Plasma fibrinogen and D-dimer in patients with acute myocardial infarction

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ABSTRACT

Objectives: To investigate the plasma fibrinogen level and D-dimer reaction in patients with acute myocardial infarction (AMI) together with other haematological parameters.

Design: A prospective clinic-haematological study.

Setting: Intensive coronary care unit in Ibn-Sina teaching hospital in Mosul during a period of 4 months from October 2004.

Participants: Forty patients with acute myocardial infarction together with a control group of 40 subjects.

Main outcome measures: Basic haematological parameters, plasma fibrinogen level and plasma D-dimer reaction tests. Biochemical tests including cardiac enzymes (CK) and aspartate transaminase (AST) were performed.

Results: Plasma fibrinogen level, while blood cell count and neutrophils count were significantly higher in patients compared to control group with P-values (<0.05) and (<0.01) respectively. Plasma D-dimer reaction was significantly more frequent in patients than in control group (p<0.05). High plasma fibrinogen level and positive plasma D-dimer reaction were seen in those with worse outcome with p-value (<0.05), (<0.05) respectively. Plasma fibrinogen was significantly higher in those with extensive infarction compared to others (p<0.05).

Conclusion: High plasma fibrinogen and positive plasma D-dimer reaction were more frequently seen in patients with complicated course of myocardial infarction.

Key words: Fibrinogen, D-dimer, acute myocardial infarction.

A cute coronary syndrome results from a ruptured plaque and intraluminal thrombus formation[1]. In addition to the hypercoagulable state, there is strong systemic imbalance of the haemostatic system with a shift to
procoagulation than fibrinolysis. So the haemostatic system plays an important role during acute illness and development of atherosclerosis.\(^2,4\) Fibrinogen might contribute to the formation and progression of atherosclerotic plaques.\(^5\) Recently fibrin D-dimer, the product of cross linked fibrin, has gained an increased interest because it acts as marker of fibrin turnover and activation of haemostasis.\(^5\)

The aim of this study was to evaluate D-dimer reaction and plasma fibrinogen level in patients with acute myocardial infarction.

**SUBJECTS AND METHODS**

This study was conducted in the intensive coronary care unit (ICCU) in Ibn-Sina Teaching Hospital during a period of 4 months starting from October 2004. We included 40 patients diagnosed as cases with acute myocardial infarction according to the criteria of the World Health Organization.\(^1\) There were 34 adult males (85%) and 6 females (15%) with ages ranging from 36-78 years with a mean of 57 years. The control group included 40 subjects who had no history of ischaemic heart disease, infection or malignant disease in the previous 6 weeks. Both control and patients groups were matched for their age and sex.

Venous blood was drawn during the first few hours from admission to the ICU (mean time 1.4 hour and a range of 1-3 hours), and complete blood counts including erythrocyte sedimentation rate (ESR) were done according to Dickh and Lewis.\(^1\)

Plasma D-dimer test was done by commercially available kit (BioMerieux/FDP slide): Direct-72 -153/France kit). It is a rapid latex agglutination slide test for the qualitative determination of D-dimer reaction in plasma by agglutination of latex particles coated with anti-D-dimer monoclonal antibodies. Plasma fibrinogen measurement was done by using (BioMerieux/Fibrinogen-68 452/France kit) that depend on the clot based method of Claus.

Cardiac enzymes assay (CK and AST) was done by routine enzymatic colorimetric methods of Randox (normal range of AST up to 22 U/L and for CK up to 160 U/L). All patients were followed for any evidence of complications as heart failure, arrhythmia or pericarditis until they are discharged or die. The statistical analysis was based on all cases. Continuous variables were described by mean, value, standard deviation, range. Chi square and student’s t-test were used.

**RESULTS**

Table (1) shows the laboratory characteristics of the study population. The WBC count, neutrophil count and ESR level were significantly higher in patients compared to control group, (P<0.05), (P<0.01) and (P<0.05) respectively.

