Biochemical role of serum uric acid and cardiac enzymes in acute myocardial infarction

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Abstract
Introduction: Acute myocardial infarction (AMI) remains a leading cause of morbidity and mortality worldwide. In India cardiovascular disease is the leading cause of death.

Materials and Methods: It is a comparative study was conducted among 50 cases of acute MI were taken in the study group, 100 age and gender matched individuals served as control group. Serum uric acid levels were estimated on the day of admission during the hospital stay. Additional parameters like CPK, CKMB, SGOT, and LDH were also estimated.

Results: Serum uric acid levels (mg/dl) is significantly increased in cases as compared to healthy controls [5.069 ± 1.244 versus 3.73 ± 0.388; (P value < 0.01)], higher in male patients compared to females [5.426 ± 1.218 versus 4.726 ± 1.058; (P value < 0.01)], higher in patients with diabetes compared to non-diabetics 5.595 ± 1.247 versus 4.559 ± 0.953 [P value < 0.0001].

Conclusion: The present study showed that the serum uric acid levels are higher in patients of acute myocardial infarction as compared to normal healthy individuals thus serum uric acid plays an important role in the early diagnosis of acute myocardial infarction. Markers like CK-MB, CPK, SGOT and LDH also play in important in early diagnosis of acute myocardial infarction.

Keywords: Acute myocardial infarction, Biochemical role, Cardiac enzymes, Serum uric acid, MIMS.

Introduction

Acute myocardial infarction (MI) remains a leading cause of morbidity and mortality worldwide. In India cardiovascular disease is the leading cause of death. The deaths due to cardio vascular disease in India were 32% of all deaths in 2007, and are expected to rise from 1.17 million in 1990 and 1.59 million in 2000 to 2.03 million in 2010.1,2 Epidemiological studies have recently shown that uric acid may be a risk factor for cardiovascular disease and a negative prognostic marker for mortality in patients with heart failure or coronary heart disease and of cardiovascular events in these patients.3 Adenosine synthesised locally by vascular smooth muscle in cardiac tissues is rapidly degraded by endothelium to uric acid which undergoes rapid efflux into the vascular lumen due to low intracellular pH and negative membrane potential.4 There is evidence that high serum uric acid levels is a negative prognostic factor in patients with mild to severe heart failure, although the development of hyperuricemia is almost always associated with worsening of renal failure in these patients, some evidence suggests that uric acid may exert a negative effect on cardiovascular disease by stimulating inflammation, which is clearly involved in the pathogenesis of cardiovascular disease.5,8 Patients who developed short-term adverse cardiac events had high uric acid concentrations and one mg/dl increase in serum uric acid levels was associated with a 26% increase in mortality.9

The present study is an attempt to note the levels of serum uric acid in acute myocardial infarction and to note any relationship between serum uric acid level and mortality following acute myocardial infarction. In addition the parameters like cardiac markers are also evaluated which aid in the diagnosis of acute myocardial infarction.

Materials and Methods

Study Design: A Case Control study.

Study Setting: Acute Coronary Unit - Department of Cardiology, MIMS, Nellimarla.

Study Subjects: Patients of acute myocardial infarction who were admitted in Acute Coronary Unit.

Sample Size: Cases – 50 and Controls – 100.

Inclusion Criteria
1. Patient presents with H/O consistent of AMI
2. Age < 65 years
3. Ischemic myocardial pain > 30 min duration, but < 24 hours duration unrelied by nitrates.
4. ECG changes consistent with acute myocardial infarction.

Exclusion Criteria
1. Any patient known with elevated uric acid level, chronic kidney disease, haematological malignancies, hypothyroidism were excluded.
2. Also patients on drugs which increase serum uric acid. E.g: Salicylates, Diuretics, Ethambutol, Pyrazinamide etc.
3. Also chronic alcoholics were excluded.

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Study Period: January 2017 – March 2018
Study Tools: Serum uric acid levels were measured on
day of admission of myocardial infarction and CPK,
CPK-MB, SGOT, LDH were measured on the day of
admission.
1. Controls were also be evaluated for baseline serum
uric acid levels and cardiac enzyme levels.

Method of Estimation
Serum Uric Acid - Uricase - Pod method
Estimation of Creatinine Kinase & Lactate
Dehydrogenase - UV kinetic method
Estimation of SGOT (AST) - UV kinetic (IFCC)
method

Statistical Analysis
Data analysis was performed using SPSS software
(version 17) and Microsoft Excel worksheet 2007.
Categorical variables were represented as
proportions/percentages and quantitative variables were
represented as means and standard deviation. Chi
square tests and independent sample t test were used. A
P value < 0.05 is considered as statistical significance at
95% confidence intervals.

Results
The present study comprises of fifty cases [50] of
acute myocardial infarction and hundred [100] age and
gender matched healthy individuals comprised as
control group.
In the study group males constituted 64% and
females constitute 36% and in controls males constitute
60% and females constitute 40%. There is no statistical
significance between the two groups (Chi square statistic =0.2249) (Table 1)
Majority of the study subjects were between 40 to
60 years of age group. There is no statistical
significance between the two groups (Chi square statistic =0.258) (Table 2)
In the present study, mean value of serum uric acid
among cases is 5.069 mg/dl ±1.244& that of controls is
3.73±0.388. The increase in serum uric acid in patients
of MI is highly significant with a p value of <0.0001
than those in healthy controls. The parameters which
were taken to support the diagnosis [cardiac enzymes]
were also increased significantly in patients than in
those obtained in controls. Serum CPK in cases
255.5±81.6 versus 70.34±31.48 in controls with p value < 0.0003. Serum CK-MB in cases 42.84±19.44 versus
4.12±1.22 in controls with p value < 0.0001. Serum
SGOT in cases 49.13±26.8 versus 25.86±2.9 in controls with p value < 0.0001. Serum LDH in cases
203.87±51.84 versus 77.18±32.3 in controls with p
value < 0.0001. (Table 3)
The mean serum uric acid levels in males
5.426±1.218 is significantly higher than in females
4.726 ±1.058 with P value < 0.01. (Table 4)

