Association of Serum Uric Acid with BMI and Lipid Profile in Patients with Acute Myocardial Infarction

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Uric acid is the final metabolite of purine in humans. Hyperuricaemia is the result of either increased purine intake or decreased excretion. The aim of present study is to find out the association of serum uric acid with BMI and Lipid profile. Total 108 patients of acute myocardial infarction were enrolled in the study. On admission their serum uric acid level, lipid profile were measured and then their height and weight was taken. Patients were classified on the basis of baseline serum uric acid level. Group-1(SUA<6.5 mg/dl, n=66), Group-II(SUA>6.5 mg/dl, n=42). Serum uric acid, lipid profile was measured in Clinical Pathology Department of BSMMU. During analysis BMI, triglyceride, total cholesterol, LDL were significantly higher and HDL was significantly lower in Group-II than Group-I($p<0.05$). Scatter diagram showed positive correlation between uric acid and BMI($r=0.543$, $p=0.001$), uric acid and TG ($r=0.621$, $p=0.001$), uric acid and TC($r=0.493$, $p=0.001$), uric acid and LDL($r=0.521$, $p=0.001$) but negative correlation between uric acid and HDL($r=-0.470$, $p=0.001$).

[Dinajpur Med Col J 2017 Jan; 10 (1):133-139]

Key words: Hyperuricaemia, coronary artery disease, metabolic syndrome, BMI

Introduction

The SUA level reflects the net balance between its constant production and excretion. Dietary intake of urate provides a source of uric acid precursors. Hyperuricaemia is a very common metabolic disorder. Elevated SUA levels occur in 2–18% of the population, varying in relation to age, sex, and many other factors.[1]

It is shown that in general population hyperuricaemia is associated with mortality. Therefore, assessment of serum uric acid may be of good value for both maintaining health and during illness.[2] Elevated serum uric acid may be a marker of tissue ischaemia and it is one possible explanation for non-causal association between hyperuricemia and cardiovascular disease.[3]

Significant correlations were found between serum uric acid and several components of the metabolic syndrome, such as a higher BMI, waist-to-hip-ratio, blood pressure and lower HDL-cholesterol in both men and women. Several possible pathophysiological mechanisms have been evoked to explain these associations including insulin resistance, the use of diuretics or impaired renal function accompanying hypertension. Indeed the kidney seems to play an important role in the development of the metabolic syndrome. Insulin resistant individuals secrete larger amounts of insulin in order to maintain an adequate glucose metabolism. The kidney which is not insulin-resistant responds to these high insulin levels by decreasing uric acid clearance, probably linked to insulin-induced urinary sodium retention.[4] In cross-sectional study with 559

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Brazilian white men without known coronary artery disease, raised uric acid levels were independently associated with CAC (coronary artery calcification) presence and severity. This relationship was significant in people with the metabolic syndrome.[5] There is positive correlation between uric acid and various cardiovascular risk factors like, BMI, systolic and diastolic blood pressure, total cholesterol, triglyceride, LDL and negative correlation with HDL cholesterol.[6]

Uric acid increases the development of atherosclerosis, causing a variety of cardiovascular events. The high level of SUA promotes the oxidation of LDL-C and the peroxidation of lipid. It also increases the formation of oxygen radicals in inflammatory reaction. In addition, the high level of SUA also promotes platelet aggregation and the formation of uric acid crystals. The deposition of uric acid crystal in the arterial wall could damage the tunica intima of arteries, enhancing coronary thrombosis.[7]

Methods

This study was carried out in the department of Clinical Pathology, BSMMU Dhaka from October 2011 to September 2012. In this case series study, 108 diagnosed patients of acute myocardial infarction free from gout, renal disease, hepatic disorder and other malignant conditions were enrolled from the cardiology department of BSMMU and BIRDEM, Dhaka. Among 108 patients, 84 patients were male and 24 patients were female. Only patients of acute MI were enrolled in the study. All subjects were categorized into Group-1(SUA less than 6.5 mg/dl) and Group-II(SUA more than 6.5mg/dl). All enrolled subjects were explained about the nature and purpose of the study and their informed consent were taken. Then 4 ml blood was taken within 24 hours of attack from all study subjects. . Blood was allowed to clot and centrifuged. Separated serum was collected into plastic micro centrifuged tube. Then they were stored at -20 degree centigrade until analysis. BMI (Body mass index) and Lipid profile of all subjects were measured and statistical analysis was done between Group-1 and Group-2 considering these parameters.

