

The Diagnostic Values of Myoglobin and CRP Levels in Acute Myocardial Infarction

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Abstract

Background- One of the most common causes of hospital admissions is chest pain of ischemic origin; a number of such cases tend to be diagnosed as acute myocardial infarction (MI) and sent to CCUs. Earlier diagnosis in these patients, particularly in those without typical signs of MI, results in better and faster service to the patient and, therefore, reduces the rate of mortality. The special role of cardiac enzymes in diagnosing myocardial infarction has been known for a long time. This study sought to investigate the sensitivity and specificity of myoglobin in MI diagnoses. As regards the role of inflammatory factors in MI, the relationship of C-reactive protein (CRP) and MI was also investigated.

Methods- Seventy-eight patients presenting to our emergency department with acute chest pain were interviewed. After it had been confirmed that they fulfilled the inclusion criteria, samples were collected for measurement of myoglobin, CRP and CK-MB. The measurement was repeated after six hours.

Results- All the patients who were diagnosed as having myocardial infarction had myoglobin levels higher than normal, which demonstrated 100% sensitivity and NPV of this test for the diagnosis of acute MI (AMI). However, the plasma level of myoglobin was also higher than normal in about 20% of the non-MI patients, which showed that the specificity of this test was about 78% and the accuracy of the test was 87%. The CRP level was also higher in MI patients in comparison to non-MI patients.

Conclusion- The results of this study and similar studies demonstrated that myoglobin measurement for the patients referred to the emergency ward should be taken at least twice, i.e. once upon admission and then after six hours. Furthermore, CRP evaluation on the first day can result in better and faster diagnoses of such patients (*Iranian Heart Journal 2005; 6 (3): 29-32*).

Key words: acute myocardial infarction Æ myoglobin Æ CRP

Cardiovascular diseases are the most common cause of death in the world, almost half of the world's mortality being related to them.¹ The usual complaint of the patients coming to the emergency ward is chest pain.² The ECG is the primary tool of diagnosis, but its accuracy is only 50% during the acute phase,³ hence the important role of cardiac markers evaluation in diagnosis.⁴ It is important to note that faster and better diagnoses result in saving money, time and energy.

Moreover, because of the shortage of beds in emergency departments and CCU, the importance of faster and more accurate diagnoses is more pronounced.⁵

Therefore, the present study was carried out to investigate both the value of myoglobin measurement in the rapid diagnosis of AMI and the relationship between CRP as an inflammatory factor with AMI.⁶

The gold standard used in this study was CK-MB measurement.⁷

Methods

Eighty-seven patients, having been referred to our emergency department and hospitalized with acute chest pain, were visited. They were selected for the study if they met the following inclusion criteria: an elapsed time of less than six hours from the onset of pain, not receiving CPR on arrival, not having had recent traumas and not suffering from acute or chronic infectious or inflammatory diseases. Blood samples were obtained for laboratory investigations. This was repeated after six hours. In the laboratory, the samples were centrifuged immediately, and the plasma obtained from heparinized blood was used for myoglobin and CK-MB measurements. The serum derived from the clot was also used for a quantitative assessment of CRP. The tests were carried out using the kits manufactured by Pars Azmoon Company in a Cobas Mira autoanalyzer employing immunoturbidometric techniques. The normal values for the factors were as follows:

CK-MB: 0-24 u/l

CRP: 0-10 mg/l

Myoglobin: 0-70µg/l

Results

The mean age of the 78 patients investigated was approximately 56 years. Out of 78 patients, 56 were men and 26 women. In the MI group, 26 patients were men and 9 were women. In the non-MI group, 30 were men and 22 were women. Out of 35 patients with MI, 31 patients were CRP-positive (Table I). However, from 52 non-MI patients, only 21 were CRP- positive, which demonstrated the importance of CRP in patients with AMI because it may indicate more widespread inflammation in MI patients in comparison to non-MI patients.

