

# Serum Lactic Acid Levels, Lactate Clearance, and Uric Acid Levels as Prognostic Markers in Acute Coronary Syndrome Patients

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## Abstract

**Introduction:** India represents the highest burden of acute coronary syndrome (ACS) in the world. There is a rising trend in the development of coronary heart disease in the rural as well as urban India and two-fold increases in mortality from 1985 to present. We need to bridge the gap between available diagnostic facilities and treatment modalities among health-care practitioners.

**Aim:** The aim of this work was to assess the prognostic role of serum lactic acid, lactate clearance, and serum uric acid in ACS patients.

**Materials and Methods:** It is a prospective observational study. 50 patients admitted to our hospital intensive care unit with a diagnosis of ACS were included in our study.

**Sample Collection:** About 3 ml of venous blood is collected on admission and 48 h after admission. Serum lactic acid levels were estimated on admission and 48 h after in 50 patients and uric acid levels were tested on admission. The outcome of the patients, death or survival of the patient is recorded. Age, gender, body mass index, vital parameters, supportive measures given, electrocardiogram and Echo findings, blood urea and creatinine values, duration of hospital stay of the patient, and time of death since admission were noted. We also have compared the lactic acid levels, lactate clearance and uric acid levels with GRACE scoring system and Killip class.

**Results:** In our study, average uric acid levels were higher among survivors compared to nonsurvivors ( $P = 0.0019$ ). Serum uric acid levels were higher among patients with higher Killip class.

**Conclusion:** There is no significant difference in lactic acid levels between survivors and nonsurvivors ( $P = 0.83$ ). Lactic acid is positively correlated with GRACE score. Lactate clearance is negatively correlated with GRACE score.

**Key words:** Acute coronary syndrome, Lactic acid, Lactate clearance, Prognosis, Uric acid

## INTRODUCTION

Acute coronary syndromes (ACS) – unstable angina (UA), non-ST-elevation myocardial infarction (MI), and ST-elevation MI – are conditions caused by coronary vessel obstruction and thrombotic occlusions from rupture or erosion of a plaque.

India represents the highest burden of ACS in the world. There is a rising trend in the development of coronary heart disease in the rural as well as urban India and two-fold increases in mortality from 1985 to present. We need to bridge the gap between available diagnostic facilities and treatment modalities among health-care practitioners.

Following MI some proteins and enzymes labeled as cardiac markers (CK, MB/Troponin T and I) are released into the blood in large quantity from the necrotic heart muscle. These markers,  $CK-MB$ , Troponin-T, Troponin-I, and myoglobin have specific temporal profile in relation to MI; however, they do not correlate with myocardial function epidemiological studies have recently shown that lactic acid and a uric acid level are recognized as a gauge of metabolic

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Month of Submission : 07-2016  
Month of Peer Review : 08-2016  
Month of Acceptance : 09-2016  
Month of Publishing : 09-2016

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function and have a diagnostic and/or prognostic role in different clinical settings.<sup>1</sup>

While the negative prognostic role of hyperlactatemia in several critical ill diseases is well established,<sup>2,3</sup> data in patients with acute cardiac conditions (i.e., acute myocardial ischemia) are scarce and controversial.<sup>4,5</sup>

Uric acid may be a risk factor for cardiovascular diseases and a prognostic marker for mortality in subjects with pre-existing heart failure.<sup>6-9</sup>

This study is aimed at summarizing available evidence on the clinical role of LA levels, lactate clearance and uric acid levels in ACS, focusing on its prognostic role.

## MATERIALS AND METHODS

### Study Design

Prospective observational study.

### Study Population

A total of 50 patients admitted to our hospital intensive care unit (ICU) with diagnosis of ACS were included in our study. 27 patients with inferior wall MI and 23 with anterior wall MI were included in our study group.

### Inclusion Criteria

Only those with electrocardiogram (ECG) evidence of MI or biochemical evidence of ACS.

### Exclusion Criteria

Those with known history of liver disease, renal disease, recent history of epileptic seizure, and sepsis was excluded.

### Duration of Study

2 months, July-August 2014.

### Sample Collection

About 3 ml of venous blood is collected on admission and 48 h after admission, serum lactic acid levels were estimated on admission and 48 h after and uric acid levels were tested on admission.

The outcome of the patients, death or survival of the patient is recorded. Age, gender, body mass index, vital parameters, supportive measures given, ECG and Echo findings, blood urea and creatinine values, duration of hospital stay of the patient, time of death since admission were noted and compared with serum levels of lactic acid and uric acid. We also have compared the lactic acid levels, lactate clearance, and uric acid levels with GRACE scoring system which is done for assessing 6 months mortality.

Uric acid levels were compared also with Killip class to check whether it is correlated with severity of the disease.

### Biochemical Markers

Lactic acid was estimated using semi auto analyzer kit method. Serum uric acid will be estimated by uricase method. Lactate clearance was calculated using the formula:<sup>10-12</sup>

$$\text{Lactate}_{\text{initial}} - \text{Lactate}_{\text{delayed}} / \text{Lactate}_{\text{initial}} \times 100\%$$

## RESULTS

Results were analyzed using Excel. Out of 50 patients studied 4 died. Since the sample size in the mortality group is less, we have correlated the serum lactic acid and uric acid levels with Grace scoring system using Pearson's correlation analysis. We have also correlated the uric acid levels with Killip class.

Since the non-survivor group is less, we have correlated lactic acid levels and lactate clearance with GRACE scoring system to assess whether it is associated with severity (Table 1).

GRACE scoring system is used to assess heart attack risk and guiding treatment. The Table 2 shows the 6 monthly mortality prediction of patients using GRACE scoring system.

Even though there is no significant difference in lactic acid levels between survivors and non-survivors, lactic acid and uric acid levels are well correlated with GRACE scores with significant *P* values (Table 3).

**Table 1: Baseline characters between survivors and non survivors**

Demographic characters	Survivors (n=46)	Non survivors (n=4)	<i>P</i> value (2-tailed <i>t</i> -test)	Statistically significant
Age (average±SD)	48.82±11.06	69.75±2.06	0.0005	Yes
Lactic acid	55.21, 14.19	56.75, 14.26	0.8360	No
Uric acid	5.404, 1.26	7.5, 0.25	0.0019	Yes
GRACE score	96.41, 20.4	176.75, 30.09	0.0001	Yes
Average hospital stay	7.23, 1.8	7, 1.41	0.8051	No
BMI	26.99, 3.88	29.915, 5.81	0.1707	No

SD: Standard deviation, BMI: Body mass index

We have compared lactate clearance with duration of ICU stay and Killip class.

Killip classification is used to stratify patients with MI and it focuses on physical examination and the development of heart failure to predict risk. Patients with higher Killip class have a higher frequency to die within the first 30 days.

This Figure 1 shows that decreased lactate clearance is associated with increased duration of ICU stay.

From the Figure 2, we can infer that decreased lactate clearance is associated with higher Killip class.

Table 4 indicates that patients with higher Killip class had higher serum uric acid levels.

This Figure 3 shows that average uric acid levels are higher in patients with increased duration of ICU stay.

### DISCUSSION

In this study, the venous lactate level immediately after admission with chest pain has been highly useful for the diagnosis of acute MI which is in concordance the study stating that lactic acid on presentation is highly sensitive for the diagnosis of MI.<sup>13</sup>

**Table 2: 6 months mortality prediction of study population using GRACE score value**

Risk category	GRACE risk score	Study group
Low	<86	13
Intermediate	86-120	27
High	>120	10* (4)*

\*In hospital mortality

**Table 3: Correlation of uric acid and lactic acid with GRACE score**

Variable	Correlation coefficient	P value	Significant?
Uric acid with GRACE score	0.335891348	0.01694	Yes $P < 0.05$
Lactic acid with GRACE score	0.321711846	0.022541	Significant

**Table 4: The comparison of uric acid with Killip class**

Killip class	<4	4-6	>6	Total
I	6	30	-	36
II	-	2	6	8
III	-	-	4	4
IV	-	-	4*	4*
Total	6	32	14	52

As observed serial lactate measurement or lactate clearance has been a prognostic tool for the duration of global tissue hypoxia (Trzeciak *et al.*).

