Original Article

Role of Heart Type Fatty Acid Binding Protein (H-Fabp) As Cardiac Bio Marker in Ischemic Heart Disease

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Introduction: Cardiovascular diseases constitute significant morbidity and mortality worldwide. Heart-type fatty acid binding protein (H-FABP) is a small intracellular protein which is abundant in the myocardium and rapidly released within 1-3 hours from damaged cardiomyocytes and may be the earliest available plasma marker of acute myocardial injury.

Material and Method: A cross sectional study was conducted at the department of physiology, BMSI, JPMC from 2010 to 2012. During this period 60 patients suspected with Ischemic heart disease were included, out of which 37 were male and 23 were female. Levels of cardiac markers troponin T and H-FABP were measured in the serum of all patients and the results were compared.

Result: Total numbers of 60 individuals were included in study out of which 61.66% (37) were males and 38.33% were females. H-FABP shows a positive result within one hour of onset of symptoms with a mean value of 22.8 ng/ml while Troponin T shows a negative result with a mean value of 0.28 ng/ml. While after 1 hour of onset of symptoms both H-FABP and Troponin T are showing positive results by having a value >6 ng/ml and >1.5 ng/ml respectively.

Conclusion: Point-of-care assays of H-FABP in patients presenting within one hours of symptom onset may lead to an earlier diagnosis of Ischemic Heart Disease.

Key words: Ischemic heart disease, H-FABP, Troponin T, Myocardial injury

Introduction

Cardiovascular disease is a global public health problem which contributes to about 30% of global mortality and 10% of all of the global diseases. Around 80% of total deaths that are occurring due to global diseases in developing countries are due to cardiovascular diseases1,2. The most common cause of Cardio Vascular Disease morbidity and mortality is ischemic heart disease (IHD)3. Myocardial ischemia, a major cause of myocardial injury and necrosis, is initiated whenever the coronary arterial flow cannot supply sufficient oxygen to the myocardium 4. Most common cause of myocardial ischemia is atherosclerotic coronary artery disease. Myocardial ischemia is developed whenever there is an imbalance between myocardial oxygen supply and myocardial oxygen consumption. The presence of atherosclerotic plaque within the vessel wall may lead to this imbalance when myocardial oxygen demands increase such as during exertion 5. There are five main manifestations of Ischemic heart disease, namely stable angina pectoris, unstable angina pectoris, MI, heart failure and sudden death. The phrase ‘acute coronary syndromes’ includes unstable angina, non-ST-elevation MI, ST-elevation MI and sudden cardiac death 6.

ECG alone is often insufficient for the diagnosis of acute coronary syndrome or acute myocardial infarction, since ST-segment deviation may be observed in other conditions So the electrocardiography (ECG) and measurement of cardiac troponins are the current diagnostic cornerstones and complement the clinical assessment 7,8.

Recent available cardiac biomarkers Troponin is considerably more sensitive and specific for heart damage than total creatine kinase (CK) or its isoform,
CK-MB. Unfortunately, troponin is elevated only 6–9 hours after onset of ischemia. So cardiac troponins, CK-MB and myoglobin, which are routinely used in the diagnosis of IHD, are not elevated in the initial hours, precluding their usefulness in the early diagnosis.

The diagnosis of acute myocardial infarction consequently requires prolonged monitoring over a period of 6 to 12 hours and serial blood sampling. A delay in confirming a diagnosis of acute myocardial infarction may increase the risk of complications. Cardiac troponins, the preferred biochemical marker for IHD frequently, show a delayed appearance in serum so patients with suspected IHD have normal cardiac troponin T levels on admission. Therefore there is still a need for reliable early markers. A biomarker that reliably detects myocardial ischemia in the absence of necrosis would be useful for initial identification of unstable angina patients and for differentiating patients with chest pain of an etiology other than coronary ischemia.

There are data documenting the diagnostic utility of H-FABP as an early marker of myocardial infarction (MI) and as a marker of reperfusion after ST-segment elevation MI. Recent studies in laboratories and the emergency department have shown that heart-type fatty acid-binding protein (H-FABP), a more recently developed cardiac biomarker, is able to detect myocardial damage as soon as one hour after onset of ischemia and, therefore, is regarded the earliest plasma marker available.

Heart Type Fatty Acid Binding Protein (H-Fabp)

Heart-type fatty acid binding protein (H-FABP) is a small intracellular protein consisting of 132 amino acid residues and weighing 14.5kDa. It is water soluble and abundant in the cytoplasm. H-FABP is abundant in the myocardium and rapidly released from cardiomyocytes into the circulation after the onset of cell damage.

