Original Research Article

A study of Killip class in patients with acute myocardial infarction on day 0, day 3, day 7

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Abstract

Background: Acute myocardial infarction has already established itself as a major threat to health both in developed and developing countries. With the emergence of this epidemic, there is increased need of effective health care strategy as well as research in this field. **Aims and Objectives:** To study Killip class in patients with acute myocardial infarction on day 0, day 3, day 7. **Methodology:** This Single center prospective study carried out in Karnataka institute of medical sciences Hubli. A total of 100 patients of AMI admitted to Medical wards and ICCU department of Department of Medicine were included in the study after considering inclusion and exclusion criteria. Information was collected through a pretested and structured proforma. The statistical analysis was done by paired and unpaired t-test and calculated by SPSS 19 version software. **Results:** The mean serum uric acid level was higher among those cases who belonged to higher Killip class. Among the patients who died all belonged to higher Killip class i.e. class 4. **Conclusion:** From our study it is clear that SUA levels are correlated with Killip Class and patients with higher Killip Class have higher SUA levels in AMI. Serum uric acid can be used as a marker of short-term mortality in acute myocardial infarction.
Key words: Killip class, AMI, Serum Uric acid level.

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INTRODUCTION

Acute myocardial infarction has already established itself as a major threat to health both in developed and developing countries.[1] With the emergence of this epidemic, there is increased need of effective health care strategy as well as research in this field. Assessment of severity of heart failure following acute myocardial infarction has been evaluated and categorized by several invasive and non-invasive techniques ranging from measurement of pulmonary capillary wedge pressure to estimation of several cardiac enzymes, most of which are not feasible and not cost effective in our country. Following myocardial infarction (MI) some proteins and enzymes labeled as cardiac markers (e.g. Creatinine Phosphokinase, Troponin T and I) are released in to the blood in large quantities from necrotic heart muscle. These markers and myoglobin have specific temporal profile in relation to AMI; however, they do not correlate with myocardial function. Previous studies have reported that a high concentration of uric acid (UA) is a strong marker of an unfavorable prognosis of moderate to severe heart failure and cardiovascular disease. [2,3] Acid has been indicated as a risk factor for CAD and as an independent prognostic factor of poorer outcomes in patients with documented CAD.[4] Serum uric acid With ischemia, ATP is degraded to adenine and xanthine, and there is also increased generation of xanthine oxidase. According to a recent study done in Japan (Japanese Acute Coronary Syndrome Study, there was a close correlation between serum uric acid concentration and Killip classification in patients of acute myocardial infarction. Patients who developed short-term adverse events had high uric acid concentrations.[5,6,7,8] Serum uric acid levels, Killip class, age, and peak creatine phosphokinase level were significant predictors of longterm mortality.[7]

So we have studied the Killip class in patients with acute myocardial infarction on day 0, day 3, day 7

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METHODOLOGY

This Single center prospective study carried out in Karnataka institute of medical sciences Hubli. A total of 100 patients of AMI admitted to Medical wards and ICCU department of Department of Medicine were included in the study after considering inclusion and exclusion criteria. Information was collected through a pretested and structured proforma. Study was carried was carried in patients with clinical features suggestive of acute Myocardial Infarction A detailed history and physical examination of the patients with acute myocardial infarction with special reference to Killip classification of heart failure was carried out .serum uric acid levels were measured on day 0,day 3 , day 7 .serum uric acid and Killip class on day 0 day 3 day 7 were compared to assess the prognosis . All the patients gave informed consent and the study protocol was approved by the college ethics committee. All patients of age Age >18 yrs.

ST elevation Myocardial Infarction , Non ST elevation myocardial Infarction were included into study while Chronic kidney disease , Gout , Hematological malignancy , Patients on drugs such as Salicylates, Ethambutol, Pyrazinamide were excluded from the study. All routine testing with Serum Uric Acid and Killip class on day 0 day 3 day 7 were compared. The statistical analysis was done by paired and unpaired t-test and calculated by SPSS 19 version software.

RESULT

Table 1: Age distribution of Patients

Age	No of cases	% of cases
<=40yrs	11	11.00
41-50yrs	18	18.00
51-60yrs	37	37.00
61-70yrs	23	23.00
71+yrs	11	11.00
Total	**100**	**100.00**

In our study majority of the patients are in the age group of 51-60 years (37%) followed by age group of 61-70 years (23%).

