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Original Article

Serum Uric Acid as a Prognostic Factor of Acute Myocardial Infarction in Hospitalized Patients

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Abstract

Background: Among non-communicable diseases, acute myocardial infarction (AMI) is a common killer of people in the world. The management of AMI patients is one of the major challenges in the field of cardiology. Uric acid has several effects of potential interest in cardiovascular disease. There are some markers indicating an unfavorable prognosis in AMI patients. Uric acid is one of the markers that have been evaluated in research.

Objective: The aim of this study was to assess the association between serum uric acid level and in-hospital outcomes of AMI patients.

Patients and methods: This longitudinal descriptive study was conducted over 115 AMI patients in the Cardiology Unit of Rajshahi Medical College Hospital during the period of January 2015 to December 2016. Baseline characteristics such as age, sex, BMI, BP, RBS, risk factors (hypertension, DM, smoking, family history of IHD, dyslipidemia), and outcomes of AMI patients (acute LVF, arrhythmia, conduction block, cardiogenic shock, death) were recorded. We measured the serum uric acid of this patient at admission.

Results: The mean age of patients was 52.83±10.71 years. Out of 115 patients, 83.5% were male, and 16.5% were female. Among the risk factors, 65.2% of patients had HTN, 20.9% DM, 64.3% smoking, 16.5% family history of IHD, and 47.8% dyslipidemia. Out of 115, 35.7% of patients demonstrated high serum uric acid. In outcomes of AMI patients, acute LVF 24.4% (p=0.031) and death 12.2% (p=0.041) were significantly higher in patients with high serum uric acid levels.

Conclusion: Significant association was found between high serum uric acid level and in-hospital outcomes of AMI patients. So, estimation of serum uric acid may offer an inexpensive, quick, and non-invasive method for identifying such high-risk patients.

Keywords: Serum uric acid, Acute myocardial infarction, Acute LVF, Death.

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Introduction

Acute coronary syndromes (ACS) remain a leading cause of morbidity and mortality worldwide.[1] Acute Myocardial infarction (AMI) (encompassing ST-segment elevation myocardial infarction, non-ST segment elevation myocardial infarction) is the leading cause of death in developed countries and the second leading cause

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of death in developing countries. By the year 2020, CAD will hold first place in the WHO's list of the leading cause of disability.[2,3]

The South Asian countries of India, Pakistan, Bangladesh, Srilanka, and Nepal contribute the highest proportion of the burden of cardiovascular diseases (CVDs) compared to any other region globally.[4] In India, 4% rural and 11% urban populations suffer from CAD.[5]

Being a South Asian country, Bangladesh is not immune to this higher prevalence of CAD. Estimates from the global burden of disease study suggest that by the year 2020, this part of the world will have more individuals with atherosclerotic cardiovascular disease than any other region.[6]

Serum uric acid is produced by the enzymatic activity of xanthine oxidase and is the final product of purine metabolism. Xanthine oxidase produces oxidants in this process that may have a role in cardiovascular disease. Some studies suggested that uric acid can cause intracellular stress and inflammation leading to endothelial injury and enhancement of vasoconstrictor effects.[7]

It is well known that smoking, hypertension, diabetes mellitus, dyslipidemia, family history of premature CAD, and obesity are the most important risk factors for CAD. Risk factors of AMI in younger people (<40 years) was observed in a study in our country, where smoking and triglyceride were found to be strikingly associated risk factors for AMI in that group.[8,9]

As the causes of disease in patients with acute myocardial infarction (MI) vary widely, accurate risk stratification to determine appropriate management and improve outcomes is essential.[10] Increased serum uric acid levels are linked to obesity, dyslipidemia, and hypertension, all of which are also associated with increased risk for cardiovascular disease.[11] However, the specific role of serum uric acid in this constellation remains uncertain.[12]

Several studies have investigated whether serum uric acid (SUA) is an independent marker of cardiovascular disease (CVD) risk.[13,14,15] Most prospective studies found a positive association between SUA and CVD mortality as well as all-cause mortality.[14,16] This study was designed to find out the association between serum uric acid level and in-hospital outcomes (acute LVF, arrhythmia, conduction block, cardiogenic shock, death) of AMI patients.

Materials and Methods

This was a longitudinal descriptive study carried out in Cardiology Department, Rajshahi Medical College Hospital, Rajshahi. The duration of the study was two years, from January 2015 to December 2016. A purposive sampling method was done. Acute myocardial infarction patients admitted in the Cardiology ward within the study period and who fulfill the inclusion criteria were enrolled.