The reasons for using H-FABP in early diagnosis of ACS are high myocardial content, presence in mainly cytosol, low molecular weight, relative tissue specificity, and early (within two hours) appearance in plasma and urine after AMI onset. An elevated H-FABP identified patients at risk for death and major cardiac events even when troponins and CK-MB are not elevated.

Recent research also suggests that human heart-type fatty-acid-binding protein (H-FABP) appears in plasma 1–3 h after cardiac damage, and may be the earliest available plasma marker of acute myocardial injury. It may have better diagnostic accuracy than other cardiac markers in the early stages after the onset of symptoms.

Materials and Methods

During analysis of a cross sectional study conducted at the department of physiology BMSI, JPMC Karachi from 2010 to 2012; 60 patients suspected with Ischemic heart disease were included. 37 (61.66%) were male and 23 (38.33%) were females. They were between the age group of 30-65 years.

Levels of cardiac markers troponin T and H-FABP were measured at the 1st, 2nd and 4th hours by Enzyme linked-Immuno-Sorbent Assay (ELISA) test-specific antibody system kits and the results were compared. Normal reference levels for troponin T and H-FABP were accepted in the range of 0.0–0.1 ng/ml and 0–6ng/ml respectively.

Results

<table>
<thead>
<tr>
<th>Troponin T and H-FABP findings with time of onset of symptoms in patients with ischemic chest pain</th>
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<tbody>
<tr>
<td>Time Of Onset Of Symptoms</td>
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<td>---------------------------</td>
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<tr>
<td>Male</td>
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<td>&gt; 2 hours</td>
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<td>1 - 2 hours</td>
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<td>Within 1 hour</td>
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<td>Female</td>
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<td>Within 1 hour</td>
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Table is showing comparison of H-FABP with Troponin T with respect to the time sample collection after the onset of chest pain of cardiac origin. It shows that H-FABP shows a positive result within one hour of onset of symptoms with a mean value of 22.8 ng/ml.
while Troponin T shows a negative result with a mean value of 0.28 ng/ml. While after 1 hour of onset of symptoms both H-FABP and Troponin T are showing positive results by having a value >6 ng/ml and >1.5 ng/ml respectively.

Discussion

Chest pain is one of the most common complaints among patients admitted to emergency departments. It may be the initial and sole complaint of Ischemic heart disease (IHD). The biochemical markers myoglobin, creatine kinase-MB isoenzyme (CK-MB), and cardiac troponins are currently used in the diagnosis of AMI. These cardiac markers are not satisfactory for detecting AMI in the early phase, especially within 3-6 h of the onset of AMI. The major limitation of standard cardiac troponin assays is their low sensitivity at the time of a patient’s presentation, owing to a delayed increase in circulating levels of cardiac troponins. Another consequence of the use of troponin is that its measurement can not distinguish between unstable angina and myocardial infarction.

Heart-type fatty acid binding protein (H-FABP) is a small intracellular protein weighing 14.5kDa and found abundantly in the cytoplasm. Heart type fatty acid binding protein (H-FABP) is the most widely distributed FABP. It is found in heart, skeletal and smooth muscle, mammary epithelial cells, aorta, distal tubules of the kidney, lung, brain, placenta and ovary. According to Glatz et al. (1997) H-FABP is released within two hours of symptom onset, reaches its peak concentration within 4–6 hours and returns to its normal basal levels by 20 hours.

The aim of this study is to determine the efficacy of H-FABP compared to troponin T in the early diagnosis of ACS, and to assess its cardio sensitivity and specificity in normal healthy individuals and patients suffering from acute coronary syndrome (ACS). We have demonstrated the sensitivity and specificity of H-FABP for the detection of early phase (at the first hour of myocardial injury) of Ischemic heart disease, and compared it to the routinely used marker, troponin T. Our data indicates that for IHDI detection, serum H-FABP shows a significantly higher diagnostic sensitivity and specificity than troponin T, especially soon after (within 1-2 hr) the onset of symptoms. Same is shown in the study of Pasuoglu et al., 2007 which showed 71.1% (61) individuals with elevated H-FABP levels.

Data of our study is completely supported by Umat Cavus et al., 2006 where at the first hour of myocardial injury, H-FABP had shown superiority to that of troponin T by showing a positive result (H-FABP level of >6ng/ml in patients) while troponin T showed a negative result. This trend changed at the fourth hour of myocardial injury where H-FABP sensitivity and specificity became equal to CK-MB and troponin T.

Conclusion

Point-of-care assays of H-FABP in patients presenting within one hours of symptom onset may lead to an earlier diagnosis of IHD. Its use in IHD appears feasible. It also has the advantage in bedside testing and rapid test results.

References

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