# **Original Research Article**

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# Serum uric acid levels in acute myocardial infarction

# Padma V.\*, Amogh Banupriya

Department of Medicine, Sree Balaji Medical College, Barath University, Chennai, India

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### \*Correspondence: Prof. V. Padma,

E-mail: padmaramesh86@yahoo.com

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#### **ABSTRACT**

**Background:** Higher uric acid is a negative prognostic factor in patients with mild to severe heart failure. Studies have shown that there is a close correlation between serum uric acid concentration and Killip classification in patients of acute myocardial infarction and uric acid levels are higher in patients with higher Killips class.

Methods: We studied 100 patients with acute myocardial infarction and compared with 100 controls. Serum uric acid level was measured on day 0, 3 and 7 of MI and results were analysed.

Results: Average uric acid level in male cases was 5.6 and female cases was 5.2, male controls were 4.2 and female controls was 3.6. Females had a higher mortality when compared with male patients. One female died due to MI on day 0, one male and two females died on day 3 and four males and four females died on day 7. All patients who died had higher uric acid levels.

Conclusions: Serum uric acid levels are higher in patients of acute myocardial infarction as compared to normal healthy persons. Serum uric levels increases in patients with higher Killip class. Combination of Killip class and serum uric acid level after acute myocardial infarction is a good predictor of mortality after acute myocardial infarction.

Keywords: Heart failure, Killips class, Myocardial infarction, Uric acid

#### INTRODUCTION

Clinical studies have proved that serum uric acid (SUA) is significantly associated with cardiovascular disease. 1-3 Uric acid is an independent predictor of major adverse cardiovascular events (MACE) in patients with coronary artery disease.4-5

High serum uric acid causes increasing platelet reactivity mediating inflammation and stimulation of smooth muscle cell proliferation which probably worsens acute thrombosis.<sup>6-7</sup> Following myocardial infarction (MI) some proteins and enzymes labeled as cardiac markers (CPK-MB / Troponin T) are released in large quantity from necrotic heart muscle into the circulation. Epidemiological studies have shown that uric acid may be a risk factor for cardiovascular diseases.

Elevated serum uric acid is highly predictive of mortality in patients with heart failure in coronary artery disease.8 The objective of the study was to study the serum uric acid level in patients with acute myocardial infraction and to correlate the associated mortality in acute myocardial infarction with uric acid levels.

#### **METHODS**

Patients more than 30 years of age who were diagnosed as ST segment elevation acute myocardial infarction (STEMI) or non-ST segment elevation acute myocardial infarction (NSTEMI) on the basis of clinical history, examination, ECG changes, biochemical markers were enrolled in this study. 100 patients with MI were enrolled after they met the inclusion criteria and written consent was taken for participating in the study.

#### Inclusion criteria for patients

Patients brought to hospital with history of chest pain and diagnosed as ST segment elevation acute myocardial infarction (STEMI) or non-ST segment elevation acute myocardial infarction (NSTEMI) on the basis of clinical history, examination, ECG changes and biochemical markers like troponin T, creatine kinase.

#### Exclusion criteria

Patients with Chronic kidney disease, gout, haematological malignancy, hypothyroidism and patients on drugs like salicylates, diuretics - mainly thiazide diuretics, pyrazinamide etc.

Detailed history and clinical examination was carried out. All patients underwent routine investigations including complete blood counts, renal function tests, liver function tests, ECG, chest X-ray and echocardiogram.

Patients were followed up till hospital stay i.e. 7 days. Serum uric acid level was measured on day 0, 3 and 7 of MI. 100 age and sex matched healthy controls were evaluated. A detailed statistical analysis was carried out. Basal serum uric acid levels were compared with controls with unpaired 't' test.

### **RESULTS**

Present study was conducted in 100 patients with acute myocardial infarction, who presented with in 24 hrs of onset of symptoms to the hospital. 100 age and sex matched controls were enrolled and uric acid levels and ECG were taken. Out of 100 patients, 56 had ST-elevation myocardial infarction (STEMI), 44 patients were of non-ST elevation myocardial infarction (NSTEMI). 96 patients were thrombolysed and 4 were not thrombolysed due to late presentation (Table 1) (Table 2) (Table 3).

Table 1: Comparison of the mean uric acid levels between killip classes at day 0.

Killips class	Number of patients	Mean
I	42	4.040
II	25	4.836
III	21	6.412
IV	12	7.422

P value < 0.001

Table 2: Comparison of the mean uric acid levels between killip classes at day 3.

Killips class	Number of patients	Mean
I	55	4.122
II	19	4.010
III	12	5.422
IV	14	7.540

P value < 0.001

Table 3: Comparison of the mean uric acid levels between killip classes at day 7

Killips class	Number of patients	Mean
I	52	4.102
II	12	5.230
III	15	6.340
IV	21	7.010

The three tables suggest that uric acid levels are higher in patients with higher complications (killips class).

Average uric acid level in male cases was 5.6 and female cases was 5.2, male controls was 4.2 and female controls was 3.6 (Figure 1).

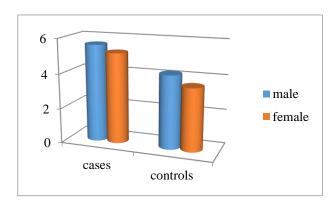


Figure 1: Uric acid levels between cases and controls.

