

Evaluation of Changes in Serum Uric Acid in a Patient with Acute Myocardial Infarction

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Abstract

Background: Acute myocardial infarction (AMI), more commonly known as heart attack, is a medical emergency and the leading cause of death for both men and women all over the world. There is a correlation between changes in the serum uric acid and acute myocardial infarction.

Objectives: This study was undertaken to evaluate the changes in serum uric acid status in patients with acute myocardial infarction.

Methods: The present cross sectional study was carried out in the Department of Biochemistry, Mymensingh Medical College, Mymensingh with the collaboration of the Department of Cardiology, Mymensingh Medical College Hospital, Mymensingh, during the period of July-2021 to June -2022. A total of 100 subjects were included in this study among them, 50 were diagnosed AMI patients denoted as case group & 50 were normal healthy individuals denoted as control group. Serum uric acid was determined by colorimetric method by using test kit for each sample. All statistical analysis was done by using SPSS (statistical package for social science) windows package version 21.

Results: The mean $\pm$ SD values of serum uric acid were 7.91 ± 0.09 mg/dl and 3.68 ± 0.72 mg/dl in case group and control group respectively. The analysis showed that, there was highly significant increase in mean serum uric acid levels between two groups were highly significant ($p < 0.001$).

Conclusion: This was a cross sectional study. Analyzing the findings of the present study, highly significant increase in serum uric acid level were observed in AMI patients.

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Keywords: Serum uric acid, Acute myocardial infarction, Cardiovascular disease, Hyperuricemia, Cross-sectional study

Introduction

Coronary artery disease (CAD) is the commonest cause of angina and acute coronary syndrome and the leading cause of death worldwide. Cardiovascular disease will soon become the leading cause of death on all continents¹. Acute myocardial infarction (AMI) is defined as death of cardiac muscle due to prolonged severe ischemia. Myocardial ischemia occurs when there is an imbalance between the supply (perfusion) and demand of the heart for oxygenated blood. Ischemia is characterized by not only an insufficiency of oxygen but also reduced availability of nutrients and inadequate removal of metabolites. It is the most important form of

ischemic heart disease (IHD). IHD is often termed as coronary artery disease². Uric acid is produced by the enzymatic activity of xanthine oxidase and is the final product of purine metabolism³. Increased Serum Uric Acid concentrations are associated with hypertension, atherogenic dyslipidemia, diabetes, age, alcohol consumption and renal failure. 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 ischemia⁴. Hyperuricemia is associated with deleterious effects on endothelial

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dysfunction, oxidative metabolism, platelet adhesiveness and aggregation. All of these conditions atherosclerosis. Previous studies have reported positive associations of increase serum uric acid levels with a greater risk of ischemic heart disease, high blood pressure, and an overall adverse cardiovascular risk profile⁵.

Materials and Methods:

After obtaining the clearance from the Institutional Review Committee of the institute the study was conducted **Approval No. : MMC/IRB/2022/448**. The present study was a cross sectional analytical study. It was carried out in out in the Department of Biochemistry, Mymensingh Medical College & sample were collected from the Department of cardiology, Mymensingh Medical College & Hospital, Mymensingh, Bangladesh during the period from July 2021 June 2022. The subjects were selected on the basis of inclusion & exclusion criteria by purposive (non- random) sampling method. A total of 100 subjects were included in this study. Out of them 50 were case (patients with acute myocardial infarction) and 50 were control (apparently healthy volunteers). The diagnosis was based on history taking, clinical examination ECG findings & changes of cardiac biomarkers.

Inclusion criteria:

1. Group-I (case) diagnosed AMI patients and age ranging from 40-65 years.
2. Group- II (control) apparently healthy people of same age group.

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Exclusion criteria:

1. Patients suffering from organic (Heart failure, cardiomyopathy) heart disease other than AMI.
2. Patients having history of chronic diuretic therapy.
3. Subjects taking any drugs interfering uric acid.

