Value of Troponin-T Test in the Diagnosis of Acute Myocardial Infarction

Rajesh Baheti*, Purnima Laddha**, RS Gehlot***

Abstract

Objective
Early diagnosis of myocardial infarction is crucial in planning the treatment modalities like thrombolytic therapy, coronary artery bypass graft, and for other therapeutic interventions, which if instituted in time reduce the morbidity and mortality considerably. The early diagnosis can be made possible by the use of bedside serum troponin-T test analysis.

Methods
The study was conducted at Dr. SN Medical College and associated group of Hospitals in 156 patients of acute myocardial infarction reaching within 24 hours of onset of symptoms. Patients after taking detailed history and clinical examination, were subjected to ECG, CPK-MB, SGOT and troponin-T test (Boehringer Mannheim, Germany). Serial ECG changes were considered as gold standard for the diagnosis of myocardial infarction.

Results
Troponin-T test was better than CPK-MB or SGOT in diagnosing myocardial infarction. In our study, sensitivity (64.7%) and specificity (71.4%) of troponin-T test was higher than CPK-MB (54.9% and 42.8%) and SGOT (31.3% and 57.0%) respectively. Troponin-T test was better than CPK-MB or SGOT after 2 hours of onset of myocardial infarction. The positivity of troponin-T test also varied with area of infarct. Positivity with anterior infarct (84%) was maximum in contrast to posterior and right ventricular infarcts (40% in each).

Conclusion
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 \( \geq 0.10 \text{ ng/ml} \) and when compared to quantitative assay had concordance of 92%.

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 (upto 8 hrs.), 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.

Material and methods
The study was conducted at Dr. SN Medical College and associated groups of hospitals. A total of 156 patients of suspected myocardial infarction presented within 24 hrs of onset of symptoms were enrolled. After taking detailed history and performing a thorough clinical examination, patients were subjected to ECG, CPK-MB, SGOT, and troponin-T test.

Troponin-T test is a bedside qualitative test done by card (Boehringer Mannheim, Germany).
consisting of a strip labelled by monoclonal antibodies for troponin-T. If blood sample contains troponin-T, it will react with the antibody and show a coloured line on the strip. Blood was collected in EDTA vial, then sucked by pipette (150 µl) and poured on the strip. The time of appearance of a second line on the strip was noted. The test was considered as positive if 2 lines appeared; it was negative if only one line appeared and invalid if no line appeared.

**Observations**

In the present study, the sensitivity and specificity of troponin-T test was highest (64.7% and 71.4%) in comparison to CPK-MB (54.9% and 42.8%) and SGOT (31.3% and 57.0%) in the diagnosis of acute myocardial infarction (Table I).

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

<table>
<thead>
<tr>
<th>Test</th>
<th>Troponin-T</th>
<th>CPK-MB</th>
<th>SGOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>64.7%</td>
<td>54.9%</td>
<td>31.3%</td>
</tr>
<tr>
<td>Specificity</td>
<td>71.4%</td>
<td>42.8%</td>
<td>57.0%</td>
</tr>
</tbody>
</table>

Troponin-T test was better in all cases after 2 hours of onset of myocardial infarction and remained so up to 12 hours, while CPK-MB and SGOT were 100% positive only after 12 hours of onset of myocardial infarction (Table II).

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

<table>
<thead>
<tr>
<th>Time</th>
<th>Troponin-T</th>
<th>CPK-MB</th>
<th>SGOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-2 hours</td>
<td>27%</td>
<td>45%</td>
<td>27%</td>
</tr>
<tr>
<td>2-4 hours</td>
<td>61%</td>
<td>46%</td>
<td>15%</td>
</tr>
<tr>
<td>4-6 hours</td>
<td>100%</td>
<td>60%</td>
<td>60%</td>
</tr>
<tr>
<td>6-8 hours</td>
<td>63%</td>
<td>63%</td>
<td>37%</td>
</tr>
<tr>
<td>8-10 hours</td>
<td>75%</td>
<td>70%</td>
<td>50%</td>
</tr>
<tr>
<td>10-12 hours</td>
<td>100%</td>
<td>71%</td>
<td>42%</td>
</tr>
<tr>
<td>&gt;12 hours</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

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. (27% positivity in comparison to 45%) (Table II).

Positivity of troponin-T test varies with the area of infarction. Maximum positive cases are seen with anterior infarct (84%), followed by anteroseptal (63%), and inferior (58%) myocardial infarctions. While least positivity is observed with posterior or right ventricular infarctions (Table III).

**Table III** : Positivity of troponin-T, CPK-MB, and SGOT in relation to area of infarction.

<table>
<thead>
<tr>
<th>Area</th>
<th>Troponin-T</th>
<th>CPK-MB</th>
<th>SGOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>84%</td>
<td>78%</td>
<td>42%</td>
</tr>
<tr>
<td>Inferior</td>
<td>58%</td>
<td>42%</td>
<td>33%</td>
</tr>
<tr>
<td>Anteroseptal</td>
<td>63%</td>
<td>50%</td>
<td>25%</td>
</tr>
<tr>
<td>Posterior</td>
<td>40%</td>
<td>40%</td>
<td>20%</td>
</tr>
<tr>
<td>Right ventricular</td>
<td>40%</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

We have also observed high mortality in cases in which troponin-T test was positive within 5 minutes of onset of myocardial infarction.

**Discussion**

ECG diagnosis of myocardial infarction may not be evident during initial 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 earlier2.

In our 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 I). The sensitivity of troponin-T
test was found to be 100% in the studies done by François¹ and Katus³. 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 Apple⁴.

The results of troponin-T test showed two peaks. First peak of 100% positivity after 4-6 hours of onset of infarct and second peak of 100% positivity after 10 hours of myocardial infarction. This disparity of two peaks was present because serial troponin-T test was not done in admitted patients and the time duration was independent for individual patient and was as per the time lag between the onset of myocardial infarction and the performance of the test.

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 II).

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 al⁵ found peak positivity of CPK-MB at 18 hours and of SGOT at 24 hours after the onset of myocardial infarction.

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 planned⁶.

Limitations of the study

1. It estimated troponin-T qualitatively.
2. Qualitative estimation detects troponin-T levels above a certain level only, i.e., ≥ 0.10 ng/ml.
3. Quantitative estimations have shown better sensitivity particularly in detection of micro-infarcts.
4. The low sensitivity of qualitative method may account for difference in sensitivity for anterior and inferior infarctions.

Qualitative troponin-T positivity occurs when levels of serum cardiac troponin-T ≥ 0.10 ng/ml, as compared to quantitative troponin-T which may have concordance of 92%⁷.

Comparison of qualitative troponin-T rapid test versus quantitative troponin-T ELISA were performed in 510 patients with suspected acute coronary syndrome, the results were comparable and qualitative estimation is reliable even in the hands of nurses and physicians working in clinical units outside the laboratory⁸.

A concordance result between quantitative troponin-T and qualitative troponin-T assay was observed in 183 (96%) test and the concordance result between CPK-MB measurance and qualitative troponin-T assay was observed in 159 (83%) of tests⁹.

The qualitative assay allows the detection of troponin-T in concentrations above the cut-off level. Meticulous observance of the manufacture’s rules is imperative. A single preclinical rapid assay does not allow excluding a MI. However, the test enables one to identify patients who are at risk of dying from an acute coronary syndrome¹⁰.

References

