

**Original Research Article**

**“A STUDY ON SERUM URICACID AND hs-CRP LEVELS IN ACUTE MYOCARDIAL INFARCTION”**

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**ABSTRACT**

**Background:** Acute myocardial infarction is one of the major causes of mortality and morbidity in the world and continues to be a major health problem in the industrialized and developing country like India, despite progressive research in diagnosis and management. Hyperuricemia due to oxidative stress is associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, hemorrheology and aggregation. C-reactive protein is an acute phase reactant protein, which can stimulate complement activity and macrophages. It is elevated in inflammatory conditions.

**Objectives:** To estimate serum uric acid and hs-CRP in cases and controls and to compare and analyze the levels of these parameters and assess whether they could be an alternate marker in MI.

**Methods:** A comparative case control study conducted on 50 patients with clinically diagnosed MI and Age and sex matched 50 healthy subjects as controls from the general population. 5ml of venous blood was collected to study the Serum Uric Acid and hs-CRP levels in each subject. The data was analyzed and expressed in terms of mean  $\pm$  SD.

**Results:** There was statistically significant increase in the levels of serum uric acid, hs-CRP ( $P < 0.0001$ ). Their diagnostic accuracy in cases was 87%, 97% respectively.

**Conclusion:** It can be concluded that hs-CRP which had diagnostic utility of 97%, could be used as a good diagnostic tool and serum uric acid could be considered as a supportive diagnostic tool in myocardial infarction.

**Keywords** –Myocardial Infarction; Serum Uric Acid; hs-CRP; Oxidative stress; Endothelial injury.

**INTRODUCTION:**

Cardiovascular diseases are the most common cause of death in the industrialized and developing country like india.<sup>1</sup>It has been estimated that by the year 2020 as many as 31.5

percent of all deaths will be due to CVD.<sup>2</sup> Acute Myocardial Infarction (AMI) is the most important form of CVD which is one of the most predominant causes of mortality worldwide despite progressive research in diagnosis and management.<sup>3</sup>

Myocardial infarction (MI) is the important manifestation of coronary heart disease. Due to imbalance between coronary blood supply and myocardial demand, myocardial necrosis occurs resulting in MI. The cause of myocardial ischemia is, reduced blood flow due to obstructive atherosclerotic plaque lesions in one of the three large coronary arteries.<sup>4</sup>

Inflammation plays a key role in the initiation and progression of atherosclerosis and its complications. CRP is a hepatically derived classical acute phase reactant, the serum level of which has long been known to increase after myocardial infarction.<sup>5,6</sup> High-sensitivity C-reactive protein (hs-CRP) is a marker of inflammation that predicts the incidence of myocardial infarction, stroke, peripheral arterial disease, and sudden cardiac death among healthy individuals.<sup>7</sup> hs-CRP has proven as a specific predictor of vascular events and cardiovascular deaths.<sup>8</sup>

Amongst the other markers, high sensitivity C-reactive protein (hs-CRP) has been found to be the most credible, consistent and sensitive marker in numerous studies conducted at various centers all over the world. Uric acid and hs-CRP is also economical and easily available.

Early diagnosis of CVD may give us lead time to save life of millions and there is need to find some definitive markers to monitor the therapy. In view of the above facts this study aims at evaluating the atherosclerotic and the inflammatory burden in patients with clinical profiles of acute MI using serum uric acid levels and serum hs-CRP levels.

Many studies on these parameters have been conducted widely in foreign countries but not many in India. So, a study on these parameters is essential in clinically diagnosed myocardial infarction as they could be alternate associated biochemical markers and cost effective.

**Objective:** To compare and analyse the levels of serum uric acid, hs-CRP and lipid profile in patients with myocardial infarction and asymptomatic healthy individuals.

## **MATERIALS & METHODS**

**Study Design:** comparative case control study.

**Study area:** The study was done in Department of Biochemistry, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry.

**Study Period:** Nov. 2021 – April. 2022.

**Study population:** patients with clinically diagnosed myocardial infarction admitted in Intensive Cardiac Care Unit.

**Sample size:** A total of 100 (50 cases 50 controls) were included in the study.

**Sampling method:** Simple Random sampling method.

**Inclusion Criteria:** Patients who were diagnosed as Myocardial Infarction on the basis of Clinical history, examination, ECG changes and biochemical analysis.