With the consent of the concerned authority, the data was collected from the respondents according to a questionnaire by face to face interview. All patients were admitted within 8 hours of the onset of symptoms, treatment was started within 1 hour of admission, streptokinase was given for STEMI, and LMW heparin was given for NSTEMI. A complete history was taken, and thorough clinical examination with measurement of pulse, respiratory rate, and basal crepitation was done by standard method. Blood pressure was measured in lying position after 5 minutes of rest. Measurement of height and weight was done for the calculation of BMI. The patients' blood sample was collected for measurement of fasting uric acid level, random blood sugar and fasting lipid profile. Normal serum uric acid level is <7 mg/dl in men and <6 mg/dl in women. Follow-up was given for up to hospital stay to see the complications of AMI patients. All relevant clinical examination findings and laboratory results were recorded in a case record form.

Results

One hundred fifteen patients were included in this study.

Table-1: Baseline characteristics of study population (n=115)

Baseline characteristics	Number (%)	Mean±SD (range)
Age (years)		52.83 ± 10.71 (32 - 76)
Sex		
Male	96 (83.5%)	
Female	19 (16.5%)	
BMI (kg/m^2)		25.72 ± 1.99
Systolic BP (mm of Hg)		126.61 ± 21.86
Diastolic BP (mm of Hg)		82.07 ± 13.11
Risk factors		
Hypertension	75 (65.2%)	
DM	24 (20.9%)	
Smoking	74 (64.3%)	
Family history of IHD	19 (16.5%)	
Dyslipidaemia	55 (47.8%)	
RBS (mmol/L)		7.62 ± 2.32
Serum uric acid (mg/dl)		6.23 ± 1.84

The mean age of patients was 52.83±10.71 years. Male patients were predominant 96 (83.5%), and females were 19 (16.5%). The mean BMI of patients was 25.72±1.99 kg/m2. Mean systolic BP was 126.61±21.86 mm of Hg and diastolic BP was 82.07±13.11 mm of Hg. Among the risk factors, 65.2% of patients had HTN, 20.9% DM, 64.3% smoking, 16.5% family history of IHD, and 47.8% dyslipidemia. Mean serum uric acid was 6.23±1.84 mg/dl.

Table-2: Distribution of patients by serum uric acid level

Serum uric acid level	No. of patients	% of patients
High	41	35.7%
Normal	74	64.3%

The frequency of patients with high serum uric acid level was 41 (35.7%), and normal serum uric acid level was 74 (64.3%).

Table-3: Association between serum uric acid and acute LVF of AMI patients

	Outcomes of AMI patients		
Serum uric acid level	**AMI without acute LVF (n= 98)**	**AMI with acute LVF (n= 17)**	**p-value**
High	31(75.6%)	10(24.4%)	0.031
Normal	67(90.5%)	7(9.5%)	

Acute LVF was significantly higher in patients with high serum uric acid levels than normal serum uric acid levels (df=1, χ^2=4.669 and p=0.031).

Table-4: Association between serum uric acid and arrhythmia of AMI patients

	Outcomes of AMI patients		
Serum uric acid level	**AMI without arrhythmia (n= 101)**	**AMI with arrhythmia (n= 14)**	**p-value**
High	37(90.2%)	4(9.8%)	0.555
Normal	64(86.5%)	10(13.5%)	

Arrhythmia was not significantly higher in patients with high serum uric acid levels than normal serum uric acid levels (df=1, χ^2=0.348 and p=0.555).

Table-5: Association between serum uric acid and conduction block of AMI patients

	Outcomes of AMI patients		
Serum uric acid level	**AMI without conduction block (n= 110)**	**AMI with conduction block (n= 05)**	**p-value**
High	40 (97.6%)	1 (2.4%)	0.455
Normal	70 (94.6%)	4 (5.4%)	

Conduction block was not significantly higher in patients with high serum uric acid levels than normal serum uric acid levels (df=1, χ^2=0.558 and p=0.455).

Table-6: Association between serum uric acid and cardiogenic shock of AMI patients

	Outcomes of AMI patients		
serum uric acid level	**AMI without cardiogenic shock (n= 100)**	**AMI with cardiogenic shock (n= 15)**	**p-value**
High	35(85.4%)	6(14.6%)	0.706
Normal	65(87.8%)	9(12.2%)	

Cardiogenic shock was not significantly higher in patients with high serum uric acid levels than normal serum uric acid levels (df=1, χ^2=0.142 and P=0.706).

Table-7: Association between serum uric acid and death of AMI patients

Serum uric acid level	Outcomes of AMI patients: AMI without death (n= 108)	Outcomes of AMI patients: AMI with Death (n= 07)	p-value
High	36(87.8%)	5(12.2%)	0.041
Normal	72(97.3%)	2(2.7%)	

Death was significantly higher in patients with high serum uric acid levels than normal serum uric acid levels (df=1, χ^2=4.159 and p=0.041).