All the subjects were clinically examined. Their age, sex, pulse and blood pressure were recorded. Everyone completed questionnaire concerning their occupation, educational status, drug history, personal history, history of recent or chronic illness etc. Data were collected by direct interview from study subjects or from their attendants. Informed written consent was taken from them. Serum Uric Acid was determined by colorimetric method by using test kit. All statistical analysis was done by using SPSS (statistical package for social science) windows package version 21. P value <0.05 was considered.

Result:

Total study subjects were 100 which were divided into two groups. Group-I consists of 50 Hospital admitted AMI patients above 40 years of both gender and group-II consists of 50 healthy subjects of same age group. Out of 100, 84 (84%) subjects were male and 16 (16%) were female. In group- I, 41 (82%) were male and 9 (18%) were female. In group- II, 43 (86%) were male and 7 (14%) were female. The age of the subjects was ranged from 40 to 65 years, with a mean age of 52.65 ± 4.93 for group- I and 51.15 ± 6.32 for group- II. Some clinical parameters are shown in table 1.

Table-I: Shows Mean $\pm$ SD of different clinical characteristics of the study subjects

Variable	Group I (case) Mean $\pm$ SD	Group II (control) Mean $\pm$ SD
Age(years)	52.65 $\pm$ 4.93	51.15 $\pm$ 6.32
BMI (kg/m ²)	24.31 $\pm$ 1.14	24.23 $\pm$ 1.20

Serum Uric Acid were estimated. Statistical analysis were done according to data. Results were presented by tables and figures. Serum Uric Acid were expressed in mg/dl. The study revealed that the serum Uric Acid level were higher in case (group I) when compared to (group II). The mean $\pm$ SD values

of serum Uric Acid were 7.91 ± 0.09 mg/dl and 3.68 ± 0.72 mg/dl in case group and control group respectively. The analysis showed that, the difference in mean serum Uric Acid levels between two groups were highly significant ($p < 0.001$). Analysis of mean serum uric acid levels were presented in table II.

Table-II: Comparison of mean serum Uric Acid in the study population

Variable	Group I (case) Mean $\pm$ SD	Group II (control) Mean $\pm$ SD	P value
Age(years)	7.91 ± 0.09	3.68 ± 0.72	$<0.001^{**}$

P<0.001 considered as highly significant result. P value less than 0.05 taken as level of significance.

