ORIGINAL RESEARCH

Heart type fatty acid-binding protein: An early diagnostic biomarker in patients with acute myocardial infarction and it's correlation with CPK MB and Troponin I

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Received: 12 June, 2023 Accepted: 16 July, 2023

ABSTRACT

Introduction: Early diagnosis can improve the outcome of patients with acute myocardial infarction (AMI). However, there are no satisfactory cardiac biomarkers for the diagnosis of AMI within 6 hours of onset of symptoms. Among novel biochemical markers of AMI, heart-type fatty acid binding protein (H-FABP) is of particular interest. **Aims and objectives:** The study aimed to investigate whether H-FABP measurement provides additional diagnostic value to that of conventional cardiac markers-CPK MB and Troponin I in AMI patients**. Material and methods**: The study included 300 subjects of AMI (150 STEMI and 150 NSTEMI), attending emergency department within 6 hours after the onset of chest pain .Peripheral venous samples were obtained on admission, post thrombolysis at 60 minutes and after 6 and 12 hours to measure a panel of conventional biomarkers HFABP,CPKMB, and Troponin I. In all the cases, serum H-FABP concentration was measured immunochemically. **Results:** The sensitivity and negative predictive values of H-FABP on admission ,in patients with AMI on admission were significantly greater than CK-MB and Troponin I but specificity and positive predictive values of Troponin I remained significantly higher (100%) than CK-MB and HFABP in patients with AMI**. Conclusion**: In conclusion, the diagnostic value of H-FABP is greater than CK-MB and troponin I for the early diagnosis of AMI within first 6 h of chest pain. H-FABP can be used as an additional earliest diagnostic tool for the diagnosis of AMI

Keywords: Creatine kinase, MB; Heart-type fatty acid binding protein, Myocardial infarction; Troponin-I.

INTRODUCTION

AMI is one of the leading causes of death in India . Prevalence rates of AMI range from 1.6 to 7.4 % in rural populations and 1 to 13.2 % in urban populations in India [1]. If AMI is diagnosed and treated within 1 h (golden hour), mortality can be reduced from 9 to 3 %, and if thetreatment is delayed for 3–4 h, mortality could be 5 times higher. Unfortunately, at least one-fifth of the cases of AMI go unrecognized either because of the atypical presentation or atypical ECG changes or delay in the rise of the serum cardiac markers [2]. So early diagnosis and management of patients with AMI represent a potential medical challenge. Availability of an early biomarker can reduce diagnostic uncertainty in patients of an AMI and also financial burden including hospital resources, and healthcare costs. Cardiac troponins (cTn) are currently the standard of care for the diagnosis of AMI patients presenting to the emergency department (ED) with chest pain . However cTn may not rise for the first 6 -12 hrs after the onset of symptoms . Moreover, ruling out AMI in low-risk patients requires prolonged ED observation and overnight hospital admission to allow serial measurements of c-Tn, adding cost. Moreover, need of the hour is to establish diagnosis of AMI much earlier , which may result in earlier initiation of appropriate treatment, including revascularization procedures . Heart-type fatty acid-binding protein (H-FABP) is a novel marker of myocardial injury with putative advantages over cTn. H-FABP is a small 15 kDa soluble protein composed of 132 amino acids. It is one of the most abundant proteins in the heart comprising 5–15 % of the total cytosolic protein pool. It is involved in intracellular transportation of fatty acids for oxidation in the mitochondria. Several studies have shown that H-FABP is a sensitive marker for the diagnosis of AMI and might be more sensitive than conventional cardiac markers .(3,4,5,6). Being present in abundance in the myocellular cytoplasm, it is released rapidly

(<1 h) after the onset of myocardial injury and could potentially play an important role in both earlier diagnosis of high-risk patients presenting early after Chest Pain onset as well as in risk-stratifying low-risk patients rapidly. Like cTnI ,HFABP also has potential role as prognostic marker in acute congestive heart failure and pulmonary embolism(7)
After thrombolysis, the serum concentrations of H-FABP peak at approximately 4 h after the onset of chest pain, and return to normal values within 24 h. Because of this rapid return of its blood concentrationto baseline, H-FABP can contribute to an early biologic diagnosis of post- thrombolysis reperfusion and re-infarction (8,9) In addition, H-FABP peaks earlier and is more sensitive than troponins in the detection of subtle myocardial injury in patients presenting with acute coronary syndrome without ST segment elevation . Limitations of H-FABP include a limited cardio-specificity, a narrow diagnostic window (20 to 30 hours), and a nearly exclusive renal elimination (10)

AIMS AND OBJECTIVE

To evaluate potential benefit and efficacy of Heart type fatty acid binding protein (HFABP) as an early marker of cardiac injury and to compare its sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) with the conventional cardiac biomarkers- Troponin I (cTnI) and creatinine Phospholinase Kinase (CPK- MB) in patients presenting with chest pain within 3 h and 6-12 h after the onset of chest pain

MATERIAL AND METHODS:

This study was conducted in the department of Cardiology Jawahar Lal Nehru Hospital and Medical College, Ajmer. It was an observational, single-center cohort study, prospective cross-sectional study. There wasa cohort of 300, patients aged 18 years or older, of AMI attending emergency department within 6 hours after the onset of chest pain, having ischaemic-type chest pain lasting more than 30 minutes. Patients were divided in two groups according to ECG finding

a) STEMI – 150 patients
b) NON STEMI – 150 patients

EXCLUSION CRITERIA

Patients with history of renal dysfunction (eGFR <60 ml/min), skeletal muscle disorder and symptoms temporally related to direct local trauma of <3days, were excluded from study. Patients with heart failure, dysrhythmias, pulmonary edema, hypotension or cardiopulmonary resuscitation were also excluded due to potential early triaging and a potential inability to follow these patients throughout thestudy.

