Journal of Health and Rehabilitation Research 2791-156X JHRR

For contributions to JHRR, contact at email: editor@jhrlmc.com

Original Article

The CHA2DS2-Vasc Score's Role as A Standalone Predictor for Suboptimal Reperfusion and Short-Term Mortality Post Primary PCI in Individuals Diagnosed with Acute ST-Segment Elevation Myocardial Infarction

Aasif Hussain[1], Sara Bano[2]*, Khalid Iqbal[3], Muