Original Article

An analytical Study to Evaluate the correlation between Serum Uric Acid Levels and Deaths in Acute Myocardial Infarction Patients at a Tertiary Level Institute Catering to Rural Population of Western Maharashtra

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Abstract:

Background: Cardiovascular diseases are the number one cause of mortality all over the world. Elevated serum uric acid is highly predictive of mortality in patients with heart failure or coronary artery disease. We conducted this study to assess serum uric acid levels on admission as a potential predictor of short-term mortality (7 days) in acute myocardial infarction patients. **Methodology:** Total of 200 patients diagnosed with the myocardial infarction (MI) in our hospital along with 200 age and gender matched controls were selected for this study. The clinical history, examination, ECG changes and biochemical markers were evaluated on day 0, 3 and 7. Association with Killips class and mortality in STEMI / NSTEMI cases was done. **Results:** The study had 200 cases and 200 controls. The mean age of cases was 62.54 ± 18.24 years and controls were 61.94±17.25 years. There were majority males among both cases 114 (57%) and controls 112 (56%). The patients were classified using Killip's class. Majority belong to class I 98 (49%) followed by II 42 (21%). There were 26 (13%) of class III and 34 (17%) into class IV. There is significant difference seen between uric acid levels of cases and control on day 1, 3 and 7 ($p<0.001$). There was 25% mortality (50 deaths) seen among the cases. There was association seen between Killips class III & IV and mortality, there was higher mortality seen in STEMI as compared to NSTEMI (i.e. $p<0.05$). **Conclusion:** Our study concludes that the serum uric acid (SUA) levels have significant association with Killip's class and mortality in Acute Myocardial Infarction cases.

Key words: Serum Uric Acid, Acute Myocardial Infarction, Killip's class, STEMI, NSTEMI

Introduction:

Cardiovascular diseases are the number one cause of mortality all over the world. An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke.[1] India also accounts a major part of global burden of cardiovascular deaths.[2] In Myocardial infarction (MI) some proteins and enzymes labelled as cardiac markers (CPK-MB/ Troponin T & I) are released in to the blood in large quantity from necrotic heart muscle. These markers viz. CPK-MB, Troponin-T, Troponin-I and myoglobin, have specific temporal profile in relation to MI, however, they do not correlate with myocardial function.[3] Whereas, elevated serum uric acid is highly predictive of mortality in patients with heart failure or coronary artery disease and of cardiovascular events in patients. Epidemiological studies have recently shown that the SUA (serum uric acid) may be a risk factor for cardiovascular diseases and a negative prognostic marker for mortality in subjects with pre-existing heart failure.[4, 5]

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Uric acid is formed when the body breaks down purine nucleotides. Adenosine synthesized locally by vascular smooth muscle in cardiac tissue is rapidly degraded by the endothelium to uric acid, which undergoes rapid efflux to the vascular lumen due to low intracellular pH and negative membrane potential Xanthine oxidase activity and uric acid synthesis are increased in vivo under ischemic conditions, and therefore elevated serum uric acid may act as a marker of underlying tissue ischemia.[6,7]

Although the mechanisms by which uric acid may play a pathogenetic role in cardiovascular disease is unclear, hyperuricaemia is associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, hemorheology, and aggregation. There is also evidence that high uric acid is a negative prognostic factor in patients with mild to severe heart failure.[8,9]

Studies done in Japan (Japanese Acute Coronary Syndrome Study) showed that there was a close correlation between serum uric acid concentration and Killip's classification in patients of acute myocardial infarction. Patients who developed short-term adverse events had high uric acid concentrations.[10,11]

Methodology:

The current study was planned to evaluate the role of serum uric acid in acute myocardial infarction as a prognostic marker.

Aims & objectives

To assess serum uric acid levels on admission as a potential predictor of short-term mortality (7 days) in acute myocardial infarction patients.

We conducted this study from January 2019 to December 2020. Total of 200 patients diagnosed with the myocardial infarction (MI) in our hospital along with 200 age and gender matched controls were selected for this study. The study was conducted among patients who were more than 18 years of age and diagnosed as ST segment elevation acute myocardial infarction (STEMI) or non-ST segment elevation acute myocardial infarction (NSTEMI) on the basis of clinical history, examination, ECG changes and biochemical markers were evaluated. We excluded cases with Chronic kidney disease, Gout, Hematological Malignancy, Hypothyroidism, Drugs- Salicylates, Diuretics, Ethambutol, Pyrazinamide etc., Chronic Alcoholics and Diagnosed cases of hyperuricemia. The controls were also be evaluated for baseline serum uric acid level who were among the non-cardiac and non-renal cases admitted in the hospital and few healthy volunteers. Majority of the subjects in control group were lacto-vegetarian with occasional non-veg diet. Serum uric acid levels were compared with the cases. Uric acid levels of <6.5mg%, 6.51-8.5mg %, >8.5mg% were classified as low risk, moderate risk and high risk respectively.[12] The levels of uric acid were checked on day 0, 3, 7 of admission.

The study was approved by the Institutional Ethics Committee, written informed consent of both the groups was taken for participation in study. The patients after meeting the inclusion criteria were evaluated by taking detail clinical history and examination and serum uric acid levels on day 0, 3, 7 were measured. Blood samples were taken immediately after admission in hospital. Association with Killips class and mortality in STEMI/ NSTEMI cases was done.

Data was entered in Microsoft excel 2013, data was analysed using SPSS version 22 and Epi Info version 7.2.1. Qualitative data is represented in frequencies and percentages, graphs and charts, quantitative data is represented in mean and SD. Students t test and fishers exact test are used for analysis with considering significant p value of <0.05.

Killip's classification [13]

Class I - No evidence of heart failure

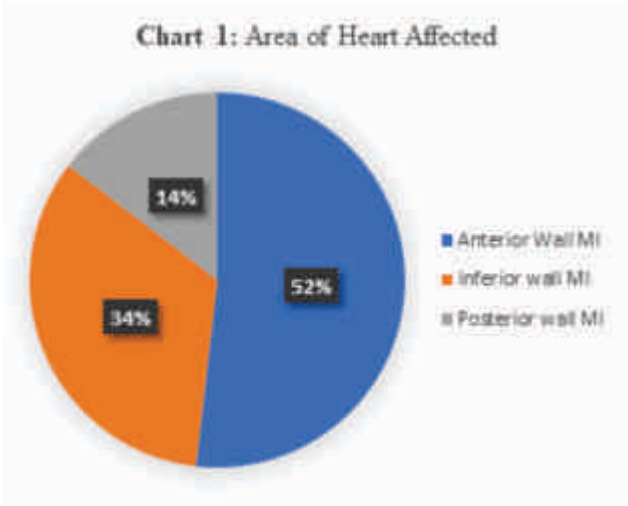
Class II - Findings consistent with mild to moderate heart failure (eg, S3 gallop, lung rales less than one-half way up the posterior lung fields, or jugular venous distension)

Class III - Overt pulmonary edema

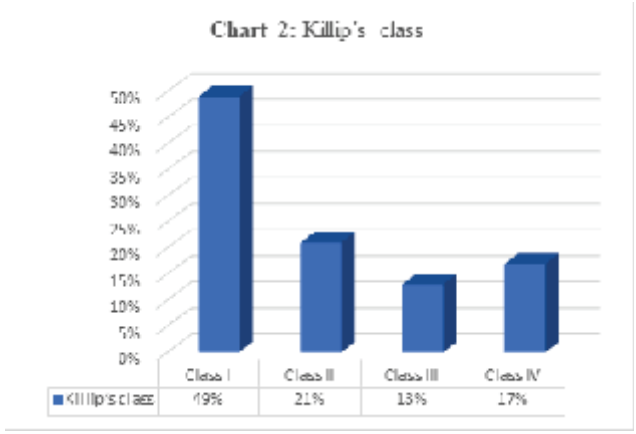
Class IV - Cardiogenic shock

Results:

The study had 200 cases and 200 controls. The mean age of cases was 62.54 ± 18.24 years and controls were 61.94±17.25 years. There were majority males among both cases 114 (57%) and controls 112 (56%). There was total 160, 80% cases of STEMI and 40, 20% NSTEMI in cases. There were majority patients of anterior wall MI (52%) followed by inferior wall (34%) and posterior wall (14%). **(Chart. 1)**



The patients were classified using Killip's class. Majority belong to class I 98 (49%) followed by II 42 (21%). There were 26 (13%) of class III and 34 (17%) into class IV. (Chart. 2)



