Study of Serum Uric Acid and BMI in Coronary Artery Disease

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Abstract

Background: Coronary artery disease is produced by blockade of the coronary arteries that deliver oxygen and nutrients to the heart. Uric acid is associated with greater risk of coronary artery disease. The serum uric acid is also found to be related with risk factors for CAD such as body mass index (BMI).

Aim: Present study was done to evaluate relationship between Serum uric acid (SUA), Body mass index (BMI) and Coronary artery disease (CAD).

Materials and Methods: In the present study SUA and BMI were compared between 100 cases and 100 age and gender matched controls. Unpaired t-Test and Pearson correlation coefficient (r) were used to assess the correlation between SUA and BMI in CAD case group.

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Result: The mean SUA and BMI levels are significantly higher in CAD cases compared with normal controls. The highly significant positive correlation is found between SUA and BMI in CAD.

Conclusion: BMI and SUA are positively associated with CAD and the relationship is not independent of each other.

Keywords: Coronary Artery Disease (CAD), Serum Uric Acid (SUA), Body Mass Index (BMI).

INTRODUCTION

Coronary artery disease is produced by the blockade of the coronary arteries that deliver oxygen and nutrients to the heart. This blockade is secondarily due to atherosclerosis of the walls of these coronary arteries. There is restriction to the flow of blood to the heart. The complete obstruction of the coronary artery leads to Myocardial Infarction. Coronary artery disease (CAD) will continue as the principal cause of death for the succeeding twenty years, according to Global and Regional Projection of mortality and burden of disease.[1]

Uric acid is the final product of purine metabolism in human beings. Apart from Uric acid having the antioxidant properties, there are studies reporting association with greater risk of coronary artery disease, higher blood pressure, and the adverse cardiovascular risk profile.[2] A probable link of serum uric acid (SUA) with coronary artery disease (CAD) has been noted in numerous scientific studies.[3,4] Other studies have not confirmed these findings.[5,6]

Several investigators have shown that uric acid is associated with risk factors for CAD such as hypertension and body mass index (BMI).[7] Thus this study was conducted to understand any association between SUA, BMI and CAD.

MATERIALS AND METHODS

The present study was done in the Department of Biochemistry, Government Medical College (GMC) Nagpur with the assistance of Medicine Department. The Institutional Ethics Committee of GMC, Nagpur granted approval for the research study.

Study design: Hospital based cross sectional study with Comparison Groups.

Sample size estimation: From the study of **Deveci OS et al**

- SD_1 in CAD cases= 121
- SD_2 in controls= 83.2
- Difference of means of serum uric acid in two groups= 56.5
- α-Error= 5%

- β-Error= 10 %
- Power= 90%
- Minimum sample size needed for study in each arm= 72
- Sample size was calculated using MedCalc Statistical software

Study population: From Oct 2013 to Sept 2015, one hundred patients with acute Myocardial infarction admitted in the ICU of Medical College were studied. The criteria to select patient was acute myocardial infarction diagnosed by physician on the basis of the definition approved by American College of Cardiology Committee (ACC) and European Society of Cardiology (ESC). The criteria included typical rise and gradual fall of troponin level and /or severe increase and decrease of CK-MB associated with at least one of the following parameters:

i.   Gradual appearance of pathological Q wave on electrocardiogram (ECG) strip or
ii. EKG changes indicating ischemia on the ECG strip (ST segment elevation)

Study groups: The study subjects were divided into two groups.

 A: Control subjects (n=100): One hundred normal subjects without CAD

 B: CAD Cases (n=100): One hundred newly diagnosed CAD patients

Inclusion criteria

➢ One hundred newly diagnosed cases of acute myocardial infarction more than or equal to twenty years of age admitted in the ICU of Medical College Hospital.

Exclusion criteria

➢ Patients with inflammatory diseases like gout, rheumatoid arthritis, inflammatory bowel disease, renal disease, hypothyroidism, diabetes, anaemia, stroke, malignancy, bacterial infections and smokers were excluded from the study.

CLINICAL DATA RECORDING

Informed consent was taken from each subject for participation in this study. History and examination of patient was recorded on preformed questionnaire which included detailed history and clinical examination.