**Exclusion Criteria:**

- Patients with previous history of MI.
- Patients having chronic inflammatory disorders like Rheumatoid Arthritis, Tuberculosis, Osteoarthritis, Inflammatory Bowel Disease etc.
- Hypothyroidism
- Patients on drugs like Diuretics, Salicylates, Ethambutol, Pyrizinamide
- Chronic Kidney Diseases

**Ethical consideration:** Institutional Ethical committee permission was taken prior to the commencement of the study.

**Study tools and Data collection procedure:**

After a thorough history taking and clinical examination, the procedure was explained to the subjects and an informed consent was obtained. 5ml of venous blood sample (fasting) was collected from each subject and it was transferred to the plain tube. It was allowed to clot and then centrifuged for serum separation. Serum was used for the analysis of serum uric acid, hs-CRP and lipid profile.

**Statistical Analysis:**

Data was analyzed by statistical tests by using SPSS package version number 21. Data was expressed in terms of mean  $\pm$  SD. Chi-square test was applied to estimate the difference between the two groups of population. Unpaired „t“-test was used to study the changes in the serum uric acid, hs-CRP and lipid profile levels.

**OBSERVATION & RESULTS:**

This was a comparative case control study conducted on 50 patients with clinically diagnosed myocardial infarction and 50 apparently normal subjects. Serum uric acid, hs-CRP and lipid levels were estimated. The results are expressed as mean  $\pm$  standard deviation.

**Table 1. Age Distribution of Cases and Controls**

Age group (years)	Cases		Controls	
	N	%	N	%
41 – 50	10	20	15	30
51 – 60	16	32	14	28
61 – 70	14	28	13	26
71 – 80	10	20	8	16
<b>Total</b>	<b>50</b>	<b>100</b>	<b>50</b>	<b>100</b>

The mean age (in years) of 50 cases was  $60.04 \pm 11.4$  and that of 50 controls was  $59.12 \pm 11.15$ .

**Table 2. Gender distribution of Cases and Controls**

Gender	Cases n (%)	Controls n (%)
Male	27 (54%)	26 (52%)
Female	23 (46%)	24 (48%)

**Table 3. Comparison of Serum Uric Acid and hsCRP levels between Cases and Controls**

Groups	Serum Uric Acid (mg/dL)	hsCRP (mg/L)
	Mean $\pm$ SD	Mean $\pm$ SD
Cases	$7.24 \pm 0.78$	$4.12 \pm 0.73$
controls	$5.56 \pm 0.69$	$0.78 \pm 0.28$
<b>t*</b>	<b>11.28</b>	<b>29.98</b>

<b>P</b>	<b>&lt; 0.0001, HS</b>	<b>&lt; 0.0001, HS</b>
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**Table 4. Diagnostic value of Serum Uric Acid in Myocardial Infarction**

<b>Serum Uric Acid</b>			
<b>Cut off value : &gt; 6.2 mg/dL</b>			
<b>Serum Uric Acid (mg/dL)</b>	<b>Cases</b>	<b>Controls</b>	<b>Total</b>
<b>&gt; 6.2</b>	46 (92%)	9 (18%)	55
<b>&lt; 6.2</b>	4 (8%)	41 (82%)	45
<b>Total</b>	50	50	100
<b>X<sup>2</sup>=55.31 P &lt; 0.0001,Significant</b>			
<b>Sensitivity = 92%</b> <b>Specificity = 82% Positive Predictive Value = 83% Negative Predictive Value = 91%</b> <b>Diagnostic Accuracy =87%</b>			

The cut off value for serum uric acid was considered as 6.2 mg/dL and the predictive value in myocardial infarction was noted. 92% of cases and 18% of the controls had serum uric acid levels > 6.2 mg/dL while 8% of cases and 82% of controls had < 6.2 mg/dL.

**Table 5. Diagnostic value of hs-CRP in Myocardial Infarction**

<b>hs-CRP</b>
<b>Cut off value: &gt; 1.3 mg/L</b>

<b>hs-CRP (mg/L)</b>	<b>Cases</b>	<b>Controls</b>	<b>Total</b>
<b>&gt; 1.3</b>	50 (100%)	3 (6%)	53
<b>&lt; 1.3</b>	0	47 (94%)	47
<b>Total</b>	50	50	100
<b>X<sup>2</sup>=88.68    P &lt; 0.0001, Significant</b>			
<b>Sensitivity = 100 %</b> <b>Specificity = 94 %</b> <b>Positive Predictive Value = 94 %</b> <b>Negative Predictive Value = 100%</b> <b>Diagnostic Accuracy = 97%</b>			

The cut off value for hs-CRP was considered as 1.3 mg/L and the predictive value in myocardial infarction was noted. 100% of cases and 6% of the controls had hs-CRP levels > 1.3 mg/L while 94% of controls had < 1.3 mg/L.