Results

In this case series study, 108 diagnosed patients of acute myocardial infarction were enrolled. Among 108 patients, 84 patients were male and 24 patients were female with the mean age of 54.62 years in group-I (range 32-80) and 60.29 years in group-II (range 35-85).

Table I: Baseline characteristics of the study subjects (n=108)

Baseline	Frequency (n)	Percentage (%)
Hypertension	34	31.5
Diabetes	19	17.6
Both hypertension and diabetes	13	12
No hypertension and no diabetes	42	38.9
Current smoker	46	42.6
Ex-smoker	10	9.3
Non smoker	52	48.1

Table I shows baseline characteristics of study subjects. Out of 108 patients 34(31.5%) patients had only hypertension, 19(17.6%) patients had only diabetes, 13(12%) patients had both hypertension and diabetes, and 42 (38.9%) patients had no hypertension and no diabetes. Majority patients were non-smoker. 46 (42.6%) patients were current smoker, 10(9.3%) ex-smoker and 52(48.1%) non smoker.

Table II: Distribution of the study patients according to variables (n=108)

Variables	Group I (n=66)		Group II (n=42)		*P value*
	Mean	± SD	Mean	± SD	
BMI (kg/m^2) Range (min-max)	23.26 (18.1	±2.98 -30.8)	26.7 (20	±2.87 -32.5)	0.001^s
TG (mg/dl) Range (min-max)	136.45 (110	±21.98 -205)	180.88 (122	±27.95 -231)	0.001^s
TC (mg/dl) Range (min-max)	168.03 (123	±31.56 -241)	204.31 (136	±29.41 -250)	0.001^s
LDL (mg/dl) Range (min-max)	97.00 (51	±31.69 -171)	134.9 (67	±26.91 -175)	0.001^s
HDL (mg/dl) Range (min-max)	42.52 (22	±7.15 -56)	34.5 (23	±6.96 -50)	0.001^s

s=significant
P value reached from unpaired t-test

Table II shows the association of SUA with other variables. The mean BMI was found 23.26±2.98 kg/m^2 in group I and 26.7±2.87 kg/m^2 in group II. The mean TG was found 136.45±21.98 mg/dl and 180.88±27.95 mg/dl in group I and group II respectively. The mean TC was found 168.03±31.56 mg/dl in group I and 204.31±29.41 mg/dl in group II. The mean LDL was found 97.00±31.69 mg/dl and 134.9±26.91 mg/dl in group I and group II respectively. The mean HDL was found 42.52±7.15 mg/dl in group I and 34.5±6.96 mg/dl in group II. The mean difference was statistically significant ($p<0.05$) between two groups in unpaired t-test. It indicates raised SUA was associated with higher BMI, TG, TC, LDL and lower HDL level.

