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 cardio vascular 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 < 0.010)], higher in male patients compared to females [5.426 ± 1.218 verses 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 cardio vascular 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 unrelieved 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.

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±1.22in 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 ±1.117in 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 verses 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

Category	Cases (%)	Controls (%)	P Value
Males	32(64)	60 (60)	
Females	18 (36)	40 (40)	0.6353
Total	50 (100)	100 (100)	Not Significant

Table 2: Age distribution of cases and controls:

Age in years	Cases (%)	Controls (%)	P Value
30-39	8 (16)	16 (16)	
40-49	20(40)	36 (36)	0.9677
50-59	12 (24)	26 (26)	Not Significant
60-69	10 (20)	22 (22)	

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

Variable	Cases Mean $\pm$ SD	Controls Mean $\pm$ SD	P value
S. Uric acid [mg/dl]	5.069 $\pm$ 1.244	3.73 $\pm$ 0.388	<0.0001 significant
CPK [IU/L]	255.5 $\pm$ 81.62	70.34 $\pm$ 31.48	<0.0003 Significant
CK-MB [IU/L]	42.84 $\pm$ 19.44	4.12 $\pm$ 1.22	<0.0001 Significant
SGOT [IU/L]	49.13 $\pm$ 26.89	25.86 $\pm$ 2.93	<0.0001 Significant
LDH [IU/L]	203.87 $\pm$ 51.84	77.18 $\pm$ 32.37	<0.0001 Significant

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

Variable	Male[n=32]	Female[n=18]	P- value
S. Uric acid (mg/dl)	5.426 $\pm$ 1.218	4.726 $\pm$ 1.058	< 0.01 Significant

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

Variable	H/O CAD [n=16]	No h/o CAD [n=34]	p-value
S. Uric acid (mg/dl)	6.02 $\pm$ 1.004	4.124 $\pm$ 1.117	< 0.0001 Highly significant

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.

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