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Original Article

ADULT CARDIOLOGY

Association of CHADVASC Score in Predicting In-Hospital Mortality in Patients with ST-Segment Elevation Myocardial Infarction Undergoing Primary PCI

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ABSTRACT

Objective: To assess CHADVASC score in predicting in-hospital mortality in patients presenting to the hospital with ST segment Elevation Myocardial Infarction undergoing primary PCI.

Study design: Analytical Cross-sectional study.

Place and Duration of Study: Armed Forces Institute of Cardiology/National Institute of Heart Diseases, Rawalpindi, Pakistan, from Mar 2023 to Apr 2023.

Methodology: A total of 198 patients were enrolled. Their CHADVASC scores were recorded and were divided into Group-A (score of 0-1), B (score 2-3) and C (score 4 and above). Sampling was done by using non-probability consecutive sampling. A brief clinical history including duration of symptoms, comorbid, duration of hospital stay and survivability status were recorded. Chi-square and Independent sample t-test were applied to find the association between In-hospital mortality and CHADVASC score, duration of hospital stay as well as comorbids. *p*-value <0.05 was taken as significant

Results: Among study participants, majority were males 133(67.2%). Mean age of patients was 60.86±9.02 years. In-hospital mortality was noted in 13(6.56%) patients. There was a significant association between CHADVASC score and mortality (p<0.001). It was also noted that mortality increased with prolonged duration of stay in hospital (p=0.03). Another observation noted was that males presented at an earlier age (59.45±9.79 years) than females (63.63±6.54 years).

Conclusion: CHADVASC score like the TIMI score and GRACE score can be used to stratify risk in patients presenting with Acute Coronary Syndrome (ACS). It is a fairly easy to use test at bed side and can help clinicians decide further treatment strategies and how aggressively to approach the case.

Keywords: CHADVASC, In-hospital mortality, Primary Percutaneous Coronary Intervention, ST Elevation Myocardial Infarction.

How to Cite This Article: *Aziz Z, Shahzad SK, Rahman FU, Khan IA, Khawaja AZ, Shafique HM, Mumtaz S, Siddiqui AH. Association of CHADVASC Score in Predicting In-Hospital Mortality in Patients with ST-Segment Elevation Myocardial Infarction Undergoing Primary PCI. Pak Armed Forces Med J 2023; 73(Suppl-3): S485-489. DOI: https://doi.org/10.51253/pafmj.v73iSUPPL-3.10647*

INTRODUCTION

ST-segment Elevation Myocardial Infarction (STEMI) remains a major health care burden throughout the world. A study conducted in the US showed that annually, there are around 750,000 cases of STEMI presenting to hospitals.[1,2] Though treatment modalities have improved for STEMI, the mortality rate remains high. A study from US showed that from 2018-2021, the in-hospital mortality of post PCI patients increased from 5.6-8.7%.[3]

A variety of factors can predispose to person developing STEMI. One factor is noted to be gender. Numerous studies conducted including the well-known INTERHEART trial,[4] has shown that males presenting at a younger age to the hospital with Myocardial Infarction than females. Another study pointed out that women presenting to the ED with Myocardial Infarction were on average 10 years older than their male counterparts.[5] Other risk factors which confer a higher risk of developing STEMI include Diabetes Mellitus, hypertension, smoking, obesity, Chronic Kidney Disease (CKD), hyperlipidemia, and family history of heart disease. Risk stratification in such patients presenting to the ED is a useful tool to deduce an individual's mortality rate and to dictate aggressiveness of treatment. Commonly used scores in clinical practice include the "Global Registry of Acute Coronary Events" (GRACE) score,[6] and the "Thrombolysis in Myocardial Infarction" (TIMI) score.[7] While these scores have proven useful in predicting mortality in patients presenting to hospitals, these do not succinctly cover comorbids such as diabetes, hypertension and stroke; all of which contribute to increased mortality rates in patients presenting with an acute Myocardial Infarction.[8-10]

An appropriate supplement to these stratification scores can be the CHADVASC score. The CHADVASC score has traditionally been used to stratify the risk of

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development of stroke in patients with atrial fibrillation.[11] However, the CHADVASC score encompasses those factors that also increase the mortality in Myocardial Infarction. The tool is very easy to use at bedside therefore, it alongside the GRACE and TIMI scores can be applied at bedside, prior to the patient proceeding to the catheter lab undergoing primary PCI.

The aim of the study was to ascertain if the CHADVASc score can be used in predicting in-hospital mortality in patients presenting to the Emergency Department with STEMI who underwent Primary Percutaneous Coronary Intervention (PPCI).

METHODOLOGY

This was an Analytical Cross-Sectional study conducted at Armed Forces Institute of Cardiology/ National Institute of Heart Diseases with the facility of primary PCI from March 2023 to April 2023. Cases were included using non-probability consecutive sampling. Approval from Institutional Ethical Review Board (IERB letter # 9/2/R&D/2023/241) was sought.

