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ORIGINAL RESEARCH

Serum Uric Acid Level in Predicting Outcome in Acute Myocardial Infarction: A Prospective Study from North India

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ABSTRACT

Background: In India, cardiovascular disease (CVD) is the main cause of morbidity and mortality. According to recent trends, this group of disorders has expanded to younger age groups as well. Cardiovascular illnesses are on the rise in India, affecting both men and women in both urban and rural areas. The objective of this study was to analyse serum uric acid levels correlate these values with Killip class in patients of acute MI.

Materials and Methods: Study was prospective type conducted at Dr. Baba SahebAmbedkar Medical College and Hospital, Rohini, New Delhi from September 2016 to August 2017. A total of 100 patients of acute MI admitted to the ICCU, falling into inclusion criteria were enrolled. Information was collected through a pre tested and structured proforma for each patient. Also, physical examination and laboratory investigation with special reference to Killip classification of heart failure was carried out. During data analysis, a p value of <0.05 was considered statistically significant.

Results: Mean age of population 54.77 years. This study population had male predominance (69.0%). In our study out of 100 patients 85 (85%) patients were STEMI and 15 (15%) patients were NSTEMI. Mean uric acid on day 7 in patients with Killip class I was 4.72 mg/dl and subjects with Killip class II was 6.62 mg/dl. In multivariate logistics regression no factors were significantly affecting mortality after adjusting for confounding factors.

Conclusion: From our study, we conclude that serum uric acid levels are correlated with Killip class and patients with higher Killip class have higher serum uric acid levels in acute myocardial infraction.

Keywords: Acute Myocardial Infarction, Cardiovascular disease, Uric Acid level.

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INTRODUCTION

In India, cardiovascular disease (CVD) is the main cause of morbidity and mortality. According to recent trends, this group of disorders has expanded to younger age groups as well. Cardiovascular illnesses are on the rise in India, affecting both men and women in both

urban and rural areas. According to data, the condition is now more prevalent in rural areas outside of the stereotyped urban areas, implying that as the disease matures and gains a stronger grip in the country, it will expand to all sections of the community, affecting the entire society.[1,2]

The socioeconomic gradient for CVD is increasingly reversing, with the poor and disadvantaged bearing an equal, if not greater, burden of CVD and associated risk factors. This could be due to the transition in lifestyle, food choices, a lack of health-care facilities, and other factors in the lower strata. In India, 1.17 million people died from cardiovascular disease in 1990. CVD develops almost ten years sooner on average in the Indian subcontinent than in the rest of the world, in addition to the high prevalence of CVD death.[3,4]

In humans, uric acid is the ultimate result of purine catabolism. Urates, the ionised form of uric acid, predominate in plasma extracellular fluid and synovial fluid, with monosodium urate accounting for 98 percent of the total at pH 7.4. In addition to the risk of gout and nephrolithiasis, there is mounting evidence that hyperuricemia may have a role in the aetiology of CVD, either directly or indirectly.[5]

SUA is known to serve as an antioxidant in the early stages of the atherosclerosis process, but tragically, as the atherosclerotic process continues and serum uric acid levels rise, the formerly antioxidant becomes a pro-oxidant. The rate-limiting enzyme for uric acid production, xanthine oxidase, has been reported in endothelial cells and smooth muscle cells of arteries. Uric acid produced as a result causes free radial injury to the vascular endothelium, contributing to the development of degenerative vascular disease and the exacerbation of acute thrombosis.[6,7]

The objective of this study was to analyse serum uric acid levels on days 0 and 7 and correlate these values with Killip class in 100 patients of acute MI and to determine a relevant correlation between serum uric acid and prognosis.

MATERIALS & METHODS

Study was prospective type conducted at Dr. Baba SahebAmbedkar Medical College and Hospital, Rohini, New Delhi from September 2016 to August 2017. The study protocol was approved by Dr. Baba SahebAmbedkar Medical College ethics committee and written informed consent was obtained from all subjects prior to participation. A total of 100 patients of acute MI admitted to the ICCU, Department of Medicine were enrolled in the study after with inclusion criteria as all new cases (age 18 years or above) of acute MI patients having acute chest pain within 12 hrs of presentation with ECG and Trop I suggestive of STEMI or NSTEMI. Patients with atypical chest pain; unstable angina; cardiogenic shock; pacemaker; valvular heart diseases; psychosomatic illness, panic disorder, hysterical patients; chronic kidney disease, gout or haematological malignancy; on drugs such as high dose salicylates, diuretics, ethambutol, cytotoxic drugs, telmisartan, pyrazinamide, corticosteroids and hydrochlorothiazide were not included in the study.

Information was collected through a pre tested and structured proforma for each patient, after taking informed consent. In all the selected patients detailed history and physical examination with special reference to Killip classification of heart failure was carried out. Each patient undergone investigation such as complete blood picture (including haemoglobin, TLC, DLC, ESR); baseline and subsequent serial 12 lead ECGs; 2D Echo Doppler; random blood sugar; blood urea; serum creatinine; serum uric acid on day 0,3 and 7; Trop I on admission; Lipid profile; serum TSH and USG whole abdomen for kidney size.

The data were collected and collated in Microsoft excel sheet. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD. Quantitative variables were compared using unpaired t-test between the two groups and ANOVA among more than two groups. Univariate and multivariate logistic regression was

used to assess the risk factors of mortality. A p value of <0.05 was considered statistically significant.

RESULTS

In this present study majority of the patients are in the age group of 51-60 years (45%) followed by age group of 41-50 years (21%). Mean age of population 54.77 years. This study population had male predominance (69.0%). In this present study 47 (47%) patients had BMI in range of 30-34.9 kg/m2 followed by 40 (40%) patients had BMI in range of 25-29.9 kg/m^2. In this present study 47(47%) patients were diabetics, and history of smoking was seen in 59 patients. In our study out of 100 patients 85 (85%) patients were STEMI and 15 (15%) patients were NSTEMI. Among STEMI, AWMI was the commonest presentation in 47 (47%) of patients followed by IWMI seen in 19 (19%) patients. In this present study out of 76 patients were thrombolysed and remaining were not thrombolysed due to contraindications. (Table 1).

Table 1:Baseline characteristics distribution of study subjects (N=100).

Variables	Frequency	Percentage (%)
Age group		
<40 years	11	11.00
41-50 years	21	21.00
51-60 years	45	45.00
61-70 years	17	17.00
71-80 years	6	6.00
Gender		
Female	31	31.00
Male	69	69.00
BMI (Kg/m^2)		
<18.5	0	0
18.5-24.9	11	11
25-29.9	40	40
30-34.9	47	47
>35	2	2
Comorbidities		
Diabetes	47	47.00
Hypertension	41	41.00
History of stroke	6	6.00
History of smoking	59	59.00
History of alcohol intake	20	20
Type of Myocardial Infraction based on ECG		
ALMI	9	9.00
ASMI	5	5.00
AWMI	47	47.00
IWMI	19	19.00
IWMI+RVMI	3	3.00
NSTEMI	15	15.00
PWMI	2	2.00
Thrombolysis done		
No	24	24.0
Yes	76	76.0

Table 2: Comparison of KILIP class with uric acid levels on day 0, day 3 and day 7 with among study subjects (N=100).

Uric acid (mg/dl)	KILIP class				P value
	1	2	3	4	
Day 0					
Number (n=100)	57	16	14	13	<.0001
Mean ± SD	4.4 ± 0.78	7.01 ± 1.12	8.29 ± 0.5	9.87 ± 0.44	
Day 3					
Number (n=100)	65	22	6	7	<.0001
Mean ± SD	4.46 ± 0.79	7.09 ± 0.89	8.53 ± 0.7	9.43 ± 0.8	
Day 7					
Number (n=94)*	89	5	0	0	<.0001
Mean ± SD	4.72 ± 0.77	6.62 ± 1.01	-	-	

*6 mortalities

Mean uric acid level in patients on day 0 (9.87 mg/dl) and 3 (9.43 mg/dl) highest in KILIP class IV and there was statistically significant difference in uric acid levels with increasing levels on Killip class on day 0, and 3. Mean uric acid on day 7 in patients with Killip class I was 4.72 mg/dl and subjects with Killip class II was 6.62 mg/dl. There was statistical significant difference in uric acid levels with increasing Killip class on day 7 (Table 2).

Table 3: Comparison of KILIP class with uric acid levels (quartiles) on day 0, day 3 and day 7 with among study subjects (N=100).

KILIP class	Uric acid (mg/dl)			
	≤ 4	4.1-5.5	5.6-7.0	>7
Day 0	n=17	n=36	n=9	n=37
1 (n=57)	17	36	4	0
2 (n=16)	0	1	5	10
3 (n=14)	0	0	0	14
4 (n=13)	0	0	0	13
Day 3	n=20	n=45	n=9	n=37
1 (n=65)	20	43	2	0
2 (n=22)	0	2	7	13
3 (n=6)	0	0	0	6
4 (n=7)	0	0	0	7
Day 7	n=15	n=63	n=14	n=2
1 (n=89)	15	62	12	0
2 (n=5)	0	1	2	2

In this study on day 0 and day 3, majority of patients (92% and 97% respectively), who belonged to Killip class I had serum uric acid levels in <5.5 mg/dl i.e. in lower two quartiles, whereas patients in Killip class III and IV all patients (100%) had uric acid values in upper fourth quartile. It was found that on day 7, 94 (94%) patients were alive and 6 (6%) patients expired. Out of 94 patients, 89 patients were in Killip class I and 5 patients were in Killip class II and there were no patients in Killip class III and IV.

Table 4: Univariate logistic regression for predicting risk factors of mortality among study subjects (N=100).

Variables	95% C.I. for Odds Ratio		P Value	Odds Ratio
	Lower	Upper		
Male	.262	20.950	.446	2.344
Diabetes Mellitus	.414	13.585	.332	2.372
Hypertension	.282	7.692	.646	1.474
History of stroke	.048	18.887	.976	0.955
History of smoking	.552	184.175	.119	10.084
History of alcohol intake	.841	24.407	.079	4.529
Thrombolysis done	0.245	83.179	0.31	4.518
Age	.923	1.065	.807	.991
BMI	.707	1.173	.469	.911
Uric acid level at Day 0	1.516	82.200	.018*	11.162
Uric acid level at Day 3	1.881	534.392	.016*	31.703
Haemoglobin	.446	1.398	.417	.789
Total Count	1.000	1.000	.377	1.000
Random blood sugar	1.004	1.027	.009*	1.015
Blood urea	.965	1.091	.407	1.026
Serum creatinine	.095	129.246	.495	3.508
Total Cholesterol	.992	1.017	.449	1.005
High Density Lipoprotein (HDL)	.831	1.029	.151	.925
Triglycerides (TG)	.991	1.025	.371	1.008
2D-ECHO	.792	1.134	.559	.948
KILIP class at day 0	0.045	21.377	0.993	.510
KILIP class at day 3	2.647	41.416	.001*	10.470

*Statistically significant

During univariate logistics regression analysis, it was found that serum uric acid on day 0, day 3, random blood sugar and Killip class on day 3 were significant risk factors of mortality. With increase in serum uric acid by 1 unit on day 0 and day 3, risk of mortality increases with odds ratio of 11.162 and 31.703 respectively.

Table 5: Multivariate logistic regression predicting risk factors of mortality among study subjects (N=100).

Variables	95% C.I. for Odds Ratio		P Value	Adjusted Odds Ratio
	Lower	Upper		
Uric acid level at Day 0	0.315	4.899	.756	1.243
Uric acid level at Day 3	0.483	3369.131	.101	40.345
Random blood sugar	0.975	1.017	.689	0.996
KILIP class at day 3	0.026	17.349	.813	0.676

In multivariate logistics regression no factors were significantly affecting mortality after adjusting for confounding factors.

DISCUSSION

Uric acid's relevance as a risk factor for myocardial infarction is debatable. Numerous studies have linked hyperuricemia to a higher risk of cardiovascular disease.[8,9] The association of serum uric acid level with cardiovascular disease was uncertain after multivariate adjustment

in a few studies, such as the Framingham Heart Study (1985) and the ARIC (Atherosclerosis Risk in Community) study (1996), and most medical societies do not consider serum uric acid level as a cardiovascular risk factor, but the association remained certain and significant in a few other studies.[9] Serum uric acid levels have been shown to rise in heart failure in studies done by Kojima et al. and Nadkar et al. and it was observed in those studies that serum uric acid correlates with Killip class.[10,11]

As a result, we considered these studies as a benchmark for evaluating this method for combining Killip class and serum uric acid levels as a predictive predictor in patients with acute myocardial infarction. We found a significant relationship between uric acid level and Killip class, as well as a significant correlation between serum uric acid and the severity of left ventricular failure on the day of admission (day 0), day 3, and day 7 in patients admitted to this hospital with acute myocardial infarction. In this study, a total of 100 patients were included, ranging in age from 28 to 80 years old. Patients were 54.77±11.44 years old on average. Males account for 69 percent of the population, while females account for 31 percent. These findings are consistent with those of earlier research. According to previous research, males are more likely than females to suffer from myocardial infarction.

All of the patients in this study were classified into different Killip classes based on their clinical course on the day of admission (day 0), day 3, and day 7. On day 0 of the study, more than half of the patients (57%) were classified as Killip class I, 16% as Killip class II, 14% as Killip class III, and 13% as Killip class IV. Similar, results were obtained in studies conducted by Nadkar et al. and Gandaiah et al. in which the majority of patients were Killip class I on the day of admission.[11,12] In this study, the mean uric acid level on the day of admission was greater than the mean uric acid level on day 7. This finding was consistent with Shetty et al. and Agarwal et al., but not with Nadkar et al.[11,13,14] It can be explained by the fact that on day 7, all of the patients in this study were classified as Killip classes I or II, resulting in decreased mean uric acid levels.

In this study, the mean uric acid level in different Killip classes was computed and compared. On day 0, day 3, and day 7, we discovered a statistically significant (0.0001) link between an increase in Killip class and an increase in mean uric acid level. Higher Kiliip class subjects had higher serum uric acid levels, according to Nadkar et al., Shetty et al., Agarwal et al. and Gandaiah et al.[11-14] The mortality of different Killip classes was investigated in this study, and it was discovered that 6 had died during the 7-day follow-up period. On the day of admission, these patients belonged to the Killip class IV subset. (The mean uric acid level was >9 mg/dl.) Patients with a higher Killip class had a higher mortality rate, and a higher Killip class had a higher mean uric acid level.

In the current study, it was found that serum uric acid on day 0, day 3, random blood sugar, and Killip class on day 3 were significant risk factors of mortality during univariate logistic regression analysis, but no factors were significantly affecting mortality after adjusting for confounding factors during multivariate logistic regression analysis. Whereas multivariate logistic regression analysis in Omidvar et al. study showed an odds ratio of 15.23 for in-hospital mortality and an odds ratio of 3.76 for short-term mortality in male hyperuricemic patients.[15] It is also suggested that in the acute phase of ST-elevation myocardial infarction, uric acid has a prognostic role for in-hospital and short-term (30-day) mortality in men. As a result, it's possible that mean serum uric acid levels rise as the Killip class rises, and that patients with higher mean uric acid on admission have a greater mortality rate.

CONCLUSION

From our study, we conclude that serum uric acid levels are correlated with Killip class and patients with higher Killip class have higher serum uric acid levels in acute myocardial infraction. Hyperuricemia is an indicator of poor prognosis in myocardial infraction. Serum uric acid can be used as a marker of short-term mortality in myocardial infraction. Serum uric acid is an economical biomarker that is readily, quickly and reliably obtainable and thus along with Killip's classification should be considered for risk stratification in patients with myocardial infraction. However, this study is limited by relatively small study population and needs to be supplanted by other similar studies.

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