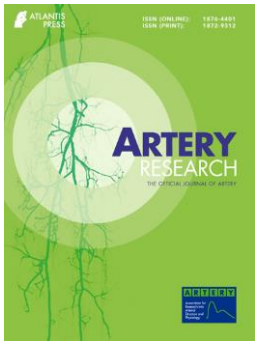


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# Assessment of the relationship between serum uric acid level and atherosclerosis burden in patients undergoing coronary angiography in Ekbatan (Farshchian) hospital, Hamadan 2015

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**KEYWORDS**
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**Abstract** *Background:* Nowadays, cardiac disease is the most widespread reason of death in most countries such as Iran. Some studies have correlated serum uric acid level with risk of death in the patients of acute coronary syndrome. The study aimed to determine if there is any correlation between serum uric level and atherosclerosis burden.
*Material and methods:* In this cross-sectional study, all the patients underwent coronary angiography in Hamadan's Ekbatan Hospital in 2015 and were studied in terms of demographic, serum lipid profile, blood glucose and uric acid. Data were obtained from patients' medical records, registered in data sheet and analyzed by spss16 statistical software.
*Results:* 140 patients participated in this study of whom 60% were male and 40% female with age mean of 62.92 ± 11.21 years old. Blood uric acid's mean was 6.39 ± 2.16 mg/dl and based on coronary artery involvement range was single vessel disease (6.17 ± 1.91), two vessel disease (6.56 ± 2.17), three vessel disease (6.32 ± 2.01), mild or minimal or patent (6.78 ± 3.16) and in ectatic or slow flow (7.30 ± 0.86) mg/dl, respectively. According to the results of Kruskal–Wallis test, no significant relation was observed between uric acid level and the range of

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coronary artery involvement (P = 0.60). But, the mean of serum uric acid level in severe Ischemic heart disease was significantly more than acute coronary syndrome (P = 0.04).
*Conclusion:* Blood uric acid is not a dependent predictive risk factor of atherosclerosis but through effects on other risk factors it may increase the risk of heart disease.


## Introduction

Increasing life expectancy, the rapid growth of urbanization, technology development, followed by decreased physical activity and increased psychological stress have caused high spread of cardiovascular disease risk factors.[1]

Cardiovascular diseases are the most common cause of death in many countries, including Iran, where more than one third of all deaths (39%) are caused by these diseases. Poor nutrition, physical inactivity, smoking, obesity, high blood pressure, diabetes and dyslipidemia are the most important risk factors for cardiovascular disease.[2]

Some researchers have reported that uric acid may be an independent risk factor for cardiovascular and kidney diseases and reduction of blood uric acid levels has cardiovascular and renal benefits.[3]

Recent epidemiological studies have shown that risk factors for metabolic syndrome are not able to justify all cardiovascular events observed in this syndrome.[4]

In some studies, in addition to the above factors, the risk factors, including inflammatory markers, microalbuminuria and hyperuricemia are mentioned. Some of these studies have described insulin resistance as the underlying cause of the metabolic syndrome while increased insulin secretion may reduce the renal excretion of uric acid and sodium and then increased blood uric acid levels increase incidence of cardiovascular events.[5–7]

In contrast, some researchers have reported that uric acid concentration is not a helpful marker to predict cardiovascular disease.[8]

Given the conflicting results about the association between uric acid and cardiovascular disease, we decided to survey correlation between the extent of coronary lesions and blood uric acid.

## Methods

In this cross sectional study, all patients admitted to the Ekbatan hospital in 2015 that were candidates for coronary angiography according to the AHA[e] (initial manifestation of chronic chest pain and heart failure, acute myocardial infarction, symptomatic post MI[f] patients, unstable angina according to Guideline class 1, 2A, 2B) were evaluated. Patients were evaluated for left ventricular ejection fraction and wall motion abnormalities by echocardiography while lipid profile, uric acid and blood sugar were checked. Test results, physical examination, and past medical history were recorded in their medical records. In this study, referring to patients' medical records, age and height, the demographic characteristics of the patients, coronary angiography result; LVEF[g] and tests results were recorded in researcher's sheets. The patients with renal impairment based on serum creatinin were excluded.

To determine the relationship between blood uric acid by the extent of atherosclerosis and other variables, Kruskal–Wallis test, Mann–Whitney and Pearson correlation coefficient were used and the significance level was set at "0.05".

## Results

A total of 140 patients were examined in this study. The mean age was 62.92 ± 11.21 years; in terms of gender, 60% were male and 40% female. The mean body mass index was 26.36 ± 3.91 kg per square meter; 29.48% of patients had diabetes, 43.57% had hypertension and 34.29% were smokers.

