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Original Research Article

Study of serum uric acid level as a prognostic marker in acute ST elevation myocardial infarction patients

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ABSTRACT

Background: The study was conducted to correlate serum uric acid levels with Killip class i.e. severity of heart failure in patients with ST elevation myocardial infarction (STEMI) and to assess any influence of serum uric acid levels on in-hospital mortality in STEMI patients.
Methods: Authors evaluated 250 consecutive (STEMI) patients who were hospitalized within 24 hours of symptom onset from September 2015 to august 2017. Detailed history, physical examination was done as per a structured proforma and necessary laboratory investigations were done.
Results: There was significant difference in mean serum uric acid level between diabetic and non-diabetic population. There was significant difference in mean uric acid level between hypertensive and non-hypertensive population. Serum uric acid level was high among STEMI patients with Killip class III and IV and low among patients with Killip class I and II. The higher the uric acid level was, the higher was the percentage of mortality during 5 days hospital course.
Conclusions: Patients of higher Killip class had higher levels of serum uric acid as compared to patients of lower Killip class. Serum uric acid level when combined with Killip class is a good predictor of severity of heart failure and short-term mortality after STEMI.

Keywords: Diabetes, Hypertension, Killip class, Mortality, STEMI, Serum uric acid

INTRODUCTION

Ischaemic heart disease, particularly acute myocardial infarction is the leading cause of death across the world accounting for 12.7 % of global mortality. Low and middle-income countries are now responsible for 80% of global burden of ischaemic heart disease death.

Since the pathophysiology of acute myocardial infarction is complicated, proper risk stratification is essential for appropriate management and better outcome. Serum uric acid levels (SUA) have been correlated with coronary artery calcification and atherosclerosis.[2]

High SUA levels also have been identified as a risk marker for cardiovascular disease development, progression and mortality.[3-6]

But only a few studies have been correlated clinically with the levels of SUA with outcomes in patients with ST elevation myocardial infarction (STEMI).

Objectives of present study were correlate serum uric acid levels with severity of STEMI i.e. Killip class at presentation and to assess any clinical role of serum uric acid levels on in-hospital mortality in STEMI patients.

METHODS

Total 250 consecutive patients of STEMI admitted in dept. of cardiology of IMS and SUM hospital who fulfilled the inclusion and exclusion criteria were included into the study. The study was conducted from September 2015 to august 2017. Valid informed consents were taken from all the patients who were included into this study.

Inclusion criteria

- Age of 18 years or more.
- Diagnosed cases of STEMI getting admitted within 24 hours of onset of symptoms.

Exclusion criteria

- Chronic kidney disease
- Hypothyroidism
- Malignancy
- Gout/other inflammatory diseases
- Use of corticosteroid/cytotoxic drugs
- Chronic alcoholism

STEMI is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with persistent electrocardiographic ST elevation and subsequent release of biomarkers of myocardial necrosis.

Diagnostic ST elevation in the absence of left ventricular hypertrophy or left bundle-branch block (LBBB) is defined by the European Society of Cardiology/ACCF/AHA/World Heart Federation Task Force for the Universal Definition of Myocardial Infarction as new ST elevation at the J point in at least 2 contiguous leads of ≥2 mm (0.2 mV) in men or ≥1.5 mm (0.15 mV) in women in leads V2–V3 and/or of ≥1 mm (0.1 mV) in other contiguous chest leads or the limb leads.[7]

Detailed history and physical examination was done in all patients at the time of admission or within 12 hours and the Killip class at admission was noted for every patient. Relevant investigations (Like blood sugar, HBA1C, lipid profile, complete blood count, serum urea, creatinine, ECG, echocardiography etc.) were done at the time of admission or within 12 hours.

Serum uric acid level was determined within 12 hours of admission (Day 0) and on Day 5 of admission. All data were then analysed statistically.

RESULTS

In present study, total 250 patients of STEMI were studied out of which 138 (55.2%) were Anterior Wall MI, 91 (36.4%) were Inferior Wall MI and 21 (8.4%) were Lateral Wall MI.

There were 17 (7%) patients with age <40 years, 152 (61%) patients with age 40-60 years and 81 (32%) patients with age >60 years. Men-to- women ratio was 181:69 in present study.

Table 1 Patient parameters likely to affect baseline serum uric acid levels on day 0.

Patient parameter	Serum uric acid level Mean±SD	P value
Raised serum LDL (81)	5.1±1.4	0.0666 (statistically not significant)
Normal serum LDL (169)	4.8±1.1	
Diabetic (102)	4.9±1.6	0.0307 (statistically significant)
Non- diabetic (148)	4.5±1.3	
Hypertensive (148)	5.4±1.3	0.0257 (statistically significant)
Non-hypertensive (102)	5.0±1.5	
Raised serum creatinine (72)	4.7±1.7	0.1161 (statistically not significant)
Normal serum creatinine (178)	4.4±1.2	
Raised serum triglyceride (148)	4.9±1.9	0.3749 (statistically not significant)
Normal serum triglyceride (102)	4.7±1.5	
Smoker (78)	4.3±1.4	0.5632 (statistically not significant)
Non-smoker (172)	4.3±1.2	

Table 2: 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	71	38	12	3	124
II	22	27	15	2	66
III	8	7	16	10	41
IV	1	4	6	8	19
Total	102	76	49	23	250

Among 250 patients, hypertension was present in 148 (59.2%) cases, and diabetes mellitus was present in 102 (40.8%) cases. Positive family history of ischemic heart disease was found in 28 (11.2%) patients. 78 (31.2%) patients were regular smokers and abdominal obesity was found in 57 (22.8%) patients.