There is significant difference seen between uric acid levels of cases and control on day 1, 3 and 7 ($p<0.001$). Uric acid levels in cases on day 1 were 7.03 ± 1.54 gm/dL, significantly higher than in controls of 1.77 ± 1.15 gm/dL. Uric acid levels in cases on day 3 were 6.12 ± 1.67 gm/dL, significantly higher than in controls of 1.21 ± 1.58 gm/dL. Uric acid levels in cases on day 7 were 5.85 ± 1.26 gm/dL, significantly higher than in controls of 1.24 ± 0.58 gm/dL. **(Table 1)**

Table 1: Comparison of Uric acid in cases and control group

Uric acid (gm/dL)	Cases group (200)	Control group (200)	p value
	Mean ± SD	Mean ± SD	
Day 1	7.03 ± 1.54	1.77 ± 1.15	p < 0.001*
Day 3	6.12 ± 1.67	1.21 ± 1.58	p < 0.001*
Day 7	5.85 ± 1.26	1.24 ± 0.58	p < 0.001*

*Significant

There was 25% mortality (50 deaths) seen among the cases. There was association seen between Killips class III & IV and mortality, there was higher mortality seen in STEMI as compared to NSTEMI (i.e. $p<0.05$). Table 2 shows association between Killips class and mortality. Significantly higher mortality seen in STEMI and at Killips class IV cases.

Table 2: Association with Killips class and mortality in STEMI / NSTEMI in 50 patients who died

Killip's class	STEMI	NSTEMI	Total
	Mortality	Mortality	Mortality
III	07 (28.57%)	1 (25%)	8 (34.78%)
IV	19 (71.43%)	3 (75%)	21 (65.22%)
Total	**26 / 28 (91.30%)**	**4 /22 (8.70%)**	**50/50 (100%)**

($p < 0.05$)

Discussion

Coronary artery disease (CAD) is the leading cause of mortality and morbidity in present days, all necessary levels of prevention should be actively practiced by physicians to reduce the mortality associated with the cardiac events of Acute myocardial infarction. Predicting the raised serum uric acid levels and acting promptly is the tertiary level prevention of preventing the complications of death from acute myocardial infarction.[5,8] Higher serum UA levels were also seen associated with more complications in AMI cases like that was observed by **S Watanabe et al**[14], who evaluated 612 cases of AMI, and found that Elevated serum uric acid is associated with higher frequency of reperfusion ventricular arrhythmia and deaths in patients.

We observed that the mean age of cases was 62.54 ± 18.24 years. There were majority males among both cases 114 (57%) and controls 112 (56%). There was total 160, 80% cases of STEMI and 40, 20% NSTEMI in cases. **Kumar N et al** [15] had 68% cases more than 50 years of age, with mean age of 59.94 ± 12.84 years and 58% males in their study.

We observed that there were majority patients of anterior wall MI (57%) followed by inferior wall (37%) and posterior wall (16%).

The patients were classified using Killip's class. Majority belong to class I 122 (61%) followed by IV 38 (19%). There were 26 (13%) of class II and 14 (7%) into class III.

We observed a significant difference seen between uric acid levels of cases and control on day 1, 3 and 7. Significantly higher mortality seen in STEMI and at Killips class IV cases.

Kumar N et al[15] observed that there was statistically significant increase in uric acid levels with the increase in Killip class on subsequent days 0, day 3 and day 7. Mean SUA levels were 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, 6.62 mg/dl in class II, on day 7. Thus, significant increase was observed associated with higher Killip class.

M Y Nadkar et al[16] studied 100 patients with acute myocardial infarction and 50 controls in a tertiary level hospital and teaching institute in Mumbai, Maharashtra. Serum uric acid level was measured on day 0, 3 & 7 of MI. They observed that there was a statistically significant higher level of serum uric acid concentration in patients of MI on day of admission as compared to controls, these findings are consistent with our results. They observed that all the five patients who had died after 3 days of hospital stay had SUA level more than 7.0 gm/dL and all of them were from the Killip class IV.

Conclusion:

Our study concludes that the serum uric acid (SUA) levels have significant association with Killip class and mortality in Acute Myocardial Infarction cases i.e. higher the SUA levels, higher the Killip class, and higher the mortality. The present study focuses on the importance of SUA estimation in acute myocardial infarction and its importance as a tertiary prevention tool in AMI cases.

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Conflicts of interest: None

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