The mean value of uric acid was 6.39 ± 2.16, the minimum being 2 and the maximum 13 mg/dl. Based on the result of Pearson correlation coefficient between the variables EF and uric acid incomplete inverse association was observed with increasing uric acid, EF was reduced (r = −0.16), but a statistically significant relationship (P = 0.057) was not found.

The highest frequency of coronary artery disease on angiography results was 3VD[h] (30.7%), SVD[i] (24.3%) and Mild, Minimal or patent (24.3%). The mean of uric acid in these groups was: SVD (6.17 mg/dl), 2VD (6.56 mg/dl), 3VD (6.32 mg/dl), Mild or Minimal or patent (6.78 mg/dl) and Ectatic or Slow flow (7.30 mg/dl). The Kruskal–Wallis analysis results showed the relation between the mean blood uric acid and the extent of coronary artery disease was not statistically significant (P value = 0.60) (Table 1).

The mean blood uric acid in different subgroups of gender, age (under 50 years, above-50 years), history of smoking, high blood pressure, PCI[j]/CABG[k] and body mass index (below 30 and above 30 kg/m$^2$) did have not a significant statistical difference. Average blood uric acid in patients with diabetes and without diabetes, respectively, was 8.5 mg/dl and 6.66 mg/dl, and the difference between

[e] American heart association.
[f] Myocardial infarction.
[g] Left ventricular ejection fraction.
[h] Three vessel disease.
[i] Single vessel disease.
[j] Percutaneous coronary intervention.
[k] Coronary artery bypass graft.

**Table 1** Distribution of the extent of atherosclerosis in patients with coronary artery disease based on the average of serum uric acid.

| Extent of atherosclerosis | Mean (SD) | Number (Percent) | P value |
|---|---|---|---|
| Single vessel disease | 6.17 (1.91) | 34 (24.64) | 0.60 |
| Two vessel disease | 6.56 (2.17) | 23 (16.66) | |
| Three vessel disease | 6.32 (2.01) | 43 (31.16) | |
| Mild or Minimal or patent | 6.78 (3.16) | 34 (24.64) | |
| Ectatic or Slow flow | 7.30 (0.86) | 4 (2.90) | |

the two groups was statistically significant. Also, average uric acid of two different impressions at admission ACS[l] (7.0) and SIHD[m] (6.15), were significantly different (Table 2).

In our study among studied medications, only between the mean uric acid in those who were taking Statins (5.83) with those who were not taking Statins (6.55) a statistically significant difference was observed (Table 3).

The relationship between serum cholesterol, triglycerides, LDL,[n] HDL[o] and creatinine with uric acid did not show any significance but only significant inverse correlation was observed between uric acid and triglycerides ($r = -0.17$, $P = 0.047$) (Table 4).

## Discussion

Physical inactivity, hypertension, abnormal blood lipid levels, smoking and obesity are major risk factors for cardiovascular diseases.[9] In our study, the amount of uric acid and extent of coronary stenosis showed no statistically significant difference. But in patients with stable ischemic heart disease compared with the patients with acute coronary syndrome the average of uric acid was significantly higher.

In the study of Rashidi et al., the blood uric acid level in patient with metabolic syndrome and healthy men was compared and they concluded that the prevalence of hyperuricemia is significantly associated with metabolic syndrome and some of its components.[10] In the study of Nissa et al., mean serum uric acid in patients with IHD[p] and with and without-infarction was significantly higher than the control group.[11] In the study of Sinan Deveci et al. a relation between uric acid level and presence and severity of coronary heart disease was observed.[12]

The results of our study are consistent with mentioned findings. In our study also, the mean uric acid was higher in the patients with stable ischemic heart disease, while no significant statistical relation between uric acid and extent of coronary lesions was seen, that is contrary to the findings of Rashid's and Nisa's study. The cause of this discrepancy is that the studies of Nisa and Rashid had non-patient group. However, in our study, there was no control group.

[l] Acute coronary syndrome.
[m] Stable ischemic heart disease.
[n] low-density lipoprotein.
[o] High-density lipoprotein.
[p] Ischemic heart disease.