Table 3: Killip class and SUA on Day 5.

Killip class	Serum uric acid values				
	<4.0	4.0-5.5	5.6-7.0	>7.0	Total
I	121	15	5	1	142
II	2	12	6	0	20
III	6	3	2	1	12
IV	4	3	7	25	39
Total					213

In the present study of 250 patients of STEMI, serum triglyceride levels were elevated in 148 (59.2%) patients, total cholesterol was elevated in 75 (30.0%) patients, LDL cholesterol was elevated in 81(32.4%) patients, HDL cholesterol was low in 127 (50.8%) patients. Mean serum uric acid levels on Day 0 was 5.1±1.3 and on Day 5 was 4.6±1.7. There is significant difference in serum uric acid levels on day 0 between diabetic and non-diabetic patients of the study population (Table 1). The serum uric acid levels on day 0 is also significantly different between hypertensive and non-hypertensive patients. There is no significant difference in SUA levels on day0 between patients with raised serum LDL and normal serum LDL.

There is no significant difference in SUA levels between those with raised serum creatinine and normal serum creatinine. There is no significant difference in SUA levels between those with raised serum TG and normal serum TG. There is no significant difference in SUA levels between smokers and non-smokers of the study population.

Killip class and serum uric acid (SUA) level on Day 0: majority (71 out of 124 patients, 57.26 %) of Killip class I patients were having SUA level < 4.0 mg/dl (Table 2). On the other hand, 42.10 % of patients in Killip class IV had SUA level > 7.0 mg/dl. So, serum uric acid level was low among patients with lower Killip class and high among higher Killip class. This shows SUA level increases with increased severity of heart failure after acute MI.

Table 4: SUA on Day 0 and alive/dead on Day 5.

SUA on Day 0	Alive on Day 5	Dead on/before Day 5	Total
<4.0	91	11	102
4.0-5.5	70	6	76
5.6-7.0	38	11	49
>7.0	14	9	23
	213	37	250

Killip class and serum uric acid (SUA) level on Day 5: 121 (85.21%) patients out of 142 patients in Killip class I had SUA level <4.0 mg/dl (Table 3). On the contrary 64.10% Killip class IV patients were having SUA level >7.0 mg/dl. Here again, SUA level was low among majority of patients with lower Killip class and high among higher Killip class. Thus, SUA level can predict the severity of heart failure after acute MI.

Distribution of study population according to Day 0 serum uric acid (SUA) level and living status (alive/dead) on Day 5: there were total 102 patients with SUA level <4.0 mg/dl on Day 0 (Table 4). Out of them 91 (89.21%) patients were alive on Day 5.

In contrast, out of 14 patients who were having Day 0 SUA >7 mg/dl, 9 patients (64.28%) died by Day 5. So, we can say patients with lower SUA level at admission had higher in-hospital survival rate and those with high SUA level had higher percentage of mortality (Figure 1 and 2).

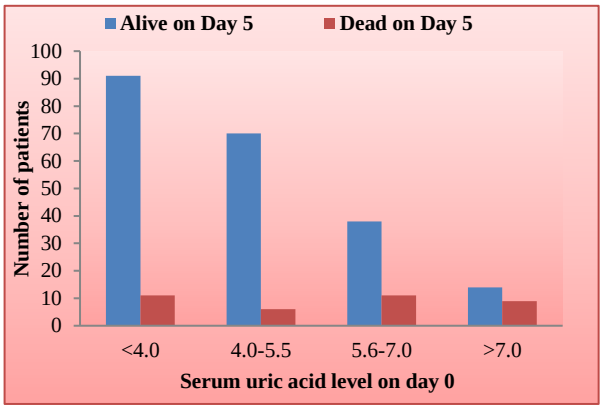

Figure 1: Relation between serum uric acid level on day 0 and number of patients alive or dead on day 5.

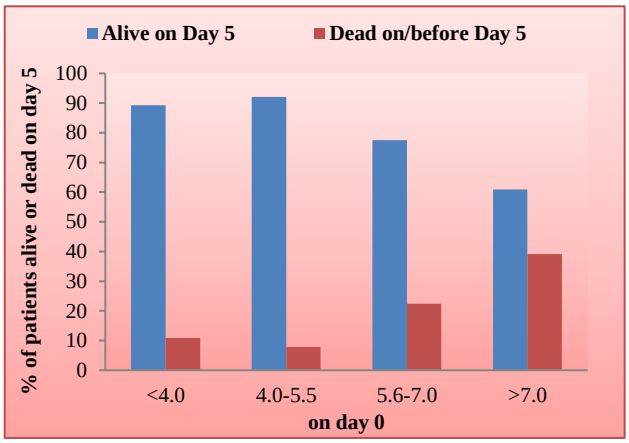

Figure 2: Relation between serum uric acid level on day 0 and % of patients alive or dead on day 5.