The sample size taken was 198 as per the calculation by WHO calculator, keeping 95% Confidence level and 5% margin of error and 15.18% prevalence of STEMI.[12]

Inclusion Criteria: Patients enrolled into the study were those who had STEMI with a duration of less than 12 hours.

Exclusion Criteria: Patients who had been thrombolysed for the same event but presented with STEMI were excluded from the study.

A brief clinical history including duration of symptoms, comorbid, and CHADVASc score was recorded. A 12 lead ECG was taken to make the diagnosis of STEMI and barring any contraindication to primary PCI patients were enrolled into the study and shifted to the catheter lab for primary PCI. Patients were monitored during their hospital admission with emphasis on duration of hospital stay. Patients who expired during the same hospital admission were recorded as well as those discharged with medication.

All patients included in the study had their CHADVASc scores recorded and were sorted into 3 separate groups (A, B, and C) depending on the respective CHADVASc score. Group-A included those patients with a CHADVASc score of 0-1, Group-B included those with a score of 2-3, and Group-C included those with a score of 4 and above.

ST-Segment Elevation Myocardial Infarction (STEMI) which is defined by the European society of cardiology as ST-segment elevation (measured at the J-point) is considered suggestive of ongoing coronary artery acute occlusion in the following cases: at least two contiguous leads with ST-segment elevation >2.5 mm in men <40 years, >2mm in men ≥40 years, or >1.5mm in women in leads V2-V3 and/or >1mm in the other leads (in the absence of left ventricular (LV) hypertrophy or left bundle branch block LBBB).[13] This is a scoring tool primarily used to assess the risk of stroke in patients with atrial fibrillation and helps in guiding clinicians when to start anticoagulation based on the score. Usually a score of 2 or more is an indication to start anticoagulation.[11]

The data was analyzed using Statistical Package for the Social Sciences (SPSS) version 29:00. Descriptive statistics were applied on qualitative and quantitative variables. Chi-square test was applied to find the association between In-hospital mortality and CHADVASC score as well as comorbid such as hypertension, diabetes, CVA, congestive heart failure, and vascular disease. Independent samples t-test was applied to find an association between age and duration of hospital stay with in-hospital mortality. *p*-value ≤0.05 was considered statistically significant.

RESULTS

A total number of n=198 patients were enrolled in the study. The mean age of the patients was 60.86±9.02 years, where the mean age of males was 59.45±9.79 years and of females was 63.63 ±6.54 years.

Table-I: Demographics and Clinical Characteristics of the Study Participants (n=198)

Variables	Frequency(%)
Age (years) (Mean±SD)	60.86±9.02
Gender	
Male	133(67.2)
Female	65(32.8)
Congestive heart failure	37(18.7)
Hypertension	149(75.3)
Diabetes Mellitus	108(54.5)
History of Vascular Disease	45(22.7)
Stroke or Transient Ischemic Attack	30(15.2)
Type of MI	
Anterior wall MI	73(36.9)
Inferior wall MI	77(38.9)
Lateral wall MI	36(18.2)
Posterior wall MI	12(6.1)
CHADVASC	
A (score 0-1)	61(30.8)
B (score 2-3)	68(34.3)
C (score ≥4)	69(34.8)
Duration of in-hospital stay(days) (Mean±SD)	5.23±2.86
In-hospital Mortality	13(6.6)

Around 37(18.7%) of the sample had history of Congestive Heart Failure, 149(75.3%) were hypertensive, 108(54.5%) were diabetics, 45(22.7%) had a history of vascular disease and 30(15.2%) had a history of stroke or TIA. Amongst total, 73(36.9%) of the patients had presented to the ED with an anterior wall Myocardial Infarction, 77(38.9%) presented with inferior wall Myocardial Infarction, 36(18.2%) had lateral wall Myocardial Infarction, and 12(6.1%) had posterior wall Myocardial Infarction (Table-I).

The mean hospital stay was 3.36±0.86 days in CHADSVaSc group-A patients, staying on average for 3 days, group B patients staying for 4.03±1.36 days and group C patients remained in hospital for 8.07±2.91 days as shown in Table-II.

Table-II: Hospital Stay of Patients on the Basis of CHADVASC Grouping (n=198)

CHADVASC Group	Hospital Stay (days) Mean±SD	*p*-value
A(score 0-1)	3.36±0.86	<0.001
B(score 2-3)	4.03±1.36	
C(score ≥4)	8.07±2.91	

Results in Table-III report the comparison of risk factors with mortality status. Total in-hospital mortality noted was 13(6.56%). Mortality was notable (p<0.001) in elderly patients i.e., mean age: 74.23±9.92 years; whereas, it was 59.88±8.24 years in patients who survived. 84.6% of patients who had mortality (n=11) were diabetic (p=0.04), all were hypertensive 13(61.5%) (p=0.07), had an episode of TIA (p<0.001). CHF and Vascular disease were more prevalent in patients who had in-hospital mortality in comparison to those who survived (53.8% vs 16.2% (p=0.003); 46.2% vs 21.1% (p=0.08)). Mean duration of hospital stay was also higher in mortality group 8.3±4.85 days (p<0.05). In-hospital mortality [12(92.3%) out of 13 patients] was more in group having CHADSVaSc score ≥4.