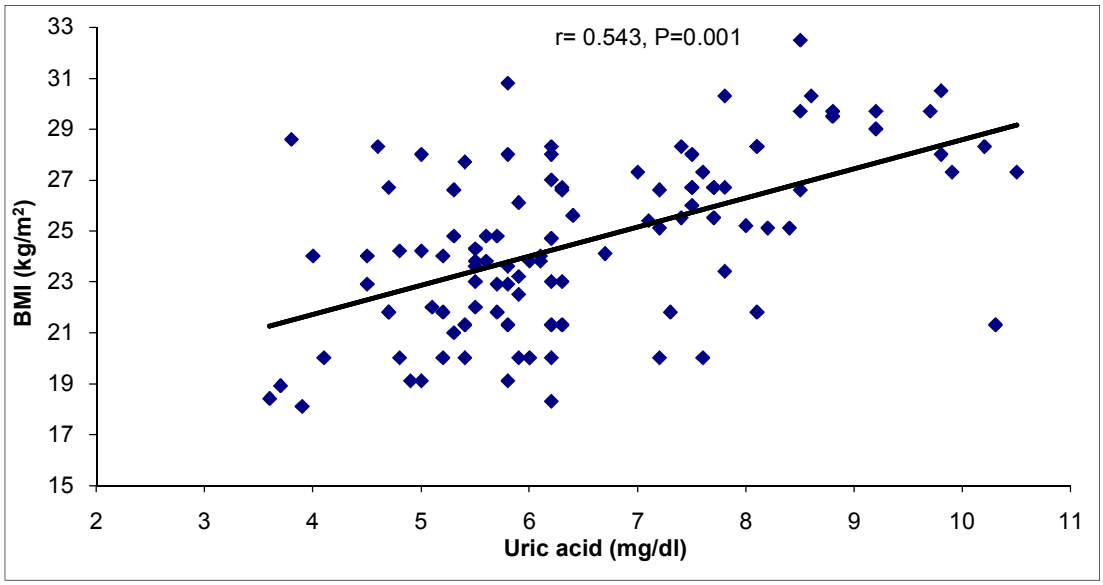

Figure 1 The scatter diagram showing relationship (r= 0.543, p=0.001) between uric acid (mg/dl) with BMI (kg/m^2) of the study patients(n=108). The figure shows significant positive relationship (r= 0.543, p=0.001) between uric acid (mg/dl) with BMI (kg/m^2) of the study patients. This diagram signifies raised uric acid was associated with higher body weight of study patients.

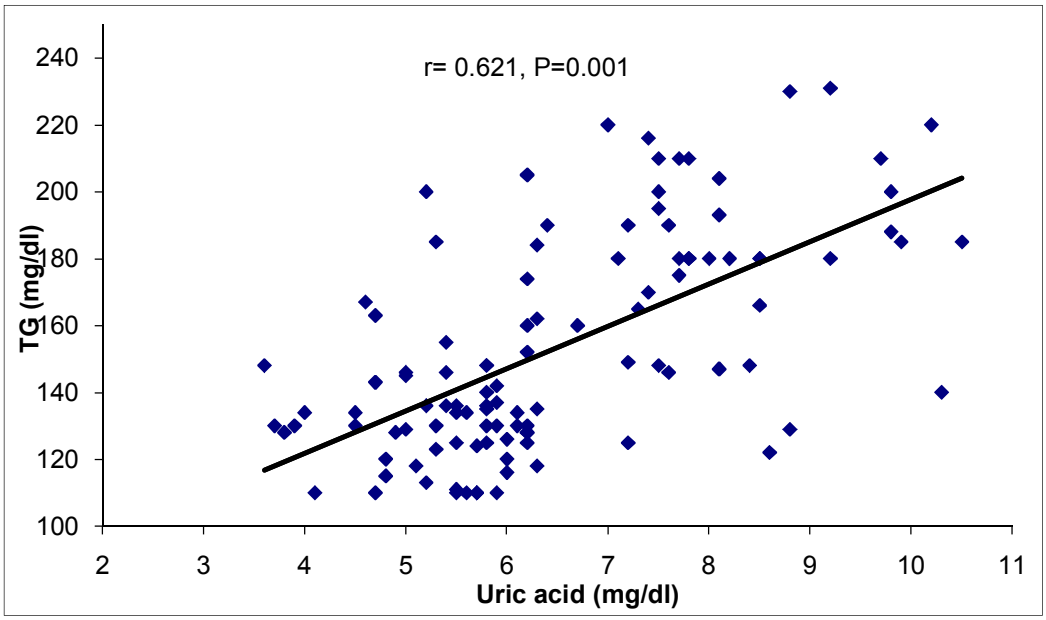

Figure 2. The scatter diagram showing relationship (r= 0.621, p=0.001) between uric acid (mg/dl) with Triglyceride (mg/dl) of the study patients (n=108).The figure shows significant positive relationship (r= 0.621, p=0.001) between uric acid (mg/dl) with Triglyceride of the study patients. This diagram signifies raised uric acid was associated with higher TG level of study patients.

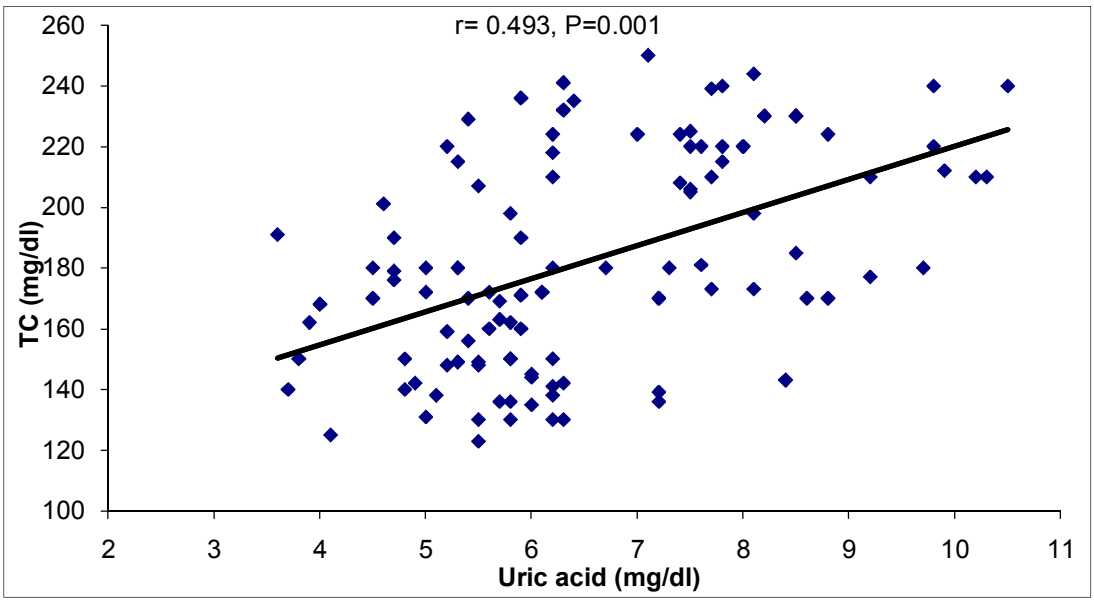

Figure 3. The scatter diagram showing relationship (r= 0.493, p=0.001) between uric acid (mg/dl) with TC (mg/dl) of the study patients. The figure shows significant positive relationship (r= 0.493, p=0.001) between uric acid (mg/dl) with Total Cholesterol of the study patients. This diagram signifies raised uric acid was associated with higher TC level of study patients.

