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ORIGINAL RESEARCH ARTICLE

STUDY OF THE SERUM URIC ACID LEVEL AS PROGNOSTIC INDICATOR IN ACUTE MYOCARDIAL INFARCTION AT A TERTIARY HOSPITAL

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Abstract

Background: Acute myocardial infarction (AMI) is one of the leading causes of mortality and morbidity globally. Though numerous cardiac biomarkers are available, occasionally there may be a need to find a simple & reliable prognostic marker. Present study was aimed to study serum uric acid level as prognostic indicator in acute myocardial infarction at a tertiary hospital.
Material and Methods: Present study was hospital based, cross sectional & observational study, conducted in patients > 18 years of age, ECG findings and biochemical markers suggestive of acute myocardial infarction [ST-segment elevation myocardial infarction (STEMI) OR non-ST segment elevation myocardial infarction (NSTEMI)] as cases. Age and sex matched healthy controls were also be evaluated for baseline serum uric acid level.
Results: Among 112 patients, most common age group was 61-70 years & male to female ratio was 1.5:1. 13 patients (11.31%) had hyperuricemia (serum uric acid >7 mg).According to Killip class 52.68%, 25.89%, 14.29% & 7.14% patients were from Killip class I, II, III & IV respectively. Patients > 60 years, had 5 patients of Killip class 1. Cases had higher uric acid levels than controls (on day 0,3& 7) & difference was statistically significant. We noted rising levels of serum uric acid level in association with Killip class, hyperuricemia (SUA > 7 mg/dl) was common in Killip class III & IV.
Conclusion: Uric acid may be considered as a reliable, non-invasive, easily available and cheap independent prognostic marker in predicting the severity of myocardial infarction along with short term outcome.
Keywords: Hypertension, Killip class, mortality, serum uric acid, myocardial infarction

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Introduction

Acute myocardial infarction (AMI) is one of the leading causes of mortality and morbidity globally[1].The prevalence of CAD in India increased from 1% in 1960 to 9.7% in 1995 in urban populations and, in rural populations, it has almost doubled in the past decade[2].Acute coronary syndrome (ACS) refers to a spectrum of clinical presentations ranging from unstable angina to Myocardial Infarction (MI). MI includes both ST-segment Elevation Myocardial Infarction (STEMI) and Non ST-segment Elevation Myocardial Infarction (NSTEMI). These are differentiated with clinical features, specific ECG changes and Cardiac enzymes like Troponin I & T and CK-MB.

Uric acid is the final breakdown product of purine degradation in humans. Uric acid had been shown to mediate inflammation, induce endothelial dysfunction and stimulate smooth muscle cell proliferation. On the basis of the evidences currently available, it seems fair to suggest that raised oxidative stress is closely associated to cardiovascular events[3].

The role of uric acid as a prognostic marker in cardiovascular syndromes is still controversial. Although the mechanisms by which uric acid may play a pathogenetic role in cardiovascular disease is unclear, hyperuricemia is associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, and aggregation.[4]Though numerous cardiac biomarkers are available, occasionally there may be a need to find a simple & reliable prognostic marker in developing countries where fibrinolytic therapy is still the primary mode of management. Present study was aimed to study serum uric acid level as prognostic indicator in acute myocardial infarction at a tertiary hospital.

Material and Methods

Present study was hospital based, cross sectional & observational study, conducted in Department of General Medicine, Kamineni Institute of Medical Sciences, Narkatpally, India. Study duration was of 2 years (January 2020 to December 2021). The study was approved by institutional ethics committee and informed consent was obtained.

Inclusion criteria

- Patients > 18 years of age, ECG findings and biochemical markers suggestive of acute myocardial infarction [ST-segment elevation myocardial infarction (STEMI) OR non-ST segment elevation myocardial infarction (NSTEMI)] as cases.
- Age and sex matched healthy controls were also be evaluated for baseline serum uric acid level.

Exclusion criteria

- Known causes of elevated uric acid level (chronic kidney disease, gout, haematological malignancy, hypothyroidism, metabolic syndrome, myeloproliferative disease, Lymphoproliferative disease, drugs-pyrazinamide, diuretics, ethambutol, ethanol, malignancy, G6PD deficiency, psoriasis).
- Patients on drugs which increase serum uric acid e.g., salicylates (2 gm/d, hydrochlorothiazide, pyrazinamide).

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The patients satisfying study criteria were informed about the nature of the study in detail and written informed consent was obtained. Patients were interviewed and demographic data, history of present illness, other comorbid conditions, personal history & clinical findings were noted.Investigations carried out were complete blood count, serum uric acid on day 0, 3 & day 5 fasting lipid profile. 12-Lead ECG, CPK-MB, Trop-I (as and when required). 2D ECHO, fasting blood sugar HbA1C were done. Patients were then classified according to clinical signs into Killip Classes.

