



CO-RELATION OF HYPERURICEMIA WITH THE SEVERITY OF THE CORONARY ARTERIES OCCLUSION IN INDIAN POPULATION

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ABSTRACT

Background: Cardiovascular disease is the most common cause of death worldwide. In this study, we tried to find a correlation between serum uric acid levels and the level of severity of coronary arteries occlusion in terms of the number of vessel involvement. **Methods:** This was a cross-sectional study conducted at a tertiary care hospital associated with medical college. A total of 102 patients were taken in the study. The patients were in the age category of 40-75 years of age. We used standard Automated Analysers for the analysis of blood glucose, lipid profile and serum uric acid level. IBM SPSS (Version 20.0) was used for all the analysis. **Results:** The patients were divided into 3 groups: single vessel disease (n=40), double vessel disease (n=38) and triple vessel disease (n=24). Biochemical profile of all the groups was obtained by proper lab tests. The group with triple vessel disease had highest amount of LDL cholesterol. This group also had highest number of serum uric acid level. Average was 8.1 ± 3.6 mg/dl. This was followed by double vessel disease followed by single vessel disease. (P value was 0.03). **Conclusion:** This study proved that with an increase in the serum uric acid level, there is an increase in the level of severity of Coronary Vessel Disease. Also, serum uric acid level is an independent risk factor for coronary artery disease.

INTRODUCTION

Uric acid (urate), an organic compound of carbon, nitrogen, oxygen and hydrogen, is the final oxidation product of purine metabolism, and its elevated levels reflect increased xanthine oxidase activity. For decades it has been hypothesised that the oxidant properties of uric acid might be protective against ageing, oxidative stress and oxidative cell injury. However, recent epidemiological and clinical evidences suggest that hyperuricaemia might be a risk factor for cardiovascular disease where enhanced oxidative stress play an important pathophysiological role.^[3] It has been recently reported that serum uric acid is an independent predictor of mortality for patients with coronary artery disease (CAD) and morbidity, including acute myocardial infarction (AMI) or congestive heart failure.^[4,5,6,7]

Ischaemic heart disease (IHD) causes more deaths and disability and incurs greater economic costs than any

other illness in the developed world. Population subgroups that appear to be particularly affected are men in South Asian countries, especially India and the Middle East. In light of the projection of large increases in IHD throughout the world, IHD is likely to become the most common cause of death worldwide by 2020.^[1]

Hyperuricemia is present frequently in patients with symptomatic heart failure, acute coronary syndromes, arterial hypertension, and atrial fibrillation.^[8,9,10] It has been postulated that serum uric acid plays a pivotal role in the pathogenesis of cardiovascular diseases affecting xanthine oxidase pathway that contributes to the production of reactive oxygen species with deterioration of cell membranes.^[11] Reactive oxygen species contribute to vascular oxidative stress and endothelial dysfunction, which are associated with the risk of atherosclerosis, damages of both cardiomyocytes and vascular endothelium inducing disturbances of

myocardial contractility and vasoconstriction.^[12] The increase in serum uric acid in patients with cardiovascular disease may reflect a compensatory mechanism to counter the oxidative stress that occurs with tissue hypoxia, thus, the higher levels of uric acid corresponding to high risk may reflect response to tissue injury, whereas the higher risk at lower levels of uric acid levels may be the result of decreased antioxidant capacity.^[13,14,15] Evidence for involvement of uric acid in cardiovascular disease is extensive, and so are the controversies surrounding the interpretation of the data. This study has been taken up to determine serum uric acid levels in Acute Coronary Syndromes (ACS) and to compare the incidence of complications in

hyperuricaemic and normouricaemic ACS patients.^[14,15,16,17]

RESULTS

In this study, patients were divided into 3 groups: single vessel disease (n=40), double vessel disease (n=38) and triple vessel disease (n=24). Biochemical profile of all the groups was obtained by proper lab tests. The group with triple vessel disease had highest amount of LDL cholesterol. This group also had highest number of serum uric acid level. Average was 8.1±3.6 mg/dl. This was followed by double vessel disease followed by single vessel disease. (P value was 0.03)

Table 1: Baseline characteristics of the study population.

	SVD	DVD	TVD
Age (years)	52±13.5	53.4±12.4	56.7±13.2
Sex (Male/Female)	26/14	24/14	17/7

Table 2: Biochemical parameters of the study population.