Peripheral venous blood samples were obtained from all patients on admission, post thrombolysis at 60 minutes and after 6 and 12 hours to measure a panel of conventional biomarkers (Immunochemically assayed FABP, cTnI and enzymatically assayed creatine phosphokinase (CPK MB).

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS version 27 for windows (SPSS inc.Chicago,IL.USA) The sensitivity, specificity, and positive and negative predictive values was calculated to assess the diagnostic accuracy of H-FABP, cTnI, and CK-MB in the exclusion of ACS on admission and at 6th and 12th hours post-admission for cTnI and CK-MB.

OBSERVATION AND RESULTS

Table 1 shows the sensitivity, specificity, PPV and NPV of all the four cardiac biomarkers. As it is evident from the table that, the sensitivity, and NPV of H-FABP were significantly higher than that of CK-MB and cTnIbut specificity and PPV was lesser than that of cTnI

Table 1: Comparison of cardiac markers on hospital admission (n=300)

	H-FABP	CPKMB	Troponin I
Sensitivity	88.7%	54.2%	67.0%
Specificity	70%	96.6%	100%
PPV	78.9%	85.3%	100%
NPV	88%	58.4%	69.4%

Table 2 shows the sensitivity, specificity, PPV and NPV of CPK MB and cTnI and it is evident from the table that, the sensitivity, specificity, PPVand NPV of cTnI was higher than that of CPK-MB

Table 2: Comparison of cardiac markers 6 hours after hospital admission (n=300)

	CPKMB	Troponin I
Sensitivity	75.2%	97.7%
Specificity	96.3%	100%
PPV	95.3%	100%
NPV	96.4%	98.4%

Table 3 shows that at 12 hours after hospital admission, sensitivity, specificity, PPV and NPV of cTnI reached 100%

Table 3: Comparison of cardiac markers 12 hours after hospital admission (n=300)

	CPKMB	Troponin I
Sensitivity	79.2%	100.0%
Specificity	92.6%	100%
PPV	88.5%	100%
NPV	78.2%	100%

Table 4: Table 4 shows that the concentration of HFABP at 60 minutes after thrombolysis was highest compared to CPK MB and cTnI

Comparison of cardiac markers post thrombolytic at 60 minutes (n=150)

Cardiac Marker	Baseline	60 minutes post thrombolysis
H-FABP (ug/L)	86.4+24	109.6+21
CPKMB IU/L	56.1+2.6	87+3.8
Troponin I (ng/ml)	7.4+1.3	19.1+2.2

The plasma or serum concentration of H-FABP under normal conditionsis < 5µg/L , upper limit for cTnI is < 0.04ng/ml and for CKMB is 24 IU/L.

DISCUSSION

In our study, H-FABP demonstrated greater sensitivity, and PPV in patients with AMI both within 6 h after the onset of chest pain. The diagnostic validity of H-FABP was comparable to troponin-I but never superior both within 6 h and 12 h after the onset of chest pain. Elmadbouh et al. (2) found that within 3 h, H-FABP had diagnostic sensitivity (81.8 %)equal to that of CK-MB and troponin-I but superior to that of myoglobin (72.7 %). Pasaoglu et al. (11) demonstrated that for AMI detection, serum H-FABP shows significantly higher diagnostic sensitivity and specificity than troponin-I and CK-MB, similar to myoglobin, especially soon after (within 1–2 and 3 h) the onset of symptoms. Orak et al. (12) showed that, for patients admitted with chest pain, H-FABP is more sensitive and specific than troponin-I and CK-MB in the early diagnosis of ACS. In patients with ACS who were admitted within 0–3 h, the H-FABP sensitivity was 100 % and specificity was 75 %; for CK-MB, the sensitivity was 81 % and the specificity was 16 %; and for troponin-I, the sensitivity was 100 % and the specificity was 20 %. McMahon et al. [13] concluded that, of the four biomarkers measured in this study, H-FABP demonstrated highest sensitivity at the early time points (64.3 % at 0–3 h and 85.3 % at 3–6 h) Superior performance of the H-FABP over CK-MB and myoglobin may be because of the following reasons: (1) H-FABP has small molecular weight (15 kDa) when compared to CK-MB (80 kDa) and myoglobin (18 kDa). (2)Relative specificity of the H-FABP for the cardiac tissue. Its concentrationwithin the myocardial tissue is 10 times higher when compared to that of skeletal muscle (14) In a multicentre study conducted by Freund et al. [15], H-FABP had no additional value over cardiac troponin-I for the diagnosis of myocardial necrosis (STEMI and NSTEMI) in ED patients with chest pain of less than 6 h duration. Reasons for the conflicting results can be the duration of MI at the time of sampling, different study settings (cardiology units, Emergency department or pre-hospital etc.), different methods and cut off values for the H-FABP used.

CONCLUSION

Our study, concludes that by doing , HFABP monitoring inpatients with acute chest pain, we could reliably diagnose AMI patients 1 to 3 hour after admission.

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