**DISCUSSION:**

Coronary Artery Disease which frequently manifests as MI continues to exert an enormous roll in western society and also in developing countries like India. Despite progress in its prevention, detection and treatment, it continues to be the leading cause of death. Research over last decade proved the role of oxidative stress and inflammation in pathophysiology of atherosclerosis. Oxidative stress, xanthine oxidase activity and inflammation are important contributors to atherosclerosis, both accelerating the process and precipitating acute plaque rupture. Various traditional and newer biomarkers were suggested for diagnosis and prognosis of MI.

In this study the minimum age of presentation of MI was found to be forty-one (41) years and maximum was eighty (80) years. The age wise distribution revealed the highest percentage of cases was seen in the age group 51 to 60 years (32%) followed by 61 to 70 years (28%) and 20% each in 70 to 80 years and 41 to 50 years. Similar findings were also observed by Munty Bhattacharya et al .<sup>9</sup>

There was statistically significant increase in the levels of serum uric acid in cases (P < 0.0001). The diagnostic accuracy in cases was 87%. This is in accordance with the study

done by Nadkar et al <sup>(10)</sup> who also found significant increase in the serum uric acid levels in patients with MI and stated that it was a good predictor of mortality in those patients.

Jacobs D et al <sup>(11)</sup> in his study found that hyperuricemia correlated strongly as an associated risk factor in MI. He stated that serum uric acid is a variable, subject to modification by a large array of complex and often inter-related factors and suggested that possible risk factors such as hyperuricemia be looked for and treated as a routine, so as to possibly reduce the incidence of MI.

Elevated serum uric acid levels associated with increased cardiovascular morbidity and mortality. Serum uric acid could promote oxidation of low density lipoprotein, cholesterol and lipid peroxidation. High SUA levels can also stimulate the release of free radicals, resulting endothelium damage thereby risk of developing MI.

There was statistically significant increase in the levels of hs-CRP in cases ( $P < 0.0001$ ). The diagnostic accuracy in cases was 97%. Hon- Kan Yip and co-researchers<sup>12</sup> in their prospective study found that serum levels of hs-CRP were significantly increased in patients with AMI. The elevated levels of hs-CRP were due to acute myocardial damage. Ridkar P M in his Physician's Health study (prospective study) found that higher baseline hs-CRP levels were associated with risk of MI.

Anderson<sup>13</sup> in his prospective study showed that hs-CRP levels were four fold increased in cases. The proposed increase in hs-CRP levels were probably the result of immune activation related to the atherogenic process, the inflammatory mechanisms that lead to acute coronary events and the inflammatory response associated with the necrotic myocardial cells in the post ischemic or reperfused myocardium.

The findings of Thompson<sup>14</sup> were contradictory who demonstrated non-significance of hs-CRP measurement in MI. However, in his study, a rather insensitive assay for CRP was used that was unable to differentiate levels with the normal range. Elevated peak CRP in the early phase of MI was related to early mechanical complications, including cardiac rupture, ventricular aneurysm and thrombus formation.

These findings may indicate that serum uric acid and serum hs-CRP may have some role in the pathophysiology of ischemic heart disease. So it can be concluded that higher levels of serum uric acid and hs-CRP were associated with poor prognosis of ischemic heart disease patients.

Myocardial necrosis leads to inflammatory response, cytokines activation and consequential increase of CRP synthesis. Binding of CRP to necrotic myocardial cells and consecutive complement activation is considered responsible for a further myocardial necrosis expansion. Higher level of serum CRP concentration in the patients with AMI indicates greater myocardial inflammatory response as the consequence of more severe myocardial lesion in AMI.

**CONCLUSION:**

Thus, it can be concluded that hs-CRP which had diagnostic utility of 97% could be used as a good diagnostic tool and serum uric acid could be considered as a supportive diagnostic tool in myocardial infarction.

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