Original Research Article

Evaluating the relationship between serum uric acid levels with Killip classification suggestive of left heart failure in acute myocardial infarction

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ABSTRACT

Background: Present evidence shows that increased uric acid level is a negative prognostic factor in patients with moderate to severe heart failure. A study has highlighted a correlation between serum uric acid levels and Killip class in patients of acute myocardial infarction (AMI). Aim of this study the relationship between serum uric acid level and Killip classification in patients with AMI.

Methods: Sixty patients with AMI were studied prospectively in Department of Medicine/ Department of Cardiology, JA Group of Hospitals between 2016-2018. Patients were grouped based on the Killip class. Age, sex, history of smoking, alcohol consumption, hypertension and diabetes were recorded. Serum uric acid level were measured on Day 1, 3 and 5, which was compared with Killip class.

Results: Majority of the patients were males (65%) and had age between (28.3%) 51-60 years. No significant association was obtained between any risk factors of AMI and Killip's class (p>0.05). Serum uric acid levels were significantly higher in Killip grade III (7.80±3.57) as compared to Killip's grade II (6.64±2.88) and I (6.30±2.33) (p=0.014). Majority of the patients with Killip's grades I and II, had uric acid level ≤7.0 mg/dl (n=18 and n=9 respectively) (p=0.040). Serum uric acid was equally distributed among different types of killip's grades between patients who expired and survived. (p>0.05).

Conclusions: Serum uric acid levels has been found to be well correlated with Killip classification in patients with AMI. Combination of Killip class and serum uric acid level after AMI is a good predictor of mortality after AMI.

Keywords: Complications, Heart failure, Risk factors, Serum uric acid level

INTRODUCTION

Acute myocardial infarction (AMI) has been found to be associated with high risk of morbidity, mortality and hospital admission globally. Male sex, hypertension, valvular heart disease, coronary artery disease, and obesity are the established risk factors of AMI. Despite of the progress made in its management, the mortality from AMI remains high, indicating the need for identification of novel risk factors that may be amenable to intervention.[1]

Serum uric acid may be useful for prognostication among those with preexisting AMI. Hyperuricemia can predict heart failure among those with preexisting hypertension. There have not been any studies that examined hyperuricemia as independent risk factors for heart failure risk among the general population.[2]

In patients with non-ST-elevation acute myocardial infarction (NSTEMI) Killip classification has been found to be a powerful independent predictor of all-cause mortality.[3] Japanese Acute Coronary Syndrome Study has showed a significant correlation between serum uric acid level and Killip classification in patients with AMI.[4] Increased serum uric acid level has been found to be closely associated with metabolic and other related syndromes.[5,6] Hence, in present study we tried to find relationship between serum uric acid level and Killip classification in patients with AMI.

METHODS

A prospective cross-sectional study was performed on 60 patients diagnosed as a case of acute myocardial infarction (STEMI, NSTEMI) on the basis of clinical history, examination, ECG changes, biochemical marker, who were admitted in ICCU in Department of Medicine/ Department of Cardiology, J. A. Group of Hospitals from 2016-2018. In all the cases written informed consent was obtained from each subjects. Institutional Ethics Committee approval was obtained before starting the study. The patients included in the study were selected consecutively among those admitted with acute STEMI having resting chest pain lasting more than 30 min, typical ischemic ST elevation in electrocardiogram (ECG) leads and rise of serum cardiac enzymes concentration (CK-MB and Troponins). Authors

excluded patients who did not received thrombolytic therapy during the first six hours after the onset of chest pain, were in cardiogenic shock, had previous pacemaker implantation, had a recent myocardial infarction (<3 months), had severe valvular disease, had impaired renal function (serum creatinine level >1.5 mg/dl) and was a known cases of hypothyroidism, malignancy, gout or other inflammatory diseases and were using corticosteroid or cytotoxic drugs. Investigations including routine haemogram (Hb, total leucocyte count, differential count), renal function test, blood sugar (random, and/or fasting, post prandial), 12 leads electrocardiogram, troponin T or troponin I, serum uric acid (on day 1, 3, 5), lipid profile and liver function tests were performed and results were recorded.