DISCUSSION

Increased CHADVASc score lead to an increase in in-hospital mortality in patients with STEMI undergoing primary PCI, which is currently the treatment of choice as per the guidelines.[13] Despite advancement of treatment options and awareness with regards to management of STEMI, the mortality for STEMI remains high. According to Takagi *et al*., in-hospital mortality rate being as high as 9.2% and 30 day mortality being up to 7.7%.[14] While the CHADVASc score was devised to assess the risk of having a stroke in patients with atrial fibrillation,[15] the risk factor parameters included in the score are those which also increase the risk of coronary artery disease.

From the current study, multiple conclusions can be drawn. One conclusion, that with a higher CHADVASc score, in-hospital mortality increased. It was also noted that with a higher CHADVASc score, there was a longer duration of stay at the hospital as is self-explanatory due to the greater number of associated comorbids which would increase the complexity of the case. The mortality of patients increased with age was another observation that was noted in the study. From the study it was noted that Inferior Wall Myocardial Infarction was the most common MI (38.9%) followed closely by Anterior Wall Myocardial Infarction (36.9%) these results relate closely to another study conducted in the US where inferior wall MI accounted for 42.2% of MI's recorded compared to 33.3% of MI's being of the anterior territory.[16]

Table-III: Association of Risk Factors with Outcome (n=198)

Risk factors	Outcome		*p*-value
	Dead (n=13) Frequency(%)	Alive (n=185) Frequency(%)	
Age (years) (Mean±SD)	74.23±9.92	59.88±8.24	<0.001
Diabetes Mellitus	11(84.6)	97(52.4)	0.04
Hypertension	13(100)	136(73.5)	0.07
Stroke or TIA	8(61.5)	22(11.9)	<0.001
Congestive Heart Failure	7(53.8)	30(16.2)	0.003
Vascular disease	6(46.2)	39(21.1)	0.08
Duration of hospital stay (days) (Mean±SD)	8.3±4.85	5±2.55	0.03
CHADVASc Score			
A (score 0-1)	0(0)	61(32.9)	<0.001
B (score 2-3)	1(7.7)	67(36.2)	
C (score ≥4)	12(92.3)	57(30.8)	

The mean age of patients presenting to the ED with STEMI in the study sample was around 60 years of age. Similar observations were noted in another study where the mean age was 60 years. The mean presentation age for males was lower than females in the study group. This difference may be due to the protective effects of estrogen against development of Coronary Artery Disease in premenopausal women which becomes less so after menopause.[17] The INTERHEART study also supports the findings of our study that, women present with ACS at an older age than their male counterparts which is most likely dependent on an interplay between numerous risk factors being present in males at an earlier age than females thereby predisposing males to an early onset of MI.

LIMITATIONS OF STUDY

This was a single centered study, therefore, an improvement on this study could be to include multiple hospitals where primary PCI is offered to patients to improve the quality of the study. A 6-month follow-up with correlation to mortality and beyond would further improve the study. One caveat with the CHADVASc score is while it includes a lot of the comorbidities that increase the risk of developing Coronary Artery Disease it does not include factors such as smoking, hyperlipidemia, obesity,[18-20] and chronic kidney disease,[21] some of which are covered in other risk calculators such as the GRACE score. As a result risk estimation will be underestimated in those patients who do not have risk factors that are covered by the CHADVASc score all the while having those risk factors not covered under the score.

CONCLUSION

Our study showed that there was a significant association between increased CHADVASc score and in hospital mortality. Therefore, the CHADVASc score may be used in patients presenting to the ED with Acute Coronary Syndrome as a means to predict in-hospital mortality as well as duration of stay in hospital.

ACKNOWLEDGEMENT

I am deeply grateful to my supervisor for his guidance, patience and support who provided insight and expertise that greatly assisted my research project. I also want to share my gratitude for Comdt Exec Dir AFIC/NIHD and R&D department for their support and contribution in completion of the research paper.

Conflict of Interest: None

Authors' Contribution

Following authors have made substantial contributions to the manuscript:

ZA, SKS: Manuscript writing, Data Analysis, Approval of the Final Version to be Published.

FUR, IAK & AZK: Data Analysis, Critical Review, Approval of the Final Version to be Published.

HMS, SM & AHS: Critical Review, Concept, Drafting the Manuscript, Approval of the Final Version to be Published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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