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Role of Serum Uric Acid as a Prognostic Marker in Patients with Acute Myocardial Infarction (AMI)

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Abstract
Background: *Acute myocardial infarction (AMI) is one of the leading causes of mortality and morbidity globally. Many prognostic markers have been evaluated in prognosis of AMI , Uric acid is one such marker that has been evaluated to assess the prognosis in patients with AMI. Various mechanisms have been postulated for the deleterious effects of hyperuricemia with adverse cardiovascular outcomes, which includes endothelial dysfunction, oxidative metabolism, platelet adhesiveness and aggregation, intracellular stress and inflammation leading to endothelial injury and enhancement of vasoconstrictor effects.*
Aim: *To correlate serum uric acid levels with Killip class and to observe any relationship between serum uric acid level and mortality following AMI.*
Materials and Method: *A Cross sectional study was conducted at Osmania General Hospital. Study included 100 patients with newly diagnosed AMI in the Department of Cardiology. After taking informed consent, patients history, clinical examination and electrocardiographical changes was taken. Laboratory investigations included blood sugar profile, renal function test, lipid profile and serum uric acid. The individuals venous blood sample 3ml each was drawn into red vacutainer and analysed in the Department of Biochemistry on Beckman Coulter Autoanalyzer AU5800.*
Results*: Out of total 100 subjects, 65 were males and 35 were females with a mean age of 59.9+/-3.9years. There was a statistically significant higher serum uric acid concentration (P=0.0001) in patients with AMI. Higher serum uric acid (>7mg/dl) level along with higher Killip class (IV) was associated with higher mortality rate.*
Conclusion: *From our study, we conclude that Serum Uric Acid levels are correlated with Killip class and patients with higher Killip Class have higher Serum Uric Acid levels in AMI. Hyperuricemia is an indicator of poor prognosis in AMI. Serum Uric Acid can be used as a marker of short-term mortality in AMI.*
Key words: *Uric Acid, Acute Myocardial Infarction, Mortality, Killip class, Prognostic marker*

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I. Background

Acute myocardial infarction (AMI) is one of the leading causes of mortality and morbidity globally [1]. Certain markers have been evaluated which indicate unfavourable prognosis in AMI [2]. Uric acid is one such marker that has been evaluated to assess the prognosis in patients with AMI. Previous studies have reported positive associations of increased serum uric acid levels with a greater risk of ischemic heart disease, higher blood pressure, and an overall adverse cardiovascular risk profile [3,4]. Various mechanisms have been postulated for the deleterious effects of hyperuricemia with adverse cardiovascular outcomes, which includes endothelial dysfunction, oxidative metabolism, platelet adhesiveness and aggregation, intracellular stress and inflammation leading to endothelial injury and enhancement of vasoconstrictor effects [5,6].

Elevated serum uric acid is highly predictive of mortality in patients with heart failure in coronary artery disease [7]. The objective of the study was to evaluate the serum uric acid level in patients with acute myocardial infarction with Killip class and to correlate the associated mortality in acute myocardial infarction with uric acid levels.

Out of the various prognostic markers for AMI, like brain natriuretic peptides, C-reactive protein, cell free DNA levels, serum uric acid level is relatively cheap and easily available [8]. However, data on the prognostic implication of serum uric acid on outcome in AMI is limited especially from India. With this background the present study was undertaken in a tertiary care teaching hospital in south India, to determine the role of serum uric acid levels in predicting in hospital outcome in AMI.

II. Materials And Methods

A Cross sectional study was conducted at Osmania General Hospital in February 2019. Study included 100 patients with newly diagnosed AMI in the Department of Cardiology. After taking informed consent, patients history, clinical examination and electrocardiographical changes was taken. Laboratory investigations included blood sugar profile, renal function test, lipid profile and serum uric acid. The individuals venous blood sample 3ml each was drawn into red vacutainer and analysed in the Department of Biochemistry on Beckman Coulter Autoanalyzer AU5800.

AMI was defined as per the following WHO criteria [9] which require at least two of the following three elements to be present:

1. A history of ischemic-type of chest pain.
2. Evolutionary change on serially obtained ECG tracings.
3. A rise and fall in cardiac markers.

Inclusion Criteria

1. Patients admitted to the General Medicine and Cardiology Departments with the diagnosis of AMI as per WHO criteria [9].

Exclusion Criteria

1. Chronic kidney disease
2. Gout
3. Malignancy
4. Hypothyroidism
5. Patients on hypo/hyper uricemic medications
6. Chronic alcoholics

Prior to initiation of the study ethical clearance from Institutional Ethical Committee was obtained.

Statistical Analysis

Statistical analysis was done using Statistical Package for Social Survey (SPSS) for windows version 17.0. A comparison between serum uric acid level and patients admitted with AMI was made. Unpaired 't' test were used to study association of serum uric acid levels with parameter like sex.

III. Results

A total of 100 patients were included (Male =65, Female =35) with a male to female ratio of 1.85:1.The sex distribution of the study population are shown in Table 1.Maximum numbers of patients were in the age group of 55-65 years irrespective of sex with an overall mean age of 59.9+/-3.9 years.

Table: 1 Sex distribution of acute myocardial infarction patients.

SEX	NO.OF CASES	PERCENTAGE
MALE	65	65%
FEMALE	35	35%
TOTAL	100	100%

Mean serum uric acid for males and females were 7.9+/-1.5 and 6.4+/-1.5 mg/dl with P value 0.0001 which was statistically significant in Table 2.

Table:2 Serum uric acid in patients with acute myocardial infarction.

URIC ACID	MALE	FEMALE	P VALUE
MEAN+/-SD	7.9+/-1.8	6.4+/-1.5	0.0001

Mean serum uric acid level was 3.8 mg/dl in patients in Killip class I, 4.5 mg/dl in patients in class II, 6.5 mg/dl in class III patients, while 7.4 mg/dl in class IV patients. Thus, it was seen that patients having higher uric acid level belonged to higher Killip class (Table 3).

Table: 3 Mean Serum Uric Acid Levels according to Killip's Classification.

KILLIP'S CLASS	NO.OF PATIENTS	MEAN SERUM URIC ACID(mg/dl)
I	15	3.8
II	34	4.5
III	24	6.5
IV	27	7.4

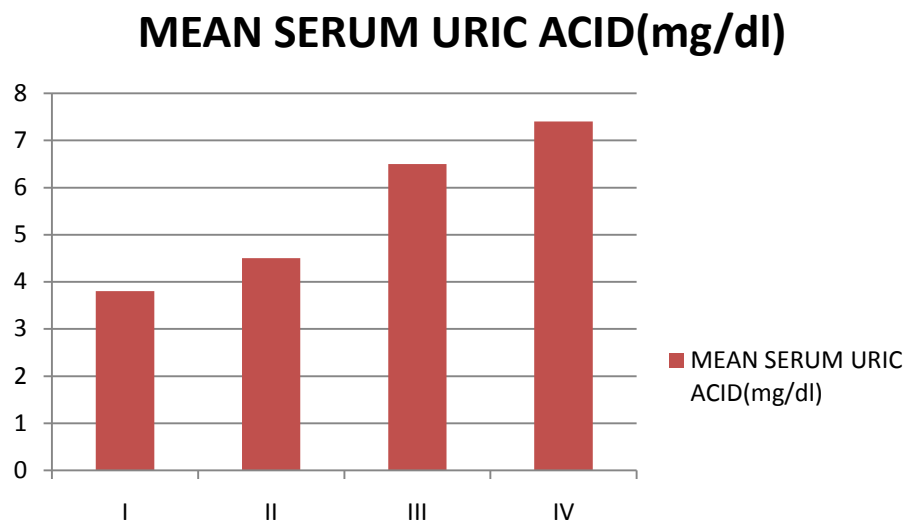

Figure 1: Correlation of mean Serum Uric Acid with Killip's classification

Table: 4 Mortality and Serum Uric Acid levels in patients with AMI.

URIC ACID(mg/dl)	NO.OF PATIENTS EXPIRED	MEAN SERUM URIC ACID(mg/dl)
<4	0	-
4.1-5.5	0	-
5.6-7.0	0	-
>7	6	9.0

Out of the total 100 patients, 6 patients (6%) expired with P value 0.001. Maximum mortality was seen in patients having serum uric acid level >7mg/dl. The results of mortality according to serum uric acid levels are shown in [Table 4]. Patients in killip class 4 have a poor prognosis after acute myocardial infarction.

IV. Discussion

Our study was carried out with the primary aim of evaluation of serum uric acid as a prognostic marker for AMI and correlate with Killip class. There was a male preponderance in our study population which is concordant to previous studies which also show a higher male preponderance in patients with AMI [2,3]

THE KILLIP'S CLASSIFICATION [10]: The classification proposed by Thomas Killip III and John T. Kimball in 1967 involved bedside stratification.
Killip class 1: patients with no clinical signs of heart failure.
Killip class 2: patients with rales in the lungs, third heart sound (S3) and elevated jugular venous pressure.
Killip class 3: patients with features of frank pulmonary edema .
Killip class 4: with cardiogenic shock or arterial hypotension (measured as systolic blood pressure < 90 mmHg), and evidence of peripheral vasoconstriction (oliguria, cyanosis, and diaphoresis).

Mortality and Killip's class

KILLIP'S CLASS	MORTALITY
KILLIP CLASS I	6%
KILLIP CLASS II	17%
KILLIP CLASS III	38%
KILLIP CLASS IV	81%

Killip class and uric acid correlation with various studies:

In the present study out of 100 patients, 6 patients had serum uric acid >7mg/dl were in Killip's class IV [P=0.001]. Similar findings were observed by M Y Nadkar et al [5] it was found that there was statistical significant (p=<0.05) increase in serum uric acid levels with increase in killip class. Higher killip class had higher uric acid level. Shetty et al [11] found there was a significant correlation between higher killip class and serum uric acid. A failing heart due to AMI may cause tissue hypoperfusion and hypoxia, which trigger xanthine

oxidase activation and oxidative stress. Xanthine oxidase and oxidative stress, as reflected by uric acid levels, may form a vicious cycle that promotes severe heart failure [12]

In the present study there was statistically significant higher uric acid in males than in female patients (P=0.0001).Similar finding was observed by Kojima S et al [13].

In the present study out of 100 patients, 6 patients died as there serum uric acid levels were more than 7.0mg/dl .Bickel C et al [14] reported that one mg/dl increase in serum uric acid levels was associated with 26% increase in mortality.

V. Conclusion

From our study, we conclude that Serum Uric Acid levels are correlated with Killip Class .Patients with elevated serum uric acid levels belonged to higher Killip classification and had higher mortality. It can be inferred from this study that serum uric acid can be regarded as an inexpensive independent risk factor and prognostic marker for assessing short term mortality in patients with AMI.

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Conflict of Interest: None

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