**Table 2** Distribution of serum uric acid in patients with coronary artery disease based on demographic variables, risk factors and medical records.

| Variable | Variable group | Number | Mean (SD) | P value |
|---|---|---|---|---|
| Gender | Male | 84 | 6.68 (2.18) | 0.05 |
| | Female | 56 | 5.94 (2.06) | |
| Age | >50 | 16 | 6.75 (2.34) | 0.60 |
| | ≤50 | 124 | 6.43 (2.30) | |
| Smoking | No | 92 | 6.29 (2.01) | 0.48 |
| | Yes | 48 | 6.57 (2.41) | |
| DM[a] | No | 99 | 6.66 (2.30) | 0.03 |
| | Yes | 41 | 5.80 (1.60) | |
| HTN[b] | No | 79 | 6.50 (2.17) | 0.49 |
| | Yes | 61 | 6.26 (2.15) | |
| PCI[c]/CABG[d] | No | 123 | 6.33 (2.16) | 0.44 |
| | Yes | 17 | 6.77 (2.17) | |
| Impression | ACS[e] | 101 | 6.15 (2.07) | 0.04 |
| | SIHD[f] | 39 | 7.00 (2.28) | |
| BMI[g] | >30 | 112 | 6.45 (2.40) | 0.92 |
| | ≤30 | 28 | 6.50 (1.80) | |

[a] Diabetes Mellitus.
[b] Hypertension.
[c] Percutaneous coronary intervention.
[d] Coronary artery bypass graft.
[e] Acute Coronary syndrome.
[f] Sever Ischemic Heart Disease.
[g] Body Mass Index.

**Table 3** Distribution of thiazide diuretics and other drugs in patients with a history of coronary artery disease based on average serum uric acid.

| Variable | Variable groups | Number | Mean (SD) | P value |
|---|---|---|---|---|
| Thiazide | Yes | 17 | 6.77 (2.02) | 44.0 |
| | No | 123 | 6.32 (2.17) | |
| Statin | Yes | 46 | 5.83 (1.74) | 041.0 |
| | No | 94 | 6.65 (2.29) | |
| ACEI[a] | Yes | 36 | 6.85 (2.07) | 14.0 |
| | No | 104 | 6.23 (2.17) | |
| ARB[b] | Yes | 36 | 6.39 (2.20) | 99.0 |
| | No | 104 | 6.38 (2.21) | |

[a] Angiotensin-converting-enzyme inhibitor.
[b] Angiotensin II Receptor Blockers.

Thus, as Rodrigues et al. reported in their study the measurement of uric acid may be useful in the risk stratification of cardiovascular disease without renal insufficiency.[13]

In contrast, Wheeler et al. reported that uric acid concentration is not a useful marker to predict cardiovascular disease risk.[8]

Some researchers have noticed relation between uric acid and one-year mortality. According to a study of one-year follow up of patients with coronary artery disease, there is a J-curve relation between uric acid level and coronary angiography findings.[14] That means mortality is higher at two extremes of uric acid, showing the importance of uric acid control, particularly high levels.

**Table 4** Mean and standard deviation creatinin, serum lipids and correlation with serum uric acid levels in patients with coronary artery disease.

| Lipid | r | Standard deviation | Mean (SD) | P value |
|---|---|---|---|---|
| Cholesterol | −0.08 | 47.77 | 164.79 | 0.33 |
| TG[a] | −0.17 | 96.14 | 168.88 | 0.04 |
| HDL[b] | 0.13 | 9.43 | 40.56 | 0.13 |
| LDL[c] | −0.10 | 30.60 | 85.87 | 0.25 |
| Cr[d] | 0.04 | 0.69 | 1.21 | 0.61 |

[a] Triglycerides.
[b] High-density lipoprotein.
[c] Low-density lipoprotein.
[d] Creatinine.

In our study the amount of EF and serum uric acid levels was inversely correlated, but the correlation was not statistically significant.

Uric acid may have direct or indirect effects on the cardiovascular system. But the determination of its effect on other cardiovascular risk factors such as hypertension, diabetes, dyslipidemia and obesity is difficult. It is not known that uric acid has destructive or protective role. But high levels of uric acid are a powerful predictor of cardiovascular risk and unfavorable prognosis.[16]

In our study, there was no significant relation between blood uric acid with age, gender, smoking, BMI,[q] hypertension, LDL, HDL, and serum cholesterol. But mean uric acid level in patients with diabetes was significantly lower than non-diabetics that may be due to the diet and drug regimen that cause controlling blood uric acid and result in decreasing blood uric acid.

## Conclusion

Determining whether uric acid is an independent risk factor for coronary heart disease progresses or not is unclear.[17] There is a relation between serum uric acid and Stable Ischemic Heart Disease. But there was no association between uric acid with the extent of coronary artery disease. Uric acid may be an independent risk factor predictive of atherosclerosis but also through effects on other variables such as blood sugar, metabolic and cardiovascular syndrome it indirectly increases the risk of vascular disease.

## Conflict of interest

The authors declare that they have no conflicts of interest.

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[q] Body Mass Index.

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