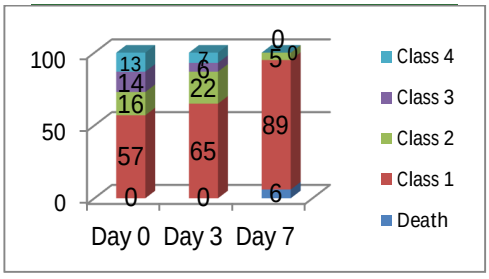
Table 2: Sex distribution of study population

Sex distribution of study population Sex	No of cases	% of cases
Male	70	70.00
Female	30	30.00
Total	100	100.00

The majority of the patients were Male i.e. 70% and Females were 30%

Table 3: Distribution of the Killip class on day 0, day 3 and day 7

KILLIP class	Day 0	Day 3	Day 7
Death	0	0	6
Class 1	57	65	89
Class 2	16	22	5
Class 3	14	6	0
Class 4	13	7	0
Total	**100**	**100**	**100**



Graph 1: Distribution of the Killip class on day 0, day 3 and day 7

From Table 3 and Graph 1: on day 0 out of 100 patients 57 patients belonged to Killip Class I, 16 patients belonged to Killip Class II, 14 patients belonged to Killip Class III, 13 patients belonged to Killip Class IV. There were no mortalities on day 0. In our study on day 3 out of 100 patients 65 patients belonged to Killip Class I, 22 patients belonged to Killip Class II, 6 patients belonged to Killip Class III, and 7 patients belonged to Killip Class IV. There were no mortalities on day 0. In our study on day 7 out of 100 patients 89 patients belonged to Killip Class I, 5

patients belonged to Killip Class II, no patients belonged to Killip Class III, and six patients expired during follow up between day and day 7.

Table 4 Comparison of Killip classes with Uric acid at day 0 by ANOVA test KILLIP class

	Mean	Std.Dev.
Class 1	4.40	0.78
Class 2	7.01	1.12
Class 3	8.29	0.50
Class 4	9.87	0.44
Total	6.07	2.22
F-value		236.2100
p-value		0.00001*
Pair wise comparisons by Tukeys multiple posthoc procedure		
Class 1 vs Class 2		p=0.0001*
Class 1 vs Class 3		p=0.0001*
Class 1 vs Class 4		p=0.0001*
Class 2 vs Class 3		p=0.0002*
Class 2 vs Class 4		p=0.0001*
Class 3 vs Class 4		p=0.0001*

Mean uric acid level in patients on day 0 belonging to Killip class I was 4.4mg/dl compared to 7.01 mg/dl in Killip class II, 8.29 mg/dl in Killip class III, and 9.87 mg/dl in Killip class IV. Mean uric acid on day 0 is 6.07 mg/dl.There is statistically significant difference in uric acid levels with increasing levels on Killip class on day 0.

Table 5: Comparison of Killip classes with Uric acid at day 3 by ANOVA test KILLIP class

	Mean	Std.Dev.
Class 1	4.46	0.79
Class 2	7.09	0.89
Class 3	8.53	0.70
Class 4	9.43	0.80
Total	5.63	1.88
F-value		146.3145
p-value		0.00001*
Pair wise comparisons by Tukeys multiple posthoc procedure		
Class 1 vs Class 2		p=0.0001*
Class 1 vs Class 3		p=0.0001*
Class 1 vs Class 4		p=0.0001*
Class 2 vs Class 3		p=0.0012*
Class 2 vs Class 4		p=0.0001*
Class 3 vs Class 4		p=0.2000

Mean uric acid level in patients on day 0 belonging to Killip class I was 4.46mg/dl compared to 7.09 mg/dl in Killip class II, 8.53 mg/dl in Killip class III, and 9.43 mg/dl in killip class IV. Mean uric acid on day 0 is 5.63 mg/dl. There is no statistical significant difference in mean uric acid levels between killip class III and Killip Class IV on day 3.

From the above table it can be inferred that on day 3 majority of patients (97%) belonging to Killip class I had serum uric acid levels in lower two quartiles .

Table 6: Comparison of Killip classes with Uric acid at day 7 by t test KILLIP class

	Mean	Std.Dev.
Class 1	4.67	0.89
Class 2	6.62	1.01
Total	4.78	1.00
t-value		**-4.7053**
p-value		**0.00001***

Mean uric acid on day 7 in patients with Killip Class I is 4.67 mg/dl. Mean uric acid in patients with Killip Class II is 6.62 mg/dl .There is statistical significant difference in uric acid levels with increasing killip class on day 7.

Table 7: Association between Killip classes at day 0 with CAG KILLIP day 0

	Normal	SVD	DVD	TVD	Total
Class 1	2	31	21	3	57
Class 2	0	8	6	2	16
Class 3	0	3	9	2	14
Class 4	3	2	5	3	13
Total	**5**	**44**	**41**	**10**	**100**
Chi-square= 21.8389 p=0.0094*					

Out of 100 patients who were enrolled in the study 5 patients had normal coronaries in CAG. 44 patients has single vessel disease, 41 patients had double vessel disease .10 patients had triple vessel disease.

Out of 57 patients who belonged to Killip class I, 2 patients had normal coronaries, 31 patients has single vessel disease .21 patients had double vessel disease. 3 patients had triple vessel disease.

Out of 16 patients who belonged to killip class II on day 0 8 patients has single vessel disease, six patients has double vessel disease and 2 patients had triple vessel disease. Out of 14 patients who belonged to killip class III on day 0 ,3patients has single vessel disease, 9 patients has double vessel disease and 2 patients had triple vessel disease. Out of 13 patients who belonged to killip class IV on day 0, 3 patients had normal coronaries 2 patients has single vessel disease, 5 patients has double vessel disease and 3 patients had triple vessel disease.

DISCUSSION

In 2014 a study was published by Bruno Henrique, Gallindo de Mello *et al* in which they evaluated 1906 patients with documented AMI and admitted to the CCU, from 1995 to 2011, with a mean follow-up of 5 years to assess total mortality. Cox proportional regression models were developed to determine the independent association between Killip class and mortality, with sensitivity analyses based on type of AMI. It was concluded that Killip and Kimball classification performs relevant prognostic role in mortality at mean follow-up of 05 years post-AMI, with a similar pattern between NSTEMI and STEMI patients. It was emphasized that in this study, [14]