Nineteen MI patients did not have elevated CK-MB on arrival, but they all had myoglobin levels exceeding normal. This indicated the earlier elevation of myoglobin

level compared to CK-MB. In all the patients in the MI group with elevated CRP levels, the myoglobin level was also higher than normal. The reverse did not occur, however. It means that out of all the patients with elevated myoglobin, 4 cases had normal CRP levels. Out of 11 non-MI patients with myoglobin levels above normal, only 4 had raised levels of CRP, which indicated the importance of doing both tests in conjunction with each other. As all the MI patients had elevated myoglobin, it can be concluded that the sensitivity and NPV of this test for AMI diagnosis is 100%. Nonetheless, because the myoglobin level was elevated in only 4 out of 52 cases of non-MI patients, the specificity was around 78%, and the accuracy of this test for AMI diagnosis was around 87% (Table II).

Table I. Sensitivity and specificity of CRP for diagnosing AMI

CK-MB \ CR	+	—	Total
+	31	21	52
—	4	31	35
Total	35	52	87

$$\text{Sen} = \frac{31 \times 100}{35} = 88\% \quad \text{Sensitivity}$$

$$\text{SP} = \frac{31 \times 100}{52} = 60\% \quad \text{Specificity}$$

$$\text{Ac} = \frac{31 + 31}{87} \times 100 = 71\% \quad \text{Accuracy}$$

$$\text{PV} = \frac{31 \times 100}{35} = 60\% \quad \text{Predictive Value}$$

Table II. Sensitivity and specificity of myoglobin test for diagnosing AMI

CK-MB \ MYO	+	—	Total
+	35	11	46
—	0	41	41
Total	35	52	87

$$\text{Sen} = \frac{35 \times 100}{35} = 100\%$$

$$\text{SP} = \frac{41 \times 100}{52} = 78\%$$

$$\text{Ac} = \frac{35 + 41}{87} \times 100 = 87\%$$

$$\text{PV} = \frac{41 \times 100}{41} = 100\%$$

Conclusion

The results of this study demonstrated that the accuracy of myoglobin level for AMI diagnosis was 87%; this accuracy was reported by Magnus et al. to be 82%.⁸ De Winter reported the NPV level for myoglobin in the first 4 hours to be 89%; this was 100% in the present study.⁹ Sallach et al. reported that myoglobin in the first hour had 100% sensitivity and NPV, which corresponds with our results.¹⁰ De Lemon et al., reporting that myoglobin was pronouncedly sensitive but non-specific, demonstrated the relationship between higher levels of myoglobin with higher risk of MI and mortality in a period of six months.¹¹ In this study, 19 out of 35 MI patients had primarily normal levels of CK-MB while their myoglobin levels were elevated at the same time, indicating the sensitivity of myoglobin in earlier diagnosis of MI. It is obvious that CK-MB test alone did not suffice to diagnose MI patients, and some of the MI patients might have been missed. There were six MI patients in this study with negative ECGs for MI on arrival.

They, however, all had elevated myoglobin and later they had ECG changes indicative of AMI. The Gibson study showed that patients with higher CRP levels had a higher risk of thrombotic occlusion and that the threshold of CRP>2 was in accordance with highest risk.¹² In our study, with regard to the higher percentage of CRP in the AMI patients versus non-MI patients (88% v. 40%), it seems that those patients who arrive at the emergency ward with ACS and have higher CRP levels should be observed more closely. The results derived from this study in conjunction with those of other studies indicate that as the elevation of myoglobin compared with other enzymes such as CK-MB and troponin is earlier and more pronounced, it is advisable to take at least two measurements of myoglobin: one on arrival and another after six hours. It can also be suggested that a quantitative measurement of CRP on the first day of hospitalization should be made. And as myoglobin level was found to have a 78% specificity in this study, it should be complemented with troponin and CK-MB tests in the later hours for definite diagnosis.

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