

# Serum Albumin and Uric Acid Estimation in Ischemic Heart Disease Patients

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## Abstract

**Aim:** The aim of the study was to evaluate serum uric acid and serum albumin levels in ischemic heart disease patients (IHD).

**Materials and Methods:** Around 60 persons were recruited for the study, with 30 patients diagnosed as IHD and 30 healthy volunteers. Serum uric acid and serum albumin were estimated using Semi Auto Analyzer. Statistical analysis was performed using SPSS version 16. The parameters were compared among two groups using independent *t*-test.

**Results:** Serum uric acid levels ( $P = 0.000$ ) were increased significantly in Group II patients compared to those in Group I controls. There was no significant difference in serum albumin levels among the two groups. Levels of serum albumin in Group I and Group II are almost similar.

**Conclusion:** From this study, serum uric acid can be used to assess the prognosis of patients with IHD. Our study showed a normal serum albumin levels in both the groups, but low serum albumin is associated with high mortality in general.

**Clinical significance:** Recent studies have provided evidence that uric acid may play a role in the progression of various diseases including cardiovascular complications. As a result, the measurement of uric acid concentrations is now mandatory for the management of those disease states. Low serum albumin level causes subclinical fluid overload in IHD patients leading to poor prognosis. Hence, further studies have to be carried out to assess the association of quality of life in IHD patients and serum albumin levels.

**Key words:** Hyperuricemia, Hypoalbuminemia, Ischemic heart disease, Oncotic pressure, Semi Auto Analyzer

## INTRODUCTION

According to 2010 Global Burden of Disease Study, ischemic heart diseases (IHD) was the single largest cause of death out of the total number of deaths in the combined regions of Central, Eastern, and Western Europe followed by cerebrovascular diseases.<sup>[1]</sup> Coronary heart disease is the major cause of death and disability in the developed countries.<sup>[2]</sup>

Uric acid is the final oxidation product of purine catabolism. Despite the fact that uric acid is an antioxidant, its role

in the pathogenesis of IHD has been well established in related studies. A systematic review and meta-analysis of hyperuricemia and coronary heart disease revealed the role of hyperuricemia as a risk factor for cardiovascular diseases.<sup>[3]</sup>

Hyperuricemia is defined as uric acid levels more than 6.5 mg/dl in males and more than 6 mg/dl in females. Hyperuricemia is associated with the generation of free radicals, endothelial dysfunction, progression of atherosclerosis, and thrombus formation. Uric acid is mainly responsible for the propagation of oxidative stress.<sup>[4]</sup> Pro-inflammatory pathway activation is mediated by uric acid.<sup>[5]</sup> The fact that uric acid as a risk factor for IHD remains a controversy. Various epidemiologic studies conducted in the past concluded uric acid as a marker of cardiovascular diseases<sup>[3]</sup> while some may contradict the statement.<sup>[6]</sup>

Serum albumin is the major plasma protein synthesized by the liver. Albumin mainly contributes about 70–80% of

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plasma oncotic pressure.<sup>[7]</sup> Hypoalbuminemia is implicated in the development of pulmonary edema.<sup>[8]</sup> Pulmonary edema results when either an increase in the pulmonary capillary pressure or fall in the colloid osmotic pressure.<sup>[9]</sup> According to Starling's hypothesis, reduced plasma oncotic pressure due to hypoalbuminemia causes shift of fluid from intravascular to interstitial space facilitating the onset of cardiogenic pulmonary edema. Furthermore, albumin binds and transports free fatty acids and protects against lipid peroxidation. Fatty acids may serve several cell functions such as gene expression and intracellular signal transduction. Some fatty acids are precursors of eicosanoids.<sup>[7,10]</sup>

Studies show that hypoalbuminemia is a predictor of cardiovascular morbidity and mortality.<sup>[11]</sup> Etiology of hypoalbuminemia may be due to malnutrition, reduced albumin production by the liver due to congestion, hemodilution, inflammation, etc.<sup>[12]</sup> In our study, we made an effort to identify the relationship between uric acid, albumin, and the IHD.

### Aim and Objectives

The objectives are as follows:

- To evaluate the serum levels of uric acid in IHD patients.
- To estimate serum albumin levels in IHD patients.

## MATERIALS AND METHODS

A case-control study was conducted with 60 individuals of both the sexes in the age group of 35–75 years. They are divided into 2 groups of 30 each. Patients with the history of chest pain diagnosed as IHD patients by the cardiologist formed the Group 2. Standard pro forma was used for history taking, examination, and investigation. Proper written informed consent was obtained from the study group. Ethical Committee Clearance was obtained from the institutional review board.

### Exclusion Criteria

The following criteria were excluded from the study:

- Chronic kidney disease
- Gout
- Malignancy
- Heart failure.

### Specimen Collection and Processing

From the controls and the patients, 5 ml of venous blood was collected in a clot activator tube. Blood was allowed to clot for 30 min and serum was separated after centrifugation.