The study shows a close correlation between serum uric acid levels and Killip class in acute myocardial infarct patients in concordance with the study done recently in japan (Japanese ACS study Kojima *et al.*).<sup>6</sup>

### CONCLUSION

In our study, decreased lactate clearance and high uric acid levels were associated with increased risk of mortality. This

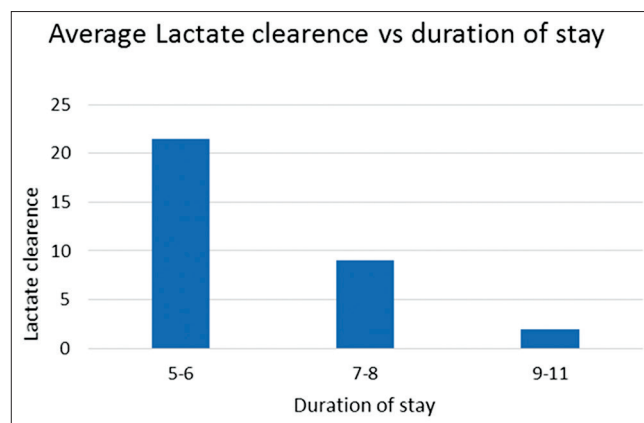


Figure 1: Comparison of lactate clearance with duration of intensive care unit stay

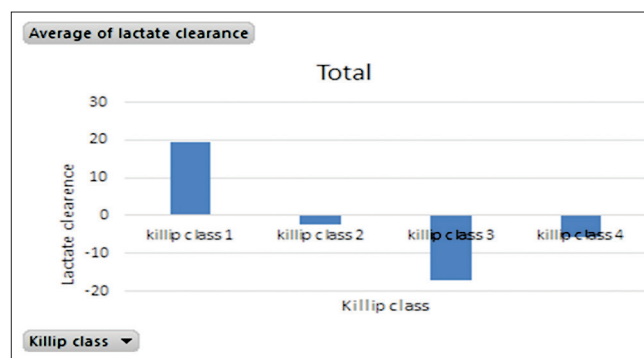


Figure 2: Comparison of lactate clearance with Killip class

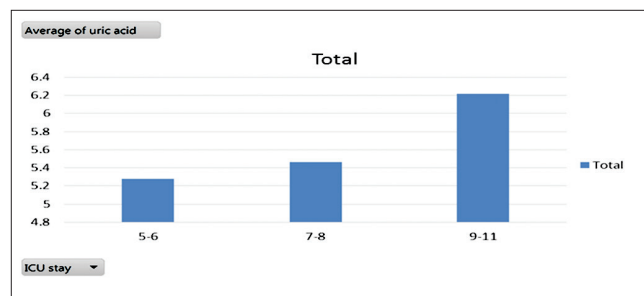


Figure 3: Comparison of uric acid with duration of intensive care unit stay

study was done as a prospective observational study in a small number of patients. Larger studies are required to confirm our finding. This simple cost-effective test can guide therapy and assess the prognosis of MI patients in the near future.

## ACKNOWLEDGMENTS

I sincerely acknowledge all my Professors, Associate Professors, Assistant Professors who have helped me in completing the study.

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**How to cite this article:** Chandrasekar HS, Devi AL. Serum Lactic Acid Levels, Lactate Clearance, and Uric Acid Levels as Prognostic Markers in Acute Coronary Syndrome Patients. *Int J Sci Stud* 2016;4(6):23-26.

**Source of Support:** ICMR-STs 2014, **Conflict of Interest:** None declared.