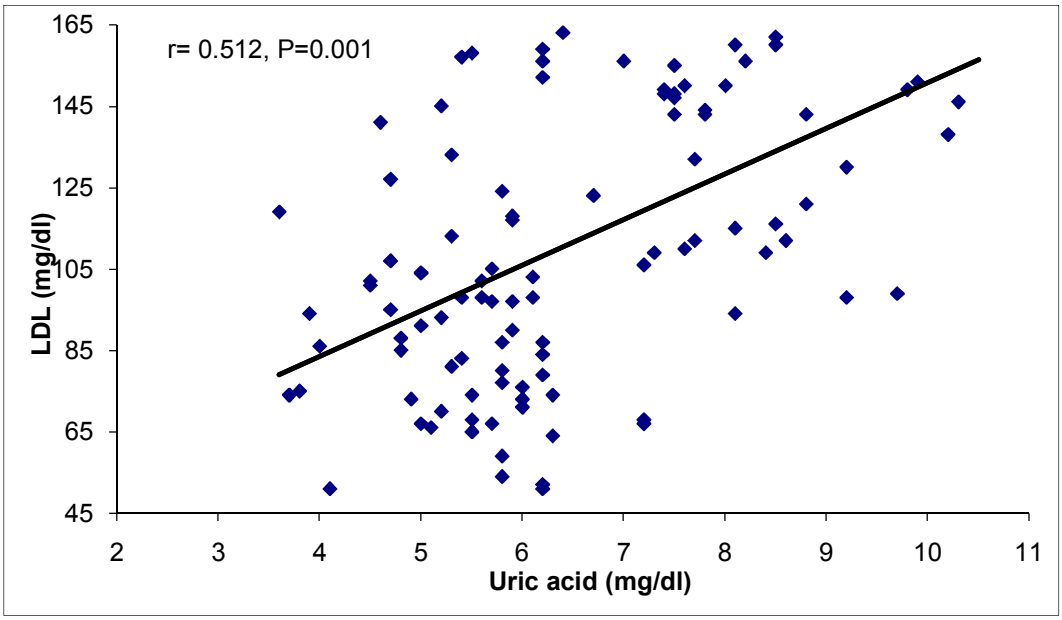

Figure 4. The scatter diagram showing relationship (r= 0.512, p=0.001) between uric acid (mg/dl) with LDL(mg/dl) level of the study patients(n=108). The figure shows significant positive relationship (r= 0.512, p=0.001) between uric acid (mg/dl) with LDL (mg/dl) level of the study patients. This diagram signifies raised uric acid was associated with higher LDL level of study patients.

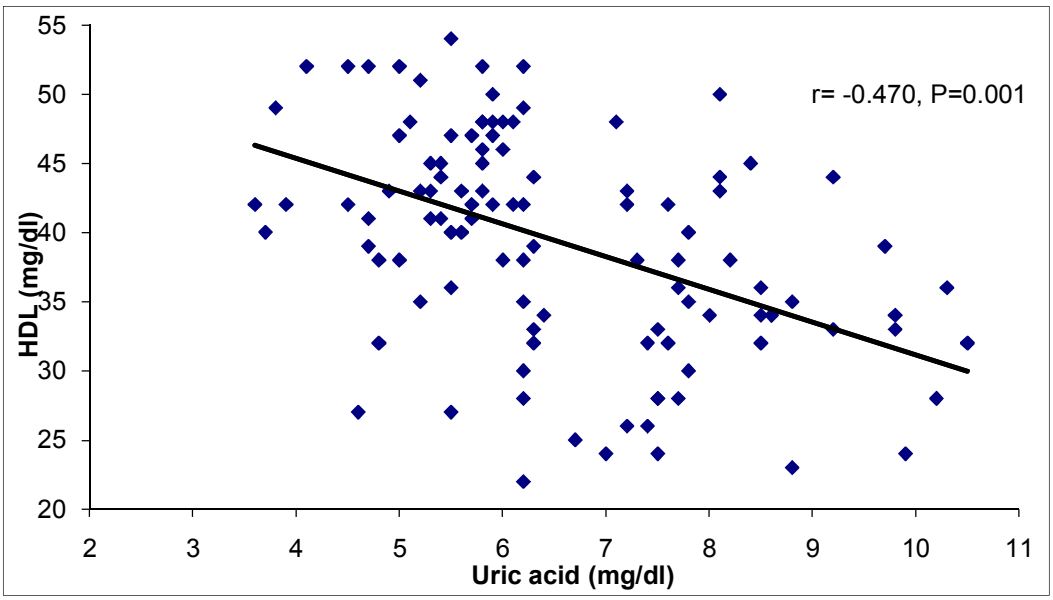

Figure 5. The scatter diagram showing relationship (r=- 0.470, p=0.001) between uric acid (mg/dl) with HDL (mg/dl) level of the study patients (n=108). The figure shows significant negative relationship (r= -0.470, p=0.001) between uric acid (mg/dl) with HDL (mg/dl) level of the study patients. This diagram signifies raised uric acid was associated with lower HDL level of study patients. Serum uric acid had inverse relationship with HDL level.