SPECIMEN COLLECTION AND PRESERVATION

Blood samples were obtained from peripheral veins of both cases and controls under hygienic conditions. There was voluntary enrolment with written consent taken from each participant. Fasting 4 ml blood sample in plain tube as well as 1 ml in sodium fluoride and oxalate bulb were collected. The diabetes was ruled out. The samples were centrifuged after one hour of collection. The separated serum and plasma were taken in the new tubes. Serum uric acid, blood urea and fasting blood sugar were estimated on XL300 - Erba Mannheim – A Fully Automatic Random Acess Clinical

Chemistry Analyzer**.** Serum was preserved at 2-8^0 C.

PARAMETERS WERE ESTIMATED WITH FOLLOWING METHODS:

S.No	PARAMETER	METHOD
1	Serum uric acid	Uricase-pap method

BODY MASS INDEX (BMI):

The body mass index was calculated by the formula, weight in kilograms 9(kg) divided by square of height in meters (m).

BMI= Weight in kg/ (Height in m^2)

Normal BMI is 18.5- 24.99 kg/m^2; Overweight was defined as BMI $\geq$ 25 kg/m^2, Obesity was defined as BMI > 30 kg/m^2.

RESULTS

Table 1: Distribution of Body Mass Index (BMI) in CAD Patients and Controls without CAD.

FEATURES	CONTROLS (Mean ± SD)	CASES (Mean±SD)	P-VALUE
BMI (kg/m^2)	25.13 ± 2.01	29.02 ± 2.82	< 0.001

* $p<0.05$ is considered significant; SD – Standard deviation

Table – 2 <u>Distribution of Serum Uric Acid (SUA) in CAD Patients and Controls without CAD.</u>

PARAMETERS	CONTROLS (Mean ± SD)	CASES (Mean±SD)	P-VALUE
Serum uric acid (mg/dl)	4.65 ± 0.77	5.756 ± 0.32	< 0.001

* $p<0.05$ is considered significant; SD – Standard deviation

Table 3: The Pearson Correlation coefficient between SUA and BMI in CAD **cases**

Pearson correlation coefficient between SUA & BMI	Value of Pearson correlation coefficient	P value
r	0.496	< 0.001

* $p<0.05$ is considered significant.

DISCUSSION

According to Table-1 highly significant increase in BMI was found in the cases as compared to that in normal controls. Several clinical and epidemiological studies showed the strong relation between obesity and CAD in different populations .[8–11]

According to Table-2 highly significant increase in serum uric acid level (SUA) was found in the cases as compared to that in the normal controls. Morris London et al,[12] Hong Evy Lim et al and M. Torun et al have stated significantly higher uric acid level in CAD cases. [13] The Rotterdam Study described uric acid as a strong risk factor for both myocardial infarction and stroke.[2] In the study by Culleton et al,[14] it was found that uric acid was not a causal risk factor for cardiovascular events as uric acid was dependent on hypertension. In a sub study of LIFE,[15] baseline serum uric acid level was found to be significantly linked with higher rate of fatal or non-fatal myocardial infarction .The greater level of SUA in ischemia is due to additional production of uric acid by xanthine oxidase enzyme which leads to oxidative stress and provokes the oxidation of LDLC and the peroxidation of lipid.[16–18] Moreover, hyperuricemia causes fall in the production of nitric oxide , endothelial dysfunction, myocardial microvascular disease and local inflammation.[17,19]

According to Table-3 BMI and serum uric acid in CAD case group was found to be positively correlated (r=0.4960), with p- value < 0.001 that means, the correlation is highly significant. Obesity raises the SUA level and leads to overproduction of inflammatory molecules like TNF- α and IL-6.[20,21] Evidence have shown that gathered visceral fat leads to an increase in free fatty acids and tumor necrosis factor alpha (TNFα) and a decline in adiponectin concentration, which reduces renal excretion of uric acid.[22] Masuo et al have shown that SUA level foresees subsequent weight gain in nonobese, healthy young men.[23]

CONCLUSION

The mean BMI and SUA levels are significantly higher in CAD cases compared with normal controls.The highly significant positive correlation is found between BMI and serum Uric Acid in CAD patients.

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