Heart Type Fatty Acid Binding Protein Is More Sensitive Than Troponin I and Creatine Kinase Myocardial Band at Early Stage in Determining Myocardial Injury Caused by Percutaneous Coronary Intervention

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SUMMARY

Measurement of circulating cardiac biomarkers has enabled early diagnosis and risk assessment of acute coronary syndrome. Heart type fatty acid binding protein (H-FABP) is a relatively novel marker for the diagnosis of myocardial injury. The purpose of the present study was to compare H-FABP with Troponin I (cTnI) and creatine kinase myocardial band (CK-MB) in determining myocardial injury in patients with early stage of percutaneous coronary intervention (PCI).

Blood was withdrawn one hour before and 3 hours after PCI from 40 patients to measure H-FABP, cTnI and CKMB. H-FABP was measured qualitatively. CK-MB and cTnI were measured by a sandwich enzyme-linked immunosorbent assay.

Before PCI, H-FABP was found to be negative, while cTnI and CK-MB were found to be in normal ranges. Statistical analysis of measurements 3 hours after PCI revealed that H-FABP was significantly positive in 15 (37%) patients, while cTnI was elevated in 11 (27%) patients and CKMB was elevated in 8 (20%) patients. H-FABP is statistically more sensitive than cTnI and CK-MB at detecting myocardial injury after PCI.

H-FABP can be used in early stages to detect myocardial injury caused by PCI. H-FABP is more sensitive than cTnI and CK-MB in determining myocardial injury due to PCI within 3 hours. H-FABP may help us stratify a patient's risk in early stages after PCI. (Int Heart J 2011; 52: 143-145)

Key words: Heart type fatty acid binding protein (H-FABP), Creatine kinase myocardial band (CK-MB), Troponin I (cTnI), Percutaneous coronary intervention (PCI)

Coronary artery disease is the leading cause of mortality in the developed countries. Advances in techniques for the measurement of circulating troponin and creatine kinase myocardial band (CK-MB) levels have enabled early diagnosis and risk assessment of myocardial injury in patients presenting with acute chest pain.[1)] In addition to conventional blood markers, heart type fatty acid binding protein (H-FABP) has recently emerged as a new circulating cardiac biomarker. H-FABP is a low-molecular-weight (15 kDa) cytosolic protein, is highly specific for cardiomyocytes, and plays an important role in intracellular transport of fatty acids for oxidation in mitochondria.[2-6)]

H-FABP is released early after the onset of ischemia and may be useful for rapid confirmation or exclusion of acute myocardial injury. H-FABP is abundant in the heart and has low concentrations in the blood and in tissues outside the heart. Recent investigations have shown that H-FABP enables early and precise diagnosis and risk assessment of myocardial injury in patients presenting with acute chest pain compared to other biomarkers.[7,8)]

Percutaneous coronary intervention (PCI) is used widely in the treatment of patients with coronary artery disease. Severe acute complications are rare, but a mild and symptomatic release of the biochemical markers of myocardial necrosis is frequently observed after otherwise technically successful interventions.[9)]

This study was designed to clarify whether H-FABP is as sensitive as cardiac troponin I (cTnI) and CK-MB at detecting myocardial injury due to PCI in early stage.

METHODS

We enrolled 40 consecutive patients with elective PCI who were admitted to the outpatient clinic of a research hospital in Ankara. Inclusion criteria were no history of recent (< 28 days) acute coronary syndrome and the need for PCI, and the first blood samples for measurements of cTnI, H-FABP and CK-MB were obtained 1 hour before and 3 hours after PCI. Informed consent was obtained from each patient.

Mass CK-MB and cTnI levels were analyzed using a Dimension RxL/HM analyzer (Dade Behring, Glasgow, DE,

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Table I. Demographic Features of the Patients

Age (years), mean (standard deviation)	59.8 (2.6)
Male *n*, (%)	30 (75)
Hyperlipidemia *n*, (%)	11 (27)
Diabetes mellitus *n*, (%)	7 (17)
Smoking *n*, (%)	12 (30)
Hypertension *n*, (%)	13 (32)

Table II. Final Diagnoses of the Myocardial Injury 3 Hours After PCI

	cTnI-CK-MB	H-FABP-CK-MB	H-FABP-cTnI
P^*	0.083	0.008	0.046

*Wilcoxon Signed Ranks Test

USA). According to the manufacturer's instruction manual, the cut-off levels for serum cTnI concentrations and serum CK-MB activity were 0.1 ng/mL and 25 U/L, respectively. H-FABP was measured qualitatively as negative or positive.