	SVD	DVD	TVD
Hba1c(mg%)	6.5±1.2	6.4±1.8	7.1±1.0
Systolic blood pressure(mmHg)	136±8.4	142±10.2	144±12.4
Diastolic blood pressure(mmHg)	86±6.2	88±7.4	90±4.2
hsTropI (ng/dl)	9.4±2.5	7.9±5.4	8.0±4.9
Total Cholesterol(mg/dl)	159±36	164±34	167±39
HDL Cholesterol(mg/dl)	45±8	42±9	38±12
LDL Cholesterol(mg/dl)	121±18	128±20	134±16

Table 3: Serum uric acid level in the study population.

	SVD	DVD	TVD	P value
Serum Uric Acid level(mg/dl)	5.4±2.0	6.4±1.3	8.1±3.6	0.03

The study populations were age and sex-matched, as shown in **Table 1**.

The biochemical characteristics of the study population are shown in **Table 2**.

As shown in **Table 3**, the mean level of serum uric acid levels significantly differed and its mean levels increases as the severity of vessel diseases increases. It shows that increase serum uric acid might cause oxidative stress and free radical injury prevailing in the cases of cardiovascular disease.

Hyperuricemia is a significant epidemiological problem in CCS, and has been strongly connected to CV mortality and CV events in this specific subgroup of patients. The most important issue in these subjects is the possible relationship between UA levels and the extent and severity of Coronary Artery Disease (CAD). As shown in **Table 3**, UA correlates with CAD, as defined as the number of vessels involved.

Hyperuricemia has not only been found to have an independent association with the development of CAD (as shown in table 2), but there is also complex interrelations with many other independent CV risk factors such as diabetes, obesity, metabolic syndrome, and chronic kidney disease. This makes it hard to confirm independent studies to investigate a firm, independent association of uric acid levels with CAD. Although the association of hyperuricemia with CAD has been found in this study.

On the basis of present study, it may be hypothesized that uric acid is involved in the process of myocardial injury by accentuating progression of atherosclerosis and occlusion of the vessel due to its role in the imbalance between myocardial oxygen supply and demand.

DISCUSSION

The present study with diagnosed and suspected cases of Cardiovascular Disease showed that serum uric acid levels were correlated with coronary vessel disease severity. Uric acid is the byproduct of purine

metabolism. The enzyme xanthine oxidase catalyses the essential reactions of conversion of hypoxanthine to xanthine and then uric acid.^[2] The final degradation product of uric acid metabolism, allantoin is then excreted freely in the urine. After filtration through the glomeruli, uric acid is completely reabsorbed in the PCT.^[18] Elevated levels of uric acid in serum can be either due to overproduction or under secretion. Previous studies have reported that a positive correlation between serum uric acid and cardiovascular conditions including hypertension, coronary artery disease, pre-eclampsia, metabolic syndrome, cerebrovascular disease, dementia.^[19]

In this study, we found that the group with triple vessel disease had highest amount of LDL cholesterol. This group also had highest number of serum uric acid level. Average was 8.1 ± 3.6 mg/dl. This was followed by double vessel disease followed by single vessel disease. (P value was 0.03)

The stipulated mechanisms for the association of uric acid with these pathological cardiovascular events could be attributed to either increased oxidative stress due to oxidants being generated by xanthine oxidase, which then impairs nitric oxide synthesis and mediated vasodilation.^[20] Studies also suggest that uric acid induces proliferation of vascular smooth muscle cells, and induces expression of pro-inflammatory molecules like C-reactive protein in endothelial cells. Genetic causes of hyperuricemia have been linked with derangement of nitric oxide synthesis, and thus, endothelial dysfunction acts as a harbinger for inflammation and cardiovascular compromise.^[21,22]

The results of this study reveal that serum uric acid levels significantly rises with the severity of the disease, from a single vessel to triple vessel involvement.^[20] On the basis of present study, it may be hypothesized that uric acid is involved in the process of myocardial injury by accentuating progression of atherosclerosis and occlusion of the vessel due to its role in the imbalance between myocardial oxygen supply and demand.^[20,21]

This study proved that with an increase in the serum uric acid level, there is an increase in the level of severity of Coronary Vessel Disease. Also, serum uric acid level is an independent risk factor for coronary artery disease.^[15] Uric acid being an inexpensive and easily available biochemical marker, it will be of much use in settings with limited resources. Compared to markers such as Brain Natriuretic peptide (BNP) and hs CRP which have been widely used in assessing prognosis of acute MI, whether SUA could be an independent predictor of prognosis of the patients with ACS needs to be confirmed by further studies. Serum uric acid can also be used to predict the severity of CAD. Hence, uric acid should form an integral part of the work up of the management of ACS patients. More interventional studies concerning the lowering of SUA levels and their

benefit on cardiovascular related mortality in ACS patients need to be carried out.^[15,16,17,18]

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