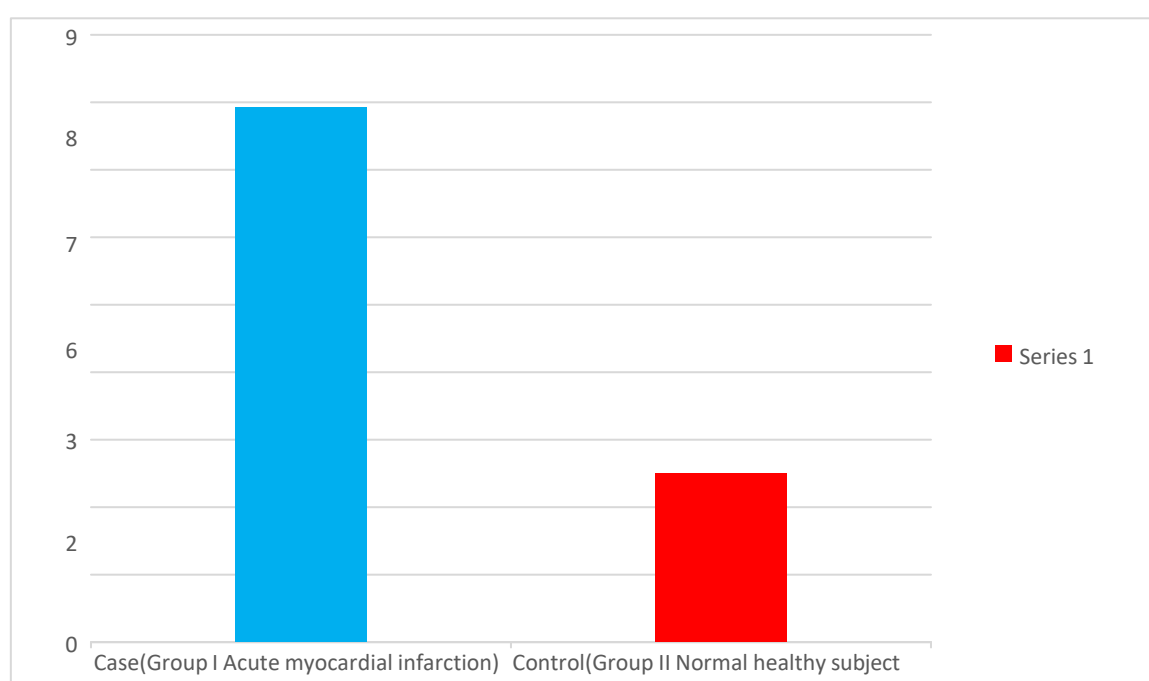


Fig-1: Comparison of mean serum uric acid levels in the study population.

Discussion:

Myocardial infarction (MI) is one of the dangerous manifestation of coronary artery disease and one of the commonest cause of mortality. MI is defined as myocardial necrosis in a clinical setting consistent with myocardial ischemia. Acute ischemia is usually, but not always caused by atherosclerotic plaque rupture, fissuring, erosion or a combination superimposed intra coronary thrombosis and is associated increase risk of cardiac death and myonecrosis⁶. Myocardial necrosis following infarction is followed by heart failure, myocardial

rupture or arrhythmia. Early treatment of myocardial infarction to prevent necrosis such as fibrinolysis, coronary artery bypass grafting and percutaneous coronary intervention have improved outcome⁷.

In the present study, the mean values of serum uric acid levels were 7.91 ± 0.09 mg/dl and 3.68 ± 0.72 mg/dl in case group and control group respectively. The level of significant was between two groups were highly significant ($p < 0.001$). The analysis showed a significant higher level of serum uric acid in AMI patients when compared that of control group. This

finding was in agreement with the result of Padma & Banupriya (2017), Amrut et al. (2016), Uric acid promotes development of atherosclerosis. The high level of uric acid causes oxidation of LDL-C and peroxidation of lipid, formation of oxygen radicals in inflammatory reaction, increases platelet aggregation and formation of uric acid crystals in the arterial wall which damage the tunica intima of arteries and promotes coronary thrombosis¹⁰. Adenosine synthesized 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 ischaemic conditions, and hence elevated serum uric acid may act as a marker of underlying tissue ischemia¹¹.

Conclusion:

Acute myocardial infarction (MI) continues to be a major public health problem in the industrialized world and is becoming an increasingly important problem in developing world. Acute myocardial infarction (AMI) is the most important consequence of coronary artery disease and it can lead to complications such as ventricular arrhythmia and congestive heart failure. The purpose of the study was to evaluate the serum uric acid level in AMI and compare with healthy volunteer. Mean $\pm$ SD of serum uric acid level of the case group were increased significantly while compared with that of the control group. Analyzing the findings of the present study, significant increase in serum uric acid level were observed in AMI patients. Therefore it may be recommended that estimation of serum uric acid may help the clinicians of for better management of the patient of AMI.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

Author Contribution

Diluara K - study design, supervision; Alam MTU - data collection, manuscript writing; Mia MAR - data collection, analysis; Samsun N - literature review, manuscript revision. All authors read and approved the final manuscript.

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Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

AI Disclosure

No artificial intelligence (AI) tools were used in the preparation of this manuscript.

Plagiarism Statement

This manuscript was checked for plagiarism using standard software, and the report was submitted to the editorial board along with the manuscript.

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