Data was collected and compiled using Microsoft Excel,analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

Results

In present study 112 patients with myocardial infarction were included.Most common age group was 61-70 years (30.35%) followed by 51-60 years (27.68%) age group. Male patients (59.82%) were more than female patients (40.18%). Male to female ratio was 1.5:1. 13 patients (11.31%) had hyperuricemia (serum uric acid >7 mg).

Table1: Age and sex wise distribution

Age in years	**Cases group**		**Control group**	
	Males (%)	**Females (%)**	**Males (%)**	**Females (%)**
< 40	5 (4.46%)	3 (2.68%)	5 (4.46%)	4 (3.57%)
41-50	11 (9.82%)	4 (3.57%)	13 (11.61%)	4 (3.57%)
51-60	17 (15.18%)	14 (12.5%)	18 (16.07%)	11 (9.82%)
61-70	19 (16.96%)	15 (13.39%)	18 (16.07%)	16 (14.29%)
71-80	13 (11.61%)	8 (7.14%)	11 (9.82%)	9 (8.04%)
>80	2 (1.79%)	1 (0.89%)	2 (1.79%)	1 (0.89%)
Total	67 (59.82%)	45 (40.18%)	67 (59.82%)	45 (40.18%)
Mean ± SD	60.59±12.04		58.90±14.15	

In present study, according to Killip class 52.68%, 25.89%, 14.29% & 7.14% patients were from Killip class I, II, III & IV respectively. Patients > 60 years, had 5 patients of Killip class 1.

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Table 2: Distribution according to Killip class

Age (Years)	Killip class				Total
	I	II	III	IV	
< 40	5 (4.46%)	2 (1.79%)	1 (0.89%)	0	8 (7.14%)
41 – 60	27 (24.11%)	11 (9.82%)	5 (4.46%)	3 (2.68%)	46 (41.07%)
> 60	27 (24.11%)	16 (14.29%)	10 (8.93%)	5 (4.46%)	58 (41.79%)
Total	59 (52.68%)	29 (25.89%)	16 (14.29%)	8 (7.14%)	112

We measured Uric acid in cases (on day 0,3 & 7) and control group (at baseline), Cases had higher uric acid levels than controls, & difference was statistically significant.

Table 3: Comparison of Uric acid in cases and control group

Uric acid	Cases group	Control group	p value
Day 0	7.31 ± 1.49	5.08 ± 1.51	0.014
Day 3	7.04 ± 1.09		0.025
Day 7	6.32 ± 1.16		0.048

We noted rising levels of serum uric acid level in association with Killip class, hyperuricemia (SUA > 7 mg/dl) was common in Killip class III & IV.

Table 4: Killip class and SUA on Day 0

Killip class	Serum uric acid values				
	<4	4.0-5.5	5.6-7.0	>7	Total
I	46 (41.96%)	10 (8.93%)	3 (2.68%)	0	59 (52.68%)
II	18 (16.07%)	7 (6.25%)	4 (3.57%)	0	29 (25.89%)
III	6 (5.36%)	4 (3.57%)	0	6 (5.36%)	16 (14.29%)
IV	0	0	1 (0.89%)	7 (6.25%)	8 (7.14%)
Total	70 (62.5%)	21 (18.75%)	8 (7.14%)	13 (11.61%)	112

Discussion

The average age for myocardial infarction (MI) attack in Indians has decreased by 20 years and about half of the reported cases are below the age of 50 years[5].Of the 17.5 million deaths due to CVD globally, 20% deaths occurred in high income countries, 8%

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in upper-middle income countries, 37% in lower-middle income countries and 35% in low income countries including India[5, 6].

Generally the risk factors of MI are older age, Male sex, Tobacco smoking, Hypercholesterolemia (more accurately hyperlipoproteinemia, especially high-LDL and low-HDL), Hyperhomocysteinemia, Diabetes (with or without insulin resistance), High blood pressure, Obesity (defined by a body mass index > 30 kg/m² or alternatively by waist to hip ratio >0.9 in women &>1.0 in men)[7].

Uric acid inhibits enzymatic endothelial dysfunction and conserves its capability to stimulate vasodilatation during oxidative stress[8].Uric acids can be an indicator of sodium retention accompanied with compromised hemodynamic reserves &/or distressed circulation.[9] Elevated Serum Uric Acid (SUA) level has been recently recognized as a risk factor for the development of the arterial hypertension, subclinical atherosclerosis, stroke and heart failure[10].