- High plasma fibrinogen was of significant values in patients who died or had complicated course during their admission in the ICU (p<0.05), (Table 2).
- Positive D-dimer reaction was significantly higher in patients than in controls and in those with worse outcome than others. (Table 2), D-dimer reaction was negative in all controls. Significant positive correlation between ESR and AST level and between plasma fibrinogen and CK level with (p<0.05) and (p<0.01) in (Figure 1) and (Figure 2) there was no significant correlation between plasma fibrinogen and AST levels.

![Figure 1](https://example.com/figure1.png)

**Figure 1:** Correlation between ESR and AST levels in AMI.

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Figure (2): Correlation between plasma Fibrinogen and CK levels in AMI.

Table (1): The laboratory parameters of the study population.

<table>
<thead>
<tr>
<th></th>
<th>Patients (N=40)</th>
<th>Control (N=40)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Range</td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Hb (g/dL)</td>
<td>120 ± 40</td>
<td>80-160</td>
<td>120 ± 20</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>0.38 ± 0.08</td>
<td>0.29-0.47</td>
<td>0.38 ± 0.07</td>
</tr>
<tr>
<td>WBC x10^9/L</td>
<td>8 ± 2</td>
<td>4-12</td>
<td>5 ± 2</td>
</tr>
<tr>
<td>Neutrophil x10^9/L</td>
<td>8 ± 2</td>
<td>4-8.5</td>
<td>5 ± 2</td>
</tr>
<tr>
<td>ESR (mm/hr)</td>
<td>26 ± 20</td>
<td>6-46</td>
<td>8 ± 2</td>
</tr>
<tr>
<td>Fibrinogen (g/L)</td>
<td>4 ± 0.9</td>
<td>3.1-4.9</td>
<td>2.6 ± 0.6</td>
</tr>
<tr>
<td>CK (U/L)</td>
<td>260 ± 120</td>
<td>140-380</td>
<td>50 ± 20</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>50 ± 43</td>
<td>7-93</td>
<td>5 ± 2</td>
</tr>
</tbody>
</table>

* Not significant

Table (2): D-dimer and plasma fibrinogen in patients with acute myocardial infarction.

<table>
<thead>
<tr>
<th></th>
<th>*Positive D-dimer</th>
<th>Negative D-dimer</th>
<th>**Patients with high Plasma Fibrinogen</th>
<th>Patients with low Plasma Fibrinogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with complicated course</td>
<td>24</td>
<td>11</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Patients without complication</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

* X(1)² = 5 (P<0.05 )  **X(1)² = 3 (P<0.05 )

DISCUSSION

Leucocytosis may be observed within several hours after AMI and after 12 hours ESR increased above the references range values and remains elevated for several weeks12. These changes were also seen in our study and are most probably a response to the acute phase of the illness (Table 1).

High plasma fibrinogen was significant in those with complicated course in our study (Table 2). The increased level of plasma fibrinogen in AMI was noticed by "Kader et al" who mentioned elevated plasma fibrinogen level especially on days 3 and 416. Also increased plasma fibrinogen level in complicated cases who died or had new myocardial infarction was discussed by others19. The incidence of MI and death predicted by plasma level of fibrinogen modified by its covariance with other inflammation sensitive proteins has been noticed20. Likewise, increased plasma fibrinogen levels have also been identified as an important risk factor for future cardiovascular events in several studies21. The increased plasma fibrinogen level reflects an acute phase response to the infarct tissue and this also may explain its high level in extensive infarction.

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Increased levels of fibrin D-dimer are indicative of hyper-coagulable state in acute coronary syndrome. Nowadays, they consider fibrin D-dimer assays are more stable and more practical to measure and therefore, more reliable in routine clinical purposes. In our study we depended on the rapid latex agglutination slide test method for plasma D-dimer reaction which is the only available method in our laboratory and showed a high percentage of positive reaction in those with complicated course AMI indicating a hypercoagulable state. In our study both CK and AST enzymes were elevated significantly but CK was increased significantly in those with high plasma fibrinogen level (Figure 2). Adams et al. mentioned that CK was more specific than AST and both reflect the presence of necrotic cardiac muscles. Also AST level had a significant positive correlation with ESR level which increased as a response to the acute phase of the illness. Conclusion: Elevated plasma fibrinogen and positive plasma D-dimer reaction were more frequently seen in patients with complicated course myocardial infarction.

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REFERENCES