Sixteen patients [out of 50] who presented with
acute myocardial infarction were already having H/O
Coronary Artery Disease. They were having higher
serum uric acid levels than those with no prior H/O
coronary artery disease, which is statistically
significant. S. uric acid levels 6.02 ±1.004 in patients
with H/O prior CAD versus levels of 4.124 ±1.117 in
those with no previous history. (Table 5)

Discussion
Present study was conducted in 50 patients of acute
myocardial infarction, who presented to the hospital
within 24 hours of onset of symptoms. They were
studied for uric acid level and its association with acute
myocardial infarction. They were also estimated for
cardiac enzymes as additional parameters which
support the diagnosis. A hundred age and sex matched
healthy controls were also evaluated for comparison of
uric acid and cardiac enzyme levels. Serum uric acid
levels were significantly higher in patients with AMI
compared to healthy controls. (5.069 mg/dl ±1.22
versus 3.73 mg/dl±0.38 [p value <0.0001]). The patients
showed higher serum uric acid level probably because of
acute myocardial infarction. Similar findings were
seen in Kojima S, Sakamoto T et al and MY Nadkar, VI
Jain study.10,11

In the present study males showed higher serum
uric acid levels than females which is statistically
significant. 5.426 mg/dl±1.218±0.175 versus 4.726
mg/dl±1.058±0.203 [p value <0.03] which were
comparable with Kojima S study.10 which showed
males had higher uric acid levels as compared to
females but different from other studies which showed
that hypertensive patients had more hyperuricemia.12,13
Out of 50 patients of acute MI, sixteen patients had
history of coronary artery disease. These patients
showed significantly higher levels of uric acid
compared to those with no previous history of CAD.
6.02 mg/dl ±1.004 versus 4.124 mg/dl± 1.117, p value
<0.0001 which is statistically significant. This was
consistent with previous studies. Kojima et al, MY
Nadkar et al.10,11

While coming to other parameters: The other
parameters like CPK, CK-MB, SGOT, LDH levels
showed a significant raise in acute myocardial
infarction patients compared to healthy controls. Robert
H et al stated that CK-MB must be considered an
important indicator for assessment of re-infarction or
infarct extension.14 In a study conducted by Ian A Katz
et al stated that among patients presenting to the
emergency department within 12h after the onset of
chest pain, with non-diagnostic clinical histories and
ECGs and change in CK-MB mass were the main
predictors of AMI.15
Table 1: Gender distribution of cases and controls

<table>
<thead>
<tr>
<th>Category</th>
<th>Cases (%)</th>
<th>Controls (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>32 (64)</td>
<td>60 (60)</td>
<td>0.6353</td>
</tr>
<tr>
<td>Females</td>
<td>18 (36)</td>
<td>40 (40)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>50 (100)</td>
<td>100 (100)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Age distribution of cases and controls:

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Cases (%)</th>
<th>Controls (%)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>8 (16)</td>
<td>16 (16)</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>20 (40)</td>
<td>36 (36)</td>
<td>0.9677</td>
</tr>
<tr>
<td>50-59</td>
<td>12 (24)</td>
<td>26 (26)</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>10 (20)</td>
<td>22 (22)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Comparison of patients and controls on the day of admission [day-0]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases</th>
<th>Controls</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Uric acid [mg/dl]</td>
<td>Mean ± SD</td>
<td>5.069 ± 1.244</td>
<td>3.73 ± 0.388</td>
</tr>
<tr>
<td>CPK [IU/L]</td>
<td>255.5 ± 81.62</td>
<td>70.34 ± 31.48</td>
<td>&lt;0.0003 Significant</td>
</tr>
<tr>
<td>CK-MB [IU/L]</td>
<td>42.84 ± 19.44</td>
<td>4.12 ± 1.22</td>
<td>&lt;0.0001 Significant</td>
</tr>
<tr>
<td>SGOT [IU/L]</td>
<td>49.13 ± 26.89</td>
<td>25.86 ± 2.93</td>
<td>&lt;0.0001 Significant</td>
</tr>
<tr>
<td>LDH [IU/L]</td>
<td>203.87 ± 51.84</td>
<td>77.18 ± 32.37</td>
<td>&lt;0.0001 Significant</td>
</tr>
</tbody>
</table>

Table 4: Serum uric acid levels in male and female in patients on the day of admission

<table>
<thead>
<tr>
<th>Variable</th>
<th>Male [n=32]</th>
<th>Female [n=18]</th>
<th>P- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Uric acid (mg/dl)</td>
<td>5.426 ± 1.218</td>
<td>4.726 ± 1.058</td>
<td>&lt;0.01 Significant</td>
</tr>
</tbody>
</table>

Table 5: Serum uric acid levels of AMI patients with previous H/O CAD & no previous history

<table>
<thead>
<tr>
<th>Variable</th>
<th>H/O CAD [n=16]</th>
<th>No h/o CAD [n=34]</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. Uric acid (mg/dl)</td>
<td>6.02 ± 1.004</td>
<td>4.124 ± 1.117</td>
<td>&lt;0.0001 Highly significant</td>
</tr>
</tbody>
</table>

Conclusion

The present study showed that the serum uric acid levels are higher in patients of acute myocardial infarction as compared to normal healthy individuals indicating that serum uric acid plays an important role in the early diagnosis of acute myocardial infarction. Markers like CK-MB, CPK, SGOT and LDH also play in important in early diagnosis of acute myocardial infarction.

References


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