### Analysis

Serum was analyzed for uric acid and albumin. The analytes were assayed using special kits from ERBA diagnostics.

The analysis of serum was performed using Semi Auto Analyzer.

### Uric Acid Measurement: Uricase Method

Uricase converts uric acid into allantoin and hydrogen peroxide. Enzyme peroxidase couples hydrogen peroxide with phenolic chromogen to form a red colored compound and its absorbance was determined at the wavelength of 510 nm.

### Albumin Measurement: Bromocresol Green (BCG)

BCG forms a colored complex with serum albumin and its absorbance was measured at the wavelength of 510 nm.

### Statistical Analysis

"Independent t-test" was applied for statistical analysis. The outcomes were presented as mean (standard deviation) and  $P < 0.05$  was considered significant and the parameters were compared among two groups. The analysis was performed using SPSS version 16.

## RESULTS

In our study, we measured the levels of serum uric acid and albumin among the IHD patients and compared with that of age sex-matched normal volunteers. We found a significant change in serum uric acid as mentioned by  $P$  value by 2 tailed student test as seen in Table 1. The mean uric acid level in IHD patients was found to be  $6.25 \pm 1.7$  mg/dl whereas it was  $4.61 \pm 0.7$  mg/dl in the control group. Serum uric level was found to be higher in the IHD patients group. In the estimation of serum albumin, we did not notice any significant difference among the 2 groups ( $P$  value 0.2). In IHD patients, the mean albumin level in serum was  $3.63 \pm 0.48$  g/dl, and in the normal group, the mean albumin level was  $3.76 \pm 0.45$  g/dl. We also noticed a small decrease in the albumin levels in the patient group.

## DISCUSSION

In our study, we found a significant association in serum uric acid levels between the two groups. As we are aware about the consequences of having high uric acid levels in IHD patients from other studies, it is better to have a constant watch in such patients to reduce the mortality

**Table 1: Mean and standard deviation of serum uric acid and albumin in controls and patients**

Parameter	Group 1 (controls)	Group 2 (IHD patients)	Student t-test Sig (2 tailed) <i>P</i> value
Uric acid (mg/dl)	$4.61 \pm 0.7$	$6.25 \pm 1.7$	$0.000^*$
Albumin (g/dl)	$3.76 \pm 0.45$	$3.63 \pm 0.48$	0.2

\* $P < 0.05$  was considered significant. IHD: Ischemic heart disease

rate. Many epidemiological studies have shown a significant correlation between elevated uric acid levels and diseases such as hypertension, atherosclerosis, stroke, and heart failure. In patients with heart failure and cardiovascular disease, uric acid levels in serum are used to predict mortality.<sup>[13,14]</sup> However, according to Framingham heart study, uric acid was not associated with the progression of cardiovascular diseases.<sup>[15]</sup>

Several cohort studies identified an association of elevated serum uric acid levels with the prognosis of cardiovascular diseases.<sup>[16]</sup> In other studies, serum uric acid was identified as negative prognostic factor in case of severe heart failure.<sup>[17]</sup> In yet another study, the relationship was determined between elevated serum uric acid levels with progression of acute myocardial infarction.<sup>[18]</sup>

Humans convert purines, namely adenosine and guanosine to uric acid. During the conversion of hypoxanthine to uric acid catalyzed by xanthine oxidase, reactive oxygen species are produced. Xanthine oxidase is involved in the pathogenesis of IHD, reperfusion injury, and heart failure. A constant balance occurs between production and excretion of uric acid. Hyperuricemia commonly results when there is any derangement in the mechanism.<sup>[13]</sup>

From our study, we could not find any significant change in albumin levels among the two groups. Hypoalbuminemia can cause worsening of cardiovascular diseases hence estimation of albumin will help to monitor IHD patients. In the Cardiovascular Health Study conducted by Gerasimos,<sup>[19]</sup> hypoalbuminemia can be used to predict the risk of HF among community-dwelling elderly people. Furthermore, in some studies, hypoalbuminemia is found to be associated in the development of pulmonary edema.<sup>[20]</sup> Hypoalbuminemia in cardiovascular disease patients is associated with increased risk of mortality.<sup>[21]</sup>

## CONCLUSION

Our study demonstrated an elevated serum uric acid levels which are significantly higher in IHD patients when compared to normal individuals hence monitoring of serum uric acid could guide the outcome or prognosis in IHD patients. Serum albumin levels were not significantly elevated in this study. Since an increased risk of mortality is established in hypoalbuminemia patients, constant measurement of serum albumin levels will improve the outcome in IHD patients.

### Limitations of the Study

The sample size is small and would have been better if it was a longitudinal study. The analytes of our study may be

affected by some diseases or treatment with some drugs. All the chronic diseases were not ruled out. Other markers of inflammation like C reactive proteins were not assessed in our study protocol.

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