Out of 250 patients in the study population, total 37 patients died during 5 days follow up in the hospital. Out of them, 19 were in Killip class IV at admission and their SUA levels were in third and fourth quartile. Twelve patients who were in Killip class III worsened to Killip class IV during hospital stay with simultaneous increase in SUA levels to highest quartile before death. Six patients died suddenly due to malignant arrhythmias without heart failure and their SUA levels were in the middle quartiles.

DISCUSSION

In present study the mean age of presentation of STEMI patients was 50.4±13.1 years, which corroborates with south Asian data where mean age of first acute myocardial infarction was 53.0±11.4.[8] The proportion of patients with <40 years of age in present study was 7% and the proportion was 11.7% in other Indian study.[8] In this study 31% of the patients were active smokers, but

other studies have shown higher frequency of smoking as a risk factor for AMI.[8] Hypertension was the most prevalent AMI risk factor in present study and approximately 59% of the patients were hypertensive. The finding is slightly lower compared to that of Nadkar et al but quite similar to that of many other studies.[9-12] Prevalence of diabetes in present study was 40% which is higher compared to previous studies because the prevalence of diabetes as a risk factor in AMI in South Asia is 20.2% in Interheart study.[13] Thirty two percent of present study population were dyslipidemic which is lower compared to sharma et al study but higher than that of Jafari et al study(18.2%).[10,11] There was a significant correlation (p=0.02) between serum uric acid level and hypertensive patients of the study population. This is consistent with other studies which showed hypertensive patients had more hyperuricemia.[14] There was significant difference in mean serum uric acid levels between diabetic and non-diabetic patients [p=0.03]. Similar finding was there in study by Safi et al which showed that hyperuricaemia is significantly associated with type 2 diabetes mellitus.[15] There was no significant difference in mean uric acid level between the patients of increased triglyceride concentration and normal triglyceride concentration in present study. In the contrary Conen et al had found in their study that serum uric acid level was strongly associated with serum triglyceride.[16] Hyperuricemia was associated with dyslipidemia, especially hypertriglyceridemia in the study of Kang et al.[17]

There was statistically significant correlation found between serum uric acid level and Killip class ($p<0.05$) on day 0 and day 5. More patients of Killip class III and IV had highest quartile of serum uric acid levels and most of the patients belonging to Killip class I were in lower quartile of serum uric acid levels. This means serum uric acid levels are low among patients with lower Killip class and high among patients with higher Killip class. In other words, serum uric acid levels increase with increased severity of heart failure in AMI patients. Thus, serum uric acid levels may predict heart failure severity and prognosis in AMI patients. These findings are consistent with previous studies. Nadkar et al, who found significant increase in the serum uric acid levels in patients with MI and stated that it was a good predictor of mortality in those patients.[9] Sokhanvar S et al concluded that there was a meaningful relation between hyperuricaemia and MI wherein serum uric acid behaved as an independent variable and had no relationship with other risk factors.[18] Jacobs D et al in his study found that hyperuricaemia correlated strongly as an associated risk factor in MI.[19] He stated that serum uric acid is a variable, subject to modification by a large array of complex and often associated factors and suggested that possible risk factors such as hyperuricaemia be assessed and treated as a routine, so as to possibly reduce the incidence of MI. In the present study of 250 STEMI patients, 37 died by the end of day 5 of admission. Out of 37 patients who died, 19 were in Killip class IV at admission and 12 patients went into Killip class IV during 5 days hospital course. All of them had higher quartile of serum uric acid at admission. Hence, it can be concluded that high level of Day 0 uric acid level was significantly associated with high mortality on 5 days follow up and higher the uric acid level, higher the chance of mortality after AMI. This finding is in accordance with Nadkar et al study.[9] In a similar study done by Fang J et al, hyperuricaemia was significantly associated with AMI and they suggested hyperuricaemic levels are independently and significantly associated with risk of cardiac mortality.[20] Though present study was only for 5 days follow up of each patient, it can suggest at least a positive correlation between serum uric acid levels and short term mortality in acute STEMI patients.

CONCLUSION

There was significant difference in mean serum uric acid levels between diabetic and non-diabetic patients of study population on Day 0. There was also significant difference in mean serum uric acid levels on day 0, between hypertensive and non-hypertensive patients. Patients of STEMI with Killip class III and IV had higher levels of uric acid as compared to patients of class I and II at admission and during hospital stay. After STEMI, serum uric acid levels when combined with Killip class is a good predictor of severity heart failure and subsequent short-term mortality.

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