LS Patil *et al*.,[11] studied 100 Patients with Acute ST elevation myocardial infraction, mean age of the patients was 58.43±13.77 & male predominance noted. Mean uric acid levels on day 0 is 5.179±1.910, on day 3 is 5.0325 ± 1.755, on day 7 is 4.953 ± 1.446. Uric acid levels was compared with Killip class on day 0 and it is found to be significant (r = 0.7374 and p < 0.0001) and results remain significant on day 3 (r = 0.5898 p<0.0001).In case of patients who expired (n = 20) the mean serum uric acid level was 6.845±2.715 and in other 80 patients was 4.783±1.386 (t=4.828, p<0.0001).Out of 20 patients who expired, 16 patients were having elevated serum uric acid levels (>7mg/dl).

Anil Katdare*et al*.,[12] studied 75 cases of acute MI, mean SUA for discharged patients was 4.67 ±1.95/dl and it was 7.1 ±1.45 mg/dl for the patients who died in the hospital. SUA levels were significantly higher in the patients who succumbed as compared to those who were discharged from the hospital (p = 0.000). There is correlation between serum uric acid level after acute myocardial infarction and age and body mass index.

In study by Kumar N *et al*.,[13] majority of the patients were in the age group of >50 years (68%). There was statistically significant increase in uric acid levels with increasing Killip class on day 0, day 3 and day 7. Mean serum uric acid level was 4.4 mg/dl in Killip class I, 7.01 mg/dl in class II, 8.29 mg/dl in class III, and 9.87 mg/dl in class IV on day 0; 4.46 mg/dl in Killip class I, 7.09 mg/dl in class II, 8.53 mg/dl in class III and 9.43 mg/dl in class IV on day 3; 4.72 mg/dl in Killip class I, 6.62mg/dl in class II, on day 7. There was statistically significant negative correlation (p-value 0.0009, 0.001, 0.0326 at day 0, 3 & 7) between serum uric acid levels and ejection fraction at all the three occasions i.e. day 0, day 3 and day 7. They concluded that serum uric acid level have significant association with Killip class, left ventricular failure and mortality i.e. higher the serum uric acid, higher the Killip class, more severe left ventricular dysfunction and higher the mortality.

Padma V *et al*.,[14] studied 100 patients with acute myocardial infarction and compared with 100 controls. Average uric acid level in males was 5.6 and females was 5.2, male controls were 4.2 and female controls was 3.6. Females (7) had a higher mortality when compared with male (5) patients. All patients who died had higher uric acid levels. Serum uric acid levels are higher in patients of acute myocardial infarction as compared to normal healthy persons. Serum uric levels increases in patients with higher Killip class. Combination of Killip class and serum uric acid level after acute myocardial

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infarction is a good predictor of mortality after acute myocardial infarction.

Shivakumar BG *et al*.,[15] studied 100 patients admitted with acute myocardial infarction within one day of the start of symptoms, majority were > 40 years age and males with the commonest presentation as chest pain. Majority of the patients had inferior wall myocardial infarction (IWMI) (40%) and most (91%) of the patients had left ventricular (LV) dysfunction (mild, moderate and severe). More patients with Killip class III and IV had abnormal uric acid levels as compared to class I, and II. Among 27 patients who expired, 23 were in Killip class III and IV (13 in Killip class III and 10 in class IV) and the mean serum uric acid levels of expired patients were elevated on all the 3 days with maximum elevation on day 1.

In study by Gosar P *et al*.,[16] serum uric acid level was estimated in MI cases (n=60) and compared with control group (healthy subjects) (n=40). Serum uric acid level was significantly higher among AMI patients (6.43±2.60) as compared to control group (4.05±0.95) ($p<0.001$). Majority (46.7%) of the AMI patients had uric acid level of >7.1 followed by 20% patients who had uric acid level between 4.5-5.9 ($p<0.001$). Uric acid level was comparable between smoker and non-smokers ($p=0.803$), alcoholic and non-alcoholic ($p=0.086$), hypertensive and non-hypertensive ($p=0.668$), patients with and without diabetes ($p=0.278$) and patients with a history of IHD and without history of IHD ($p=0.403$).

Hyperuricemia is believed to cause endothelial dysfunction, vasoconstriction, platelet aggregation and act as a potent pro-inflammatory agent in the pathogenesis of atherothrombosis. Higher SUA determined on admission (within 48 hours since the symptom onset) in a cohort of patients from Croatia was independently associated with higher short-term mortality and poorer long-term survival after AMI[17].

Conclusion

Serum uric acid level in association with Killip class is a good predictor of the severity of heart failure and short-term mortality after myocardial infarction. Uric acid may be considered as a reliable, non-invasive, easily available and cheap independent prognostic marker in predicting the severity of myocardial infarction along with short term outcome.

Conflict of Interest: None to declare.
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