The Wilcoxon Signed Ranks test was used to analyze the association of parameters. Statistical analysis was performed using an SPSS statistical program package (SPSS version 13.0, SPSS Inc, Chicago, IL, USA).

Results

The demographic characteristics of the study population were representative of the normal population with respect to diabetes, hyperlipidemia, hypertension, and smoking. Table I shows the demographic features of the patients. Twenty-six (65%) patients were men and 14 (35%) were women. The mean age of the patients was 59.8 ± 2.6 years. The demographic features are shown in Table I.

None of the patients had elevation in cTnI and CKMB or positive H-FABP before the PCI. Table II shows the final diagnoses of the myocardial damage 3 hours after PCI; there were 15 (37%) patients with H-FABP elevation, 11 (27%) with cTnI elevation, and 8 (20%) with CK-MB elevation. H-FABP is more statistically sensitive than cTnI and CK-MB at detecting myocardial injury after PCI (Table II).

Five patients had chest pain, 4 of whom experienced dissection. The other patient did not have any problems. H-FABP, cTnI and CK-MB were all elevated in the 4 patients with chest pain. Lesion length was greater, although not significantly, in the patients whose H-FABP was only high. CK-MB was not elevated more than 5 times its upper limit of 25 U/L.

Discussion

It is important to detect myocardial injury caused by PCI since it may help us to identify patients at high risk for future major cardiac events. Troponins and CK-MB levels have enabled the diagnosis and risk assessment of acute myocardial injury. cTnI is established as a widely used biomarker of myocardial injury, although it is less sensitive at a very acute phase within 6 hours from the onset of symptoms.[1,10] It was also reported that the rapid troponin T test is not always adequate for diagnosing myocardial injury in the early acute phase.[11,12] Thus, a biomarker which can be detected in the early phase of myocardial injury is needed. It may be H-FABP (discovered by Ockner in 1972[13]). It appears in the blood as early as 1.5 hours after the onset of symptoms of myocardial injury, peaks around 6 hours, and returns to baseline values in 24 hours. Ruzgar, *et al* showed H-FABP is more sensitive than cardiac troponin T at detecting myocardial damage in the first 6 hours of acute coronary syndromes.[14] These features of H-FABP make it an excellent potential candidate for the detection of acute myocardial injury.[7] In our opinion, all of these features of H-FABP can contribute to the early and sensitive detection of myocardial injury after PCI. Minimal myocardial injury or micronecrosis can be identified by H-FABP.

Myocardial injury caused by PCI can put the patient at high risk. In our study, the Pearson chi-square test showed that H-FABP was more sensitive than cTnI and CK-MB in determining myocardial injury 3 hours after PCI. We found H-FABP to be positive in 15 (37%) patients, and elevated cTnI in 11 (27%) patients and elevated CK-BM in 8 (20%). H-FABP was statistically more sensitive than cTnI and CK-MB at detecting myocardial injury after PCI ($P < 0.05$) (Table II). It seems cTnI and CK-MB may be used to detect myocardial injury 6 hours after PCI, while on the other hand, in 3 hours, H-FABP may be needed. Combined use of these biomarkers could contribute to early decision-making in an emergent situation and to the early prediction of the severity of ischemia-induced myocardial injury.

H-FABP can easily be measured qualitatively within 15 minutes. The results of the present study suggest that the newly developed rapid H-FABP test compensates for the limitations of rapid cTnI and CK-MB determination, within 3 hours after PCI.

Conclusion: It is important to detect myocardial injury after PCI as it helps with the risk stratification of patients and the commencement of advanced therapy in an early stage of PCI. Different features of biomarkers are likely to be complementary, and suggest that the combined assessment of these markers can contribute to risk stratification in PCI patients. Finally, our findings show that H-FABP has greater diagnostic value in patients with suspected myocardial injury than does cTnI and CK-MB 3 hours after PCI.

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