Females had a higher mortality when compared with male patients. One female died due to MI on day 0, one male and two females died on day 3 and 4 male and 4 females died on day 7. All patients who died had higher uric acid levels (Figure 2).

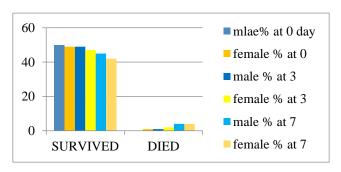


Figure 2: Comparison of mortality between genders.

#### **DISCUSSION**

Following myocardial infarction (MI) some proteins and enzymes labeled as cardiac markers (CPK-MB / Troponin T) are released in large quantity from necrotic heart muscle into the circulation. Epidemiological studies have shown that uric acid may be a risk factor for cardiovascular diseases. Elevated serum uric acid is highly predictive of mortality in patients with heart failure in coronary artery disease. Clinical studies have proved that serum uric acid (SUA) is significantly associated with cardiovascular disease. Uric acid is an independent predictor of major adverse cardiovascular events (MACE) in patients with coronary artery disease. High serum uric acid causes increasing platelet reactivity mediating inflammation and stimulation of smooth muscle cell proliferation, which probably worsens acute thrombosis.

Normal uric acid level is 3.4-7.2 mg/dL for men and 2.4-6.1 mg/dL for women.

# Causes of high uric acid

- Hereditary- Lesch-Nyhan syndrome, an extremely rare inherited disorder, associated with very high serum uric acid levels. Spasticity, involuntary movement and cognitive retardation, gout is seen
- High intake of dietary purine, high fructose corn syrup and table sugar can cause increased levels of uric acid
- Serum uric acid can be elevated due to reduced excretion by the kidneys
- Certain drugs like thiazide diuretics can increase uric acid levels.

#### Uric acid and cardiovascular disease

Although uric acid can act as an antioxidant, excess serum accumulation is often associated with cardiovascular disease.

#### Uric acid and type 2 diabetes

Hyperuricemia has always been presumed to be a consequence of insulin resistance. Studies have shown that high serum uric acid is associated with higher risk of type 2 diabetes, independent of obesity, dyslipidemia, and hypertension.<sup>9</sup>

#### Uric acid and MI

Following myocardial infarction (MI) proteins and enzymes labeled as cardiac markers (CPK-MB/ Troponin T and I) are released in to the blood in large quantity from necrotic heart muscle. Elevated serum uric acid is highly predictive of mortality in patients with heart failure or coronary artery disease. Adenosine synthesized by vascular smooth muscle in cardiac tissue is rapidly degraded by the endothelium to uric acid, which

undergoes rapid efflux to the vascular lumen due to low intracellular pH and negative membrane potential.<sup>10</sup> Xanthine oxidase activity and uric acid synthesis are increased in vivo under ischaemic conditions, and hence elevated serum uric acid may act as a marker of underlying tissue ischaemia. Hyperuricaemia associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, haemorheology, and aggregation. Evidences suggest that high uric acid is a negative prognostic factor in patients with mild to severe heart failure. 11 Some evidences suggest that uric acid may exert a negative effect on cardiovascular disease by stimulating inflammation, which is clearly involved in the pathogenesis of cardiovascular disease. 12 Uric acid is a general marker of cell death and elevated serum uric acid is linked with obesity, dyslipidemia, hypertension, insulin resistance, male gender, aging, menopause, excessive alcohol intake and diuretic use. Uric acid level reflects xanthine oxidase pathway activity, which has the potential to contribute in to the progression of left ventricular dysfunction by interfering with myocardial energetics and myofilament calcium sensitivity. 13

A study done in Japan showed that serum uric acid levels correlated with Killip classification. <sup>14</sup> Combination of Killip class and serum uric acid level after acute myocardial infarction was a good predictor of mortality in MI patients. Using this as referral study, we tried to find correlation between serum uric acid and Killip classification in prognosis of post myocardial infarction patients.

In our study males had higher uric acid levels as compared to females. <sup>14</sup> Similar finding were seen in another study. <sup>15</sup> Killip classification is indicator of severity of heart failure. There was a correlation between serum uric acid level and Killip class on day of admission and also on day 3 and day 7 as in earlier study. <sup>14</sup> Studies have shown that serum uric acid level increases in cardiac failure. <sup>16</sup> In our study there was statistically significant correlation found between serum uric acid level and Killip class (p=0.001) on day 3 and patients of Killip class Ill and IV had higher levels of uric acid as compared to patients of class 1 and 1l. Of the 12 patients expired, 7 were in Killips class IV, 3 were in Killips class III and 2 in class I. All patients who died had a higher uric acid levels.

Hyperuricemia is also associated with dyslipidemia, especially hypertriglyceridemia.<sup>17</sup> The mechanism of the relationship between uric acid and lipid metabolism has not been understood completely. Uric acid promotes the development of atherosclerosis. The high level of uric acid causes oxidation of LDL-C and the peroxidation of lipid, formation of oxygen radicals in inflammatory reaction, increases platelet aggregation and the formation of uric acid crystals in the arterial wall which damages the tunica intima of arteries and promotes coronary thrombosis.<sup>18</sup>

#### **CONCLUSION**

Serum uric acid levels are higher in patients of acute myocardial infarction as compared to normal healthy persons. Serum uric levels increases in patients with higher Killip class. Combination of Killip class and serum uric acid level after acute myocardial infarction is a good predictor of mortality after acute myocardial infarction.

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institutional ethics committee

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