Discussion

The study population was between 32-76 years. Only 11(9.6%) patients were below 40 years. The mean age of patients was 52.83±10.71 years. It was found that the study population was mainly male 96(83.5%) and female were only 19(16.5%).

Our study revealed several risk factors such as hypertension, diabetes mellitus, smoking, dyslipidemia, and family history of IHD. These were 65.2%, 20.9%, 64.3%, 47.8% and 16.5% respectively. Dharma et al.[17] found the same risk factors such as hypertension, diabetes mellitus, smoking, dyslipidemia, and family history of IHD, which were 53%, 21%, 52%, 69%, and 24%, respectively. Omidver et al.[18] also found some risk factors like hypertension, diabetes mellitus, smoking, and dyslipidemia which were 37%, 29.3%, 46.2%, and 33.2%, respectively.

The frequency of hyperuricemia among AMI patients in our study was 35.7%. Almost similar frequency of hyperuricemia among ACS patients observed by Timoteo et al.[9] which was 30.20%. The frequency of hyperuricemia in our study was lower than the prevalence observed by Jularattanaporn et al.[20], which was 42.9%. Sarma et al.[21] found hyperuricaemia (>6mg/dl) in 68.5% of CAD. A lower prevalence of hyperuricemia was observed by Keya et al.[22], Dharma et al.[17] and Ndrepepa et al.[23]

In this study, acute LVF 10(24.4%) was in high serum uric acid level patients, and 7(9.5%) was in normal serum uric acid level patients. Acute LVF was significantly higher in high serum uric acid level than normal serum uric acid level patients (p=0.031). Kojima et al.[24] and Keya et al.[22] found a significant association between heart failure and high serum uric acid level patients. Heart failure was not significant in hyperuricaemic patients observed by Jularattanaporn et al.[20] and Omidvar et al.[18]

In our study, arrhythmia 4(9.8%) was found in high serum uric acid level patients and 10(13.5%) in normal serum uric acid level patients. Arrhythmia was not significantly higher in high serum uric acid level patients. Similar findings observed by Jularattanaporn et al.[20] and Chen et al.[25] found no association between arrhythmia and high serum uric acid level patients. Lazzeri et al.[26] studied 856 STMI patients and showed that high serum uric acid was associated with arrhythmia.

We found conduction block 1(2.4%) was in high serum uric acid level patients and 4(5.4%) in normal serum uric acid level patients. There was no significant association between conduction block and high serum uric acid level patients. Conduction block was not significant in hyperuricaemic patients observed by Chen et al.[25]. Abdullah et al.[27] found a significant association between conduction block and high serum uric acid level patients who studied 93 ACS patients.

In our study, cardiogenic shock 6(14.6%) found in high serum uric acid level patients and 9(12.2%) in normal serum uric acid level patients. Cardiogenic shock was not significantly higher in patients with higher serum uric acid levels than patients with normal uric acid levels. Abdullah et al.[27] studied 93 ACS patients and found similar findings. Ndrepepa et al.[23] and Chen et al.[25] found a significant association between cardiogenic shock and high serum uric acid.

In our study, death, 5(12.2%) was in high serum uric acid level patients and 2(2.7%) in normal serum uric acid level patients. Death was significantly higher in high serum uric acid levels than normal uric acid level patients (p=0.041). Lazzeri et al.[28] studied 466 STEMI patients, and Car et al.[29] assessed 621 AMI patients and showed in-hospital mortality was higher in patients with elevated uric acid. Death was not significant in hyperuricaemic patients as in normouricemic patients observed by Culleton et al.[13] and Abdullah et al.[27]

Our study provided a significant association between high serum uric acid level on admission and poor in-hospital outcomes like acute LVF and death in AMI of hospitalized patients. The measurement of serum uric acid levels, an easily available, cheap biochemical tool, might be used as a valuable risk marker for detection and prevention of in-hospital outcomes in AMI patients.

Conclusion

A significant association was found in our study between high serum uric acid level and in-hospital outcomes of AMI patients. This study suggests that high serum uric acid may be an independent risk factor and a predictor of poor prognosis in acute myocardial infarction patients. Estimation of serum uric acid offers a simple, inexpensive, quick, and non-invasive method for identifying such high-risk patients. As high serum uric acid is modifiable and preventable, clinical investigation of serum uric acid may potentially evaluate the patients for AMI in early-stage and prevention of morbidity and mortality of acute myocardial infarction patients.

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