Patients were ranked by Killip class in the following way:

- Killip class I (individuals with no clinical signs of heart failure).
- Killip class II (individuals with rales or crackles in the lungs, an S3, and elevated jugular venous pressure).
- Killip class III (individuals with frank acute pulmonary edema)
- Killip class IV (individuals in cardiogenic shock or hypotension (measured as systolic blood pressure lower than 90 mmHg), and evidence of peripheral vasoconstriction (oliguria, cyanosis or sweating).

Table 1: Comparing risk factors with killips class.

Risk Factors		Killips class					Total	p value
		I	II	III	IV	Normal		
Smoking	No	19	7	5	0	2	33	0.269
	Yes	9	9	5	0	4	27	
	Total	28	16	10	0	6	60	
Alcohol	No	27	15	8	0	5	55	0.355
	Yes	1	1	2	0	1	5	
	Total	28	16	10	0	6	60	
HTN	No	24	13	9	0	6	52	0.649
	Yes	4	3	1	0	0	8	
	Total	28	16	10	0	6	60	
DM	No	22	13	8	0	5	48	0.993
	Yes	6	3	2	0	1	12	
	Total	28	16	10	0	6	60	
IHD	No	19	12	6	0	3	40	0.690
	Yes	9	4	4	0	3	20	
	Total	28	16	10	0	6	60	

Data is expressed as numbers, DM; diabetes mellitus, HTN; hypertension, IHD; ischemic heart disease. p value of <0.05 is considered as significant

Risk factors and Uric acid level was compared with each Killip class on each day. Normal uric acid levels was considered as 2.4-6.0 mg/dl (female) and 3.4-7.0 mg/dl (male). All the data analysis was done using IBM SPSS ver. 20 Software. Cross tabulation and frequency

distribution was used to prepare tables. Microsoft office 2010 was used to prepare the graphs. Paired sample t test and one way ANOVA was used to compare the mean whereas categorical data was compare using Chi square test. Level of significance was assessed at 5%.

RESULTS

Majority of the subjects in Case group (28.3%) belonged to age group of 51-60 years. Majority of the patients were males (65%). Most common complaint of patients was chest pain (86.7%).

Table 2: Comparing day 1 killip grades with serum uric acid level.

Day 1 Killip grades	Uric acid level	N	Std. Deviation	p value
I	6.30	28	2.33	
II	6.64	16	2.88	
III	7.80	10	3.57	0.014
IV	0	0	0	
Normal	10.20	6	1.76	
Total	7.03	60	2.86	

Mean uric acid levels were significantly higher in Killip grade III (7.80±3.57) as compared to Killip grades II (6.64±2.88) and I (6.30±2.33) (p=0.014).
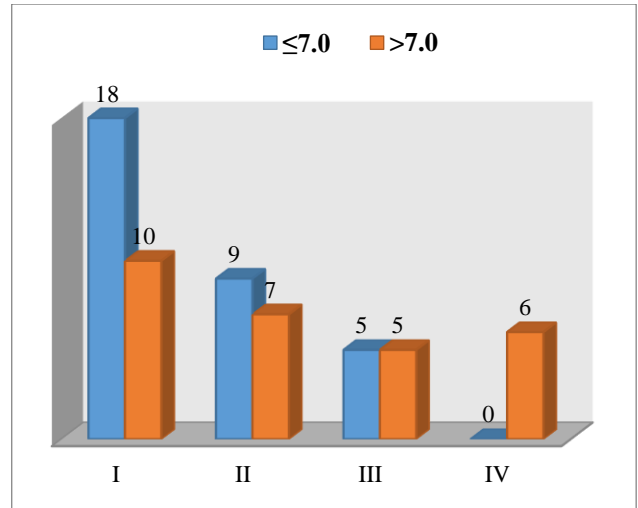
Majority of the patients with Killip grades I and II, had uric acid level ≤7.0 mg/dl (n=18 and n=9 respectively) (p=0.040).

Figure 1: Killips grades and severity of serum uric acid on day 1 of admission (mg/dl).

Table 3: Outcome in relation to killips grades and serum uric acid.

Outcome			Uric acid (mg/dl)		Total	p value
			≤7.0	>7.0		
Expired	Killip grades	I	0	4	4	
		II	0	1	1	
		III	1	1	2	0.268
		IV	0	0	0	
		Normal	0	2	2	
Survived	Killip grades	I	18	6	24	
		II	9	6	15	
		III	4	4	8	0.564
		IV	0	0	0	
		Normal	0	4	4	

Outcome in relation to Killip grades and serum uric acid revealed that serum uric acid was equally distributed among different types of Killip grades between patients who expired and survived. (p>0.05).

Table 4: Correlation between killip grades and serum uric acid at day 1, 3 and 5.

Killips grades/SUA	Day 1	Day 3	Day 5
Day 1	r=-0.65, p=0.621		
Day 3		r=-0.331, p=0.010	
Day 5			r=-0.470, p<0.001

Person correlation between Killip grades and serum uric acid level at day 1, day 3 and day 5 revealed that at day 3 (r=-0.331, p=0.010) and day 5 uric acid r=-0.470, p<0.001 showed significant negative correlation with Killip grades at respective day. That means with the decrease in Killip grades from IV to I at day 3 and day 5, an increase in serum uric acid is recorded in present study.

DISCUSSION

Following STEMI, Left ventricular dysfunction is reported to be the single most important predictor of mortality.[7,8] Killip and Kimball in the year 1967 proposed a prognostic classification which was based on the presence and severity of rales detected in patients presenting with STEMI.[9] Previous studies have reported that Killip classification is a powerful independent

predictor of all-cause mortality in patients with non-ST-elevation acute coronary syndromes.[3] Clinical studies have also proved that serum uric acid is significantly associated with cardiovascular disease. Uric acid is an independent predictor of major adverse cardiovascular events (MACE) in patients with coronary artery disease. In present study we tried to find relationship between serum uric acid level and Killip classification in patients with AMI.

In present study majority of the patients with Killip grades I and II, had uric acid level ≤7.0 mg/dl (p=0.040). In agreement to that Harris et al reported that majority (49%) of the cases belonging to Killip class 1, 29% in Killip class 2, 15% in Killip class 3 and 7% in Killip class 4.[10]

Outcome in relation to Killip grades and serum uric acid revealed that serum uric acid was equally distributed among different types of Killip grades between patients who expired and survived. (p>0.05). In present study we also found that mean uric acid levels were significantly higher in Killip grade III (7.80±3.57) as compared to Killip grades II (6.64±2.88) and I (6.30±2.33) (p=0.014). Harris et al, studied the usefulness of serum uric acid in acute myocardial infarction and reported that patients of Killip class III and IV had higher levels of uric acid as compared to patients of class I and II. (p <0.001).[10] Similar findings were noted by Kojima S et al, in their study.[4] Nadkar et al, showed that serum uric acid levels were higher in patients of acute myocardial infarction and correlated well with Killip class.[11] However, Jularattanaporn et al, noted that there was no association between hyperuricemia and Killip class at first presentation.[12]

Person correlation between Killip grades and serum uric acid level at day 1, day 3 and day 5 revealed that at day 3 (r=-0.331, p=0.010) and day 5 uric acid r=-0.470, p<0.001 showed significant negative correlation with Killip grades at respective day. That means with the decrease in Killip grades from IV to I at day 3 and day 5, an increase in serum uric acid is recorded in present study. Padma et al reported that 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.[13]

Studies have shown that serum uric acid level increases in cardiac failure.[14] Padma et al, found a statistically significant correlation between serum uric acid level and Killip class (p=0.001) on day 3 and patients of Killip class lll and lV had higher levels of uric acid as compared to patients of class l and ll.[13] Beheraet al, reported that there was statistically significant correlation found between serum uric acid level and Killip class (p<0.05) on day 0 and day 5.[15] This means serum uric acid levels are low among patients with lower Killip class and high among patients with higher Killip class. In other words, serum uric acid levels increase with increased severity of heart failure in AMI patient

Present study has few limitations. First cross sectional nature of the present study was the main limitation which restricts the use of present study findings to large population. Second is the small sample size; a large randomize clinical trial is required to strengthen the present study findings.

CONCLUSION

Serum uric acid level was higher among the patients with acute MI. In acute MI, patients with hyperuricemia had higher mortality. Serum uric acid level showed positive correlation with Killip classification in acute MI. Serum uric acid can be used as a marker of short-term mortality in patients with acute MI. To conclude hyperuricemia is an indicator of poor prognosis in acute MI.

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