Discussion

Cardiovascular diseases are the commonest cause of death globally and major contributor of burden of premature mortality and morbidity. Cardiovascular risk factors are rising in Bangladesh.[8] Serum uric acid is an important risk factor for CAD.

Our study showed mean BMI was 23.26±2.98 kg/m^2 in group I and 26.7±2.87 kg/m^2 in group II. The mean TG was found 136.45±21.98 mg/dl and 180.88±27.95 mg/dl in group I and group II respectively. The mean TC was found 168.03±31.56 mg/dl in group I and 204.31±29.41 mg/dl in group II. The mean LDL was found 97.00±31.69 mg/dl and 134.9±26.91 mg/dl in group I and group II respectively. The mean HDL was found 42.52±7.15 mg/dl in group I and 34.5±6.96 mg/dl in group II. The mean difference was statistically significant (P<0.05) between two groups in unpaired t-test. It indicates raised SUA was associated with higher BMI, TG, TC, LDL and lower HDL level. Similar findings were also observed by Kojima S et al[9] Barbosa MCC et al[10] Conen D et al. Yong Quan Wu et al[11] Kojima S et al showed that SUA was positively correlated with BMI (p>0.0001). Yong Quan Wu et al depicted the significant association of SUA with BMI, TG, TC (for all values p<0.05). Conen D et al demonstrated the similar findings.

Sadr SM et al[12] showed that prevalence of hyperuricaemia and metabolic syndrome in men and women was(17.9%,11,25% p=0.001) and (11,8%,19.32% p=0.01), respectively. Hyperuricaemia was more prevalent in metabolic syndrome and ischaemic heart disease independent of age and sex.

Ouppatham S et al[13] done a study on 5,564 subjects. Of the total subjects, 4,099 (73.7%) were male. Mean SBP and DBP were 128.73±17.06 and 81.62 ± 11.58 mm Hg, respectively. The mean serum uric acid level was 6.54 ± 1.71 mg/dL. A significant and positive correlation was found both between serum uric acid and SBP (r=0.186, $P < 0.001$) and between serum uric acid and DBP (r=0.255, $P < 0.001$). After multiple regression analysis of various clinical variables, serum uric acid levels were correlated with the severity of both SBP and DBP, increased age, increased body mass index, decreased glomerular filtration rate, increased serum cholesterol and male gender.

Li Duo et al. showed that serum uric acid was positively correlated with BMI(r=0.343, p<0.0001), totalcholesterol (r=0.192,p=0.0026), triacylglycerol (r=0.306, p<0.0001) and negatively correlated with HDL-cholesterol(r=-0.381, p<0.0001).

Yong-Quan Wu et al had a study in which a total of 3570 patients were selected from 20 hospitals in Beijing and Shanghai, China. All patients were divided into two main groups according to their SUA levels, high SUA and normal SUA groups. Compared with normal SUA group, high SUA group had significant difference in systolic blood pressure (SBP), total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-C), body mass index (BMI), and age (P <0.05 or P <0.01).

Our study revealed that raised SUA was also associated with increased BMI, triglycerides, total cholesterol, LDL and it had negative relation with HDL level (all variables were statistically significant).

Conclusion

Uric acid is easy to measure and there way to treat hyperuricaemia. Hyperuricaemia is associated with cardiovascular risk variables and metabolic syndrome. So it can be useful in individual cardiovascular risk assessment.

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