The Killip classification was an important independent predictor of mortality, even after adjustment for important covariates such as clinical, laboratory, electrocardiographic, and angiographic characteristics related with the risk of mortality in patients with AMI, as well as of the occurrence of relevant complications independently associated with the risk of death, including cardiac arrest during hospitalization and acute renal failure. It provides relevant information on the early risk stratification of mortality in patients with NSTEMI, similar to that in patients with STEMI. Study detected a direct, significant, and independent association between the Killip classification and risk of death during late follow-up post-AMI. In fact, there was consistent risk stratification at 30-day, 5-year, and total follow-up time post-AMI. [9] Khot *et al* published a study to determine the prognostic importance of physical examination for heart failure analyzed according to Killip classification in non–ST-elevation acute coronary syndromes and to understand its predictive value relative to other variables. From April 2001 to September 2003, they analyzed information from 4 large clinical trials of patients with acute coronary syndromes without ST elevation in which prospectively recorded data regarding Killip classification were available. These trials included GUSTO IIb, PURSUIT, PARAGON A, and PARAGON B. Information regarding Killip classification was available for 26 090. This study of more than 26000 patients with non–ST-elevation acute coronary syndromes indicates that assessment for the presence and severity of heart failure through Killip classification provides powerful independent prognostic information regarding both short-term (30-day) and long-term (6-month) all-cause mortality. Furthermore, Killip class III/IV is the most powerful predictor of short-term and long-term mortality in non–ST-elevation acute coronary syndromes. [10, 15] Granger BC *et al* published a study to develop a simple model to assess the risk for in-hospital mortality for the entire spectrum of ACS treated in general clinical practice, multivariable logistic regression model was developed using 11 389 patients (including 509 in-hospital deaths) with ACS with and without ST-segment elevation enrolled in the Global Registry of Acute Coronary Events (GRACE) from April 1, 1999, through March 31, 2001. [16] independent risk factors were studied, age, Killip class, systolic blood pressure, ST-segment deviation, cardiac arrest during presentation, serum creatinine level, positive initial cardiac enzyme findings , and heart rate . In this multivariable model study, Killip class was the most powerful predictor of mortality, with a 2-fold increased risk for death with each worsening of class[11] Kerry L. Lee *et al* published a study to study Predictors of 30-Day Mortality in for Acute Myocardial Infarction. 41021 patients enrolled in GUSTO-I, a randomized trial of four thrombolytic strategies, relations between clinical descriptors routinely collected at initial presentation, and death within 30 days (which occurred in 7% of the population) were examined with both univariable and multivariable analyses. The most significant factor among these variables was Killip class at enrollment. Although relatively few patients presented in Killip class III or IV (2%), their mortality rate was very high. Killip class was the most powerful predictor of mortality.[12] Younes Nozari *et al* published a study in 2010 to study Correlation between the Serum Levels of Uric Acid and HS-CRP with the Occurrence of Early Systolic Failure of Left Ventricle Following Acute Myocardial Infarction. 188 patients were studied. In this study they found that there was a significant relation between heart failure and serum level of uric acid. The highest level of Acid uric was among Killip class IV patients. But among patients in class I to III, there was not significant [16] Difference for the serum level of the uric acid. In other words, Killip class IV was associated with high level of uric acid. This finding has been found in both males and females[13] In our study majority of the patients are in the age group of 51-60 years (37%) followed by age group of 61-70 years (23%). The majority of the patients were Male i.e. 70% and Females were 30%. On day 0 out of 100 patients 57 patients belonged to Killip Class I, 16 patients belonged to Killip Class II, 14 patients belonged to Killip Class III, 13 patients belonged to Killip Class IV. There were no mortalities on day 0. In our study on day 3 out of 100 patients 65 patients belonged to Killip Class I, 22 patients belonged to Killip Class II, 6 patients belonged to Killip Class III, and 7 patients belonged to Killip Class IV. There were no mortalities on day 0. In our study on day 7 out of 100 patients 89 patients belonged to Killip Class I, 5 patients belonged to Killip Class II, no patients belonged to Killip Class III, and six patients expired during follow up between day and day 7. Mean uric acid level in patients on day 0 belonging to Killip class I was 4.4mg/dl compared to 7.01 mg/dl in Killip class II, 8.29 mg/dl in Killip class III, and 9.87 mg/dl in Killip class IV. Mean uric acid on day 0 is 6.07 mg/dl. There is statistically significant difference in uric acid levels with increasing levels on Killip class on day 0. Mean uric acid level in patients on day 0 belonging to Killip class I was 4.46mg/dl compared to 7.09 mg/dl in Killip class II, 8.53 mg/dl in Killip class III, and 9.43 mg/dl in killip class IV. Mean uric acid on day 0 is 5.63 mg/dl. There is no statistical significant difference in mean uric acid levels between killip class III and Killip Class IV on day 3. From the above table it can be inferred that on day 3 majority of patients (97%) belonging to Killip class I had serum uric acid levels in lower two quartiles. Mean uric acid on day 7 in patients with Killip Class I is 4.67 mg/dl. Mean uric acid in patients with Killip Class II

is 6.62 mg/dl. There is statistical significant difference in uric acid levels with increasing killip class on day 7. Out of 100 patients who were enrolled in the study 5 patients had normal coronaries in CAG. 44 patients has single vessel disease, 41 patients had double vessel disease .10 patients had triple vessel disease. Out of 57 patients who belonged to Killip class I, 2 patients had normal coronaries, 31 patients has single vessel disease .21 patients had double vessel disease. 3 patients had triple vessel disease. Out of 16 patients who belonged to killip class II on day 0 8 patients has single vessel disease, six patients has double vessel disease and 2 patients had triple vessel disease. Out of 14 patients who belonged to killip class III on day 0 ,3patients has single vessel disease, 9 patients has double vessel disease and 2 patients had triple vessel disease. Out of 13 patients who belonged to killip class IV on day 0 , 3 patients had normal coronaries 2 patients has single vessel disease , 5 patients has double vessel disease and 3 patients had triple vessel disease. These findings are similar to L S Patil they found that Mean uric acid levels on day 0 is 5.179±1.910, on day 3 is 5.0325±1.755, on day 7 is 4.953± 1.446. Uric acid levels was compared with Killip class on day 0 and it is found to be significant($r = 0.7374$ and $p < 0.0001$) and results remain significant on day 3($r = 0.5898$ p7mg/dl). 19 patients were in Killip's class IV at the time of death. On all the days serum uric acid levels were higher in patients who were in higher Killip class.

CONCLUSION

From our study it is clear that SUA levels are correlated with Killip Class and patients with higher Killip Class have higher SUA levels in AMI. Serum uric acid can be used as a marker of short-term mortality in acute myocardial infarction .

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