Risk Assessment of Patients After ST-Segment Elevation Myocardial Infarction by Killip Classification: An Institutional Experience

Kashif Ali Hashmi
Chaudhry Pervaiz Elahi Institute of Cardiology
Fahar Adnan
Jinnah Hospital
Atif Ali Hashmi
Liaquat National Hospital and Medical College
Javaria Parwez Ali
Liaquat National Hospital and Medical College
Muhammad Irfan
Liaquat National Hospital and Medical College
Amir Khan (dramirkhan04@gmail.com)
Kandahar University Faculty of Medicine https://orcid.org/0000-0002-8763-7690
Muhammad M. Edhi
Brown University

Research note

Keywords: Killip class, ST elevation myocardial infarction, Heart Failure, In-Hospital Mortality

Posted Date: October 7th, 2020

DOI: https://doi.org/10.21203/rs.3.rs-85950/v1

Version of Record: A version of this preprint was published at Cureus on December 21st, 2020. See the published version at https://doi.org/10.7759/cureus.12209.

Abstract

Objectives: Revalidation of Killip class in our local population is mandatory. We planned this study to increase cardiologist readiness to tackle the risks associated with increased mortality in each class post ST elevation myocardial infarction (STEMI). Objectives were to determine frequency of Killip class I, II, III, IV and in-hospital mortality in each Killip class in patients with left ventricle failure secondary to STEMI.

Results: This cross-sectional Study was conducted in Department of Cardiology, Jinnah Hospital. Patients with STEMI were stratified using Killip Class and validation was performed by determining the within 15 days in-hospital mortality in each Killip class. Patients with chronic disease were excluded. The frequency (percentage) of patients with STEMI in each killip class from I to IV was 395 (81.4%), 46 (9.5%), 27(5.6%) and 17(3.5%) respectively while in-hospital mortality came out to be, 39 (9.8%), 4 (8.6%), 25 (92.5%), and 17(100%), in Killip class I, II, III and IV respectively. Presence of diabetes, history of smoking and BMI more than 30kg/m^2 were significant contributor to mortality along with higher Killip class and age of presentation. It is concluded that Killip class is a valid tool for risk stratification for patients after STEMI.

Introduction

Myocardial infarction serves as one of the most common entity among the life-threatening diagnoses in emergency hospital admissions. First few hours are critical as most of the complications occur during that time [1]. With the advent of new biomarkers, guideline committees have upgraded the criteria for diagnosis and inclusivity of suspected cases [2]. As such, this has greatly improved the prognosis of patients with left ventricular systolic dysfunction (LVSD) or heart failure (HF) [3].

The Killip class introduced for clinical assessment of patients with acute myocardial infarction stratifies individuals according to severity of their post MI heart failure [4]. This system provides effective stratification of long-term and short-term outcome in patients with acute myocardial infarction (MI) and influences the treatment strategies [5]. While evaluating post MI heart failure, it is important to understand that these patients have a complex clinical syndrome in which increased myocardial damage or stress initiates a systemic response that provides short-term support of the cardiovascular system while also adversely affecting its structure and function. The goals of the clinical assessment are to assess severity of the disease and predict prognosis [6]. Killip classification serves as an independent predictor of early mortality after MI, and presence of left ventricular systolic dysfunction (ejection fraction < 50%) and high Killip class predicts poor short-term prognosis [5]. In a study, the in-hospital mortality rates for STEMI were 2.9% ,13.6%, 27.4%, 50.5% respectively for Killip classes I, II, III, IV; out of 19158, 6059 (31.6%) belong to class I, 978 (5.1%) belong to class II, 320 (1.6%) belong to class III and 69 (0.36%) belong to class IV [7].

The rationale of our study is that early diagnosis of high-risk patients may help reduce the mortality associated with MI. Above cited studies emphasize the continuous use of Killip class in resource depleted

setting like ours and still find its utility in risk stratification of patients with LVF secondary to MI. MI is associated with high mortality and multiple complications in our population [8, 9]. As no such facilities (emergency angioplasty and emergency bypass surgery) are available in tertiary care hospitals, so mortality may be different in each class. Revalidation of this classification in Pakistani population may reduce burden on units and increase cardiologist readiness to tackle the risks associated with increased mortality in each class.

Materials And Methods

This cross sectional study was conducted in department of cardiology, Jinnah hospital, Lahore after the approval of ethical review committee from 31st October 2013 to 30th March 2014. A total of 485 patients presenting with ST elevation myocardial infarction admitted via emergency department of Jinnah Hospital Lahore, fulfilling the inclusion and exclusion criteria were enrolled in the study after obtaining informed consent. Estimated sample size was 485 patients at 95% confidence level, 1.5% margin of error taking an expected percentage of patients in killip class I to be 2.9%. Patient of either gender with left ventricular failure secondary to ST elevation myocardial infarction and age 40 to 70 years were included in study. Patient with acute or chronic liver disease, auto-immune disease and diagnosed cases of chronic obstructive pulmonary disease and chronic kidney disease determined by history and lab examination were excluded from study. All patients were treated according to department protocols and were classified according to Killip's classes. History of diabetes, smoking and BMI > 30 kg/m^2 were treated as effect modifier. A proforma for assessing patient's demographics was filled for each patient who was followed for 15 days during his/her stay at hospital for assessment of prognosis. Data analysis was done on software Statistical Package for the Social Sciences (SPSS) version 21. Numerical variables like age was described as means and standard deviations, while categorical variables like Killip class, history of diabetes, smoking, BMI > 30 kg/m2 and in-hospital mortality was described as frequencies and percentages. Data was cross tabulated and post stratification chi square or Fischer exact test was applied. Independent sample t test and ANOVA was used to determine mean age distribution across in hospital mortality and Killip class. A p-value < 0.05 was considered significant.

Results

Total 485 patients with mean age of 55.5 + 6.43 years were included in the study. 25.4% were female while 74.1% were male. 259 (53.4%) patients were diabetic and 196(40.4%) patients were current smoker. 44.7% patients had body mass index greater than 30 kg/m^2. Most of the patients lie in killip class I (81.4%) and least were present in Killip class IV i.e.3.5%. 85 patients (17.4%) died during their hospital stay within 15 days of MI. Descriptive statistics of study population are presented in Table-1.

When Killip class was cross tabulated with in-hospital mortality there came out a significant difference when fisher exact test was applied (p value < 0.01). When killip class was cross tabulated against gender there was a non-significant difference. Diabetes was found associated with Killip. Similarly smoking and

BMI greater than 30 kg/m^2 were significantly different in each Killip class. Mean comparison and association of killip class according to population characteristics are presented in Table-2.

In-hospital mortality was found be higher in males as compared to females (p = 0.01). Similarly, in-hospital mortality was higher among diabetics, current smokers, and BMI > 30 mg/m^2. When independent sample T-test was applied, older patients were more associated with mortality; similarly increase in age was significantly associated with Killip class. Mean comparison and association of in-hospital mortality with population characteristics are presented in Table-3.

Discussion

Myocardial infarction serves as one of the most common entity among the life-threatening diagnoses in emergency hospital admissions. First few hours are critical as most of the complications occur during that time [10]. With the passage of time, there has been a significant improvement in diagnosis and management of complications of MI [11]. However, Pakistan is a resource limited country with lack of well developed screening programs due to which patients present late, leading to high rate of complications like left ventricular thrombosis [12]. Moreover, frequency of multi-vessel disease even in the absence of ST segment elevation on electrocardiogram is high [13].

Patients belonging to a younger age group (mean age 57 years) have the maximum burden of CHD. Our age range was 43–70 years showing a need of extensive preventing program that can lead to decrease in young age mortality in our patients at risk of coronary artery disease. Majority of the patients were male.

Frequency of patients with post MI failure decreased from Killip class I-IV. 395 (81.4%) individuals fell in Killip class I while 46(9.5%) in killip class II 27(5.6%) in killip class III and 17(3.5%) in killip class IV. 85% (17.5%) died during their stay in hospital. It is quite high as compared to developed nations; owing to delayed presentation and poor patient compliance.

Our results showed that diabetes and smoking were significantly associated with MI. Coronary heart disease was common among obese patients as our study depicted that 44.7% had their BMI > 30 kg/m^2. Killip class significantly determined increased mortality in our sampled population.

Our results are concordant with the published literature. Mello BH et al [14] conducted a study in Brazil where they evaluated 1906 patients with documented MI with a mean follow up of 5 years for the assessment of mortality. They developed Kaplan-Meier (KM) curves for comparison between survival distributions according to Killip class. Their results showed that the Killip classification played a relevant prognostic role in mortality at mean follow-up of 5 years post-MI. Similarly, a study conducted by Khot et al [15] also showed that higher Killip class is associated with higher mortality at 30 days.

Therefore, Killip classification has proven to be a good reliable and valid tool for early risk stratification of MI patients. Almost 100% mortality was found in Killip class IV in our study. Presence of diabetes,

smoking and obesity increase the likelihood of increased risk and higher killip class as shown by our results.

Conclusion

It is concluded that Killip classification is a valid tool for risk stratification of the patients with STEMI especially in resource limited countries.

Limitations

One of the limitations of the study was that this was a single institution study; there we recommend large scale re-validation of our findings in a multi-institutional study. Secondly, our follow up period was short i.e. 15 days.

Abbreviations

ST elevation myocardial infarction =STEMI

Body mass index=BMI

Declarations

Ethics approval and consent to participate

Ethics committee of Jinnah Hospital, Lahore, Punjab, Pakistan approved the study. Written informed consent was obtained from the patients for participation.

Consent to publish

Not Applicable.

Availability of data and materials

The datasets used during this study are available from the corresponding author on request.

Competing interests

The authors declare that they have no competing interests.

Funding

Not applicable

Authors' contributions

KAH and FA: main author of manuscript, have made substantial contributions to conception and design of study. AAH, JPA, MI, AK, and MME have been involved in requisition, analysis of the data and provided final approval and revision of the manuscript. All authors read and approved the final manuscript.

Acknowledgments

We gratefully acknowledge all staff members of Department of Cardiology Jinnah Hospital, Lahore, Punjab, Pakistan for their help and cooperation.

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Tables

Table-1: Descriptive statistics of study population

		n(%)
Age(years)°		57.57±6.43
Gender	Male	362(74.6)
	Female	123(25.4)
Diabetes Melitus	Yes	259(53.4)
	No	226(46.6)
Smoking	Yes	196(40.4)
	No	289(59.6)
Obesity	Yes	217(44.7)
	No	268(55.3)
In Hospital Mortality	Yes	85(17.5)
	No	400(82.5)
Killip Class	Class I	395(81.4)
	Class II	46(9.5)
	Class III	27(5.6)
	Class IV	17(3.5)
°Mean±SD		

Table-2: Association of Killip class with clinical characteristics of studied population

		n(%)				P-value
		Class I	Class II	Class III	Class IV	
Age(years)**		56.27±5.98	62.43±6.84	64.89±1.34	63.12±0.33	<0.01
Gender	Male	296(74.9)	32(69.6)	22(81.5)	12(70.6)	0.690
	Female	99(25.1)	14(30.4)	5(18.5)	5(29.4)	
Diabetes Mellitus	Yes	215(54.4)	17(36.9)	20(74)	7(41.2)	<0.01
	No	180(45.6)	29(63.1)	7(26)	10(58.8)	
Smoking*	Yes	111(28.1)	42(91.3)	26(96.3)	17(100)	<0.01
	No	284(71.9)	4(8.7)	1(3.7)	0(0)	
Obesity*	Yes	132(33.4)	42(91.3)	26(96.3)	17(100)	<0.01
	No	263(66.6)	4(8.7)	1(3.7)	0(0)	
In Hospital Mortality*	Yes	39(9.9)	4(8.7)	25(92.6)	17(100)	<0.01
	No	356(90.1)	42(91.3)	2(7.4)	0(0)	
Chi-square test applied.						
*Fisher exact test was applied.						
**ANOVA was applied.						

Table-3: Association of In-hospital mortality with clinical characteristics

		In-hospital mortality n(%)		P-Value
		Yes	No	
Age(years)°		62.55±5.25	56.51±6.15	<0.001
Gender	Male	72(84.7)	290(72.5)	<0.01
	Female	13(15.3)	110(27.5)	
Diabetes mellitus	Yes	56(65.9)	203(50.8)	<0.01
	No	29(34.1)	197(49.2)	
Smoking	Yes	80(94.1)	116(29)	<0.01
	No	5(5.9)	284(71)	
Obesity	Yes	72(84.7)	145(36.3)	<0.01
	No	13(15.3)	255(63.7)	
Chi-square test applied.				
°Independent t-test was applied.				