN THE DIAGNOSIS OF ACUTE MYOCARDIAL INFARCTION?

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Abstract

Introduction: Myocardial infarction (MI), a common cause of mortality and morbidity, needs early and reliable diagnosis. We determined the validity of rapid troponin T (rTropT) in the diagnosis of MI in our local population to know if it can be used as a single diagnostic test.

Method: This was a case control study conducted in patients admitted to ICU/CCU/medical ward in a teaching hospital towards north of Pakistan over a period of six months. Fifty patients were included in study group and 50 in control group, depending on the presence or absence of MI respectively. Patients in control group were age and sex matched. WHO criteria was used for the diagnosis of acute MI. Rapid TropT was performed in study group after establishing the diagnosis of MI and in control group after excluding the diagnosis of acute MI. CK, SGOT, LDH and rTropT were done by Humazyn M test kit Germany, Granutest Merck Germany, monokinetic method and Boehringer Mannheim Germany respectively.

Results: In the study group, 34 (68%) patients were male. Age range was 55-65 years. Overall sensitivity, specificity, positive predictive value and negative predictive value of Rapid troponin T were 92% (CI 80.8-97.8), 100% (CI 92.89-100.0), 100% and 92.6% (CI 83.0-96.9) respectively.

Conclusion. Rapid trop T was a reliable marker for the diagnosis of MI in our patients over a prolonged window period of 7 days after MI. So it can be used as a single diagnostic test in our local population avoiding the need to do many other tests.

Key words: Myocardial infarction, Sensitivity and specificity, Troponin T

Introduction

Early diagnosis of MI may reduce the subsequent complications like cardiac remodeling and failure. [1] In spite of World Health Organization (WHO) criteria for early diagnosis of MI, its diagnosis may be difficult.[2] It may be painless especially in diabetics.[3] Release of cardiac enzymes may be delayed, and they may be raised in patients without MI. This led to the search for new biochemical markers for the Diagnosis of MI. Cardiac troponin T (c trop-T) and troponin I were two such markers, which are components of troponin-tropomyosin complex.[4]

After MI, troponin T is released in two peaks. Early peak on day one is due to release of cytosolic form and a second peak after 3-4 days is due to breakdown of structural part of trop T. The later persists in the blood for longer duration prolonging the window period for detection of MI. [5,6] In April 2000, the Joint European Society of Cardiology/ American College of Cardiology Committee (ESC/ACC) proposed that cardiac troponins may be used as the most sensitive and specific markers of acute MI and they redefined the criteria for its diagnosis. [2,7]

Troponins are most sensitive and specific markers of myocardial injury and provide important information about prognosis, risk stratification and therapeutic planning of patients with acute coronary syndromes.[8,9] In 1990, katus HA et al developed a quantitative enzyme immunoassay for cardiac troponin T, now available as a commercial kit by the name of 'enzymun test system' Boehringer-Mannheim.[10]

According to Mair J et al, sensitivity of cTrop-T for acute MI was 100% at 10 to 120 hours after onset of symptoms and 86% on seventh day while specificity was 96%.[11] In normal people there was a rise in creatine kinase and myoglobin after exercise but cTrop-T remained normal.[12] In a study by Uji Y et al, a rise of 7 to 10 fold in cTrop-T was observed with acute MI within 6 hours after chest pain. Levels remained elevated for 14 to 20 days. Sensitivity and specificity in acute MI was 100% and 92% respectively. [13]

Most of the people in our local population are poor and cannot do multiple tests because of their high cost. If there is a test with high sensitivity and specificity in the diagnosis of acute MI, it can be used as a single, sole investigation for this purpose decreasing the cost and financial burden on the patient. Hence, we tried to get the answer by determining the validity of rTrop t in the diagnosis of MI in our local patients within 8 hours to 7 days after onset of chest pain.

Materials and Methods

This was a case control study conducted at District Headquarter Teaching Hospital Abbottabad, Pakistan. Both male and female patients were selected from coronary care unit/intensive care unit (CCU/ICU) and medical ward. Informed consent was taken from the participants. We made two groups of participants, study group and control group. Study group contained fifty patients with confirmed diagnosis of MI. Control group also contained 50 age and sex matched patients from medical ward. They were not suffering from ischaemic heart disease (IHD).

In study group, diagnosis of MI was established according to WHO criteria (history, ECG changes and cardiac enzymes CK, SGOT and LDH).[2] After the diagnosis of acute MI, rapid Trop-T was done. Time after MI to perform rapid Top-T was noted and it ranged between 8 hours to 7 days. In control group rapid Trop-t was done after excluding MI as per WHO criteria.

Rapid Troponin-T was done using a kit from Boehringer Mannheim Germany based on the principle of Troponin T rapid immunoassay. Humazyn M test kit, Germany and Granutest, Merck, Germany were used for the estimation of creatine kinase and SGOT respectively. Monokinetic method was used for the estimation of LDH. The collected data was analyzed by calculating various proportions using simple mathematics. Sensitivity, specificity, positive predictive value and negative predictive value

were calculated using free statistical calculator, Medcalc easy, taking into account standard formulae.[14]

Results

In the study group, there were 50 patients with MI. Majority of them were males (n=34) and age range was 55-65 years. Among these, 40 had Q wave MI, six had non-Q wave MI while the four patients had left bundle branch block on ECG. Details of Trop-T results in them are shown in table 1.

Group B i.e. control group also contained 50 patients who were age and sex matched with study group. In study group, Trop-T was positive in 46 (92%) and negative in 4 (8%) patients. In control group, Trop-T was negative in all the 50 subjects. (Table 1)

Overall sensitivity, specificity, positive predictive value and negative predictive value for rapid trop T are shown in Table 2.

Sensitivity, specificity and other indices of rTrop-T, determined at different time intervals after the onset of ischaemic symptoms, are shown in Table 3. In 13 patients with acute MI, rapid Trop-T was done during 8-48 hours after chest pain and it was positive in 12 of them and negative in only one. In corresponding control group all thirteen were negative for trop-T. Therefore, the sensitivity in this group was 92.3% and specificity 100%. Similar parameters were calculated for time intervals 49-96 hours and 97-168 hours after chest pain and results are shown in Table 3.

Discussion

Early and accurate diagnosis of MI is important. High sensitivity and specificity of rTrop T in our study indicated that it could be used as reliable marker for the diagnosis of acute MI in our patients. Moreover, it remained sensitive and specific over a prolonged period after MI, which is useful in those who present late after the event. High sensitivity of rTropT in our study, over an extended period of time (8 hours to one week) was also observed in other studies worldwide. Ebell MH et al, in a systematic review, concluded that sensitivity of Trop T increased from 10 to 45% within first hour to more than 95% at 8 or >8 hours after the onset of chest pain.[15] These results showed that sensitivity of Trop T might be low in first few hours (less than 8 hours) after acute MI. Hence, we may need more sensitive biomarkers during this time interval so that the critical diagnosis of MI is not missed. In a study by Haltern G et al, sensitivity of Troponin-T was 42% in first four hours. Measurement of human heart-type fatty acid binding protein (H-FABP) with TropT in first 4 hours, improved the sensitivity and negative predictive value for acute MI.[16] In another study, sensitivity of cardiac Trop T was lower (38%) than H-FABP (95%) within first 6 hours. However, it was higher than H-FABP between 6-24 hours (100% versus 91%) and at 24 hours (91% versus 27.3%).[17]A study by Nagahara D et al showed higher specificity but lesser sensitivity of cTrop T compared to H-FABP and myoglobin (new cardiac markers) in the early detection of acute coronary syndromes.[18] A study by Figiel Ł et al showed sensitivity of 64.9% and specificity of 100% for cardiac Trop T after non-ST elevation acute coronary syndrome, when done early at admission.[19]

The greater sensitivity of the marker at the onset of chest pain for detection of acute MI is highly desired. Newly developed high sensitivity cardiac Trop T assay was found to be highly sensitive in first 2 hours after MI and it was recommended that it should be repeated 4-6 hours after the onset of the symptoms.[20]

Our results showed that early sensitivity of rTropT (8-48 hours) was high (92%). Its positive predictive value was 100% and negative predictive value was also high. So it can be used reliably for early diagnosis of MI which is useful in the management and prevention of

complications. The long diagnostic window of Trop-T is helpful in detecting acute MI when patients present late. In this situation CK, CK-MB and other cardiac enzymes may return to baseline and ECG changes may not be helpful.

In our study, rTropT was positive in all the cases who suffered from MI except four. In one case, it was done between 8 to 48 hours after chest pain. In the remaining three cases, it was performed after 48 hours. No good reason can be given to explain the false negative results.

Conclusion

Rapid TropT was a sensitive and specific marker for the diagnosis of acute MI in our local patients over a prolonged window period of 7 days after MI. Hence, it can be used as a single reliable test in acute MI in our local population obviating the need to do other tests like cardiac enzymes. It is useful in our set up where people are poor and cannot afford multiple tests. Its prolonged diagnostic window provides advantage in our population where people may not seek early medical advice after an attack of MI.

Table 1. Number of patients in different groups and subgroups, showing results of rapid cTrop T

Study group	Number	Trop-T	
		Positive	Negative
A: Acute MI			
1. Q wave Myocardial infarction	40	38	2
2. Non Q wave Myocardial infarction	6	4	2
3. Patients with left bundle branch block	4	4	0
Total	**50**	**46**	**4**
B: Control			
Total	**50**	**0**	**50**

Table 2. Various parameters of validity for rapid Trop T

Parameter	rTrop T %(Confidence Interval)
Sensitivity	92 (80.8-97.8)
Specificity	100 (92.89-100.0)
Positive predictive value	100 .0
Negative predictive value	92.6 (83.0-96.9)

Table 3: Sensitivity, specificity and other indices for rapid Trop T at various time intervals after onset of ischaemic symptoms.

Rapid Trop-T	**Time from onset of chest pain to test performance**					
	8-48 hours		**49-96 hours**		**97-168 hours**	
	MI	***Control***	***MI***	***Control***	***MI***	***Control***
Positive (n)	12	0	14	0	20	**0**
Negative (n)	1	13	2	16	1	**21**
Sensitivity %(CI)	92.3 (63.9-99.8)		87.5 (61.6-98.4)		**95.2 (76.2-99.9)**	
Specificity %(CI)	100.0 (75.3-100.0)		100.0 (79.4-100.0)		**100.0 (83.8-100.0)**	
Positive predictive value %(CI)	100.0		100.0		**100.0**	
Negative predictive value %(CI)	**92.9 (66.4-99.9)**		**88.9 (68.6-96.6)**		**95.4 (75.6-99.3)**	

CI: Confidence interval; MI: Acute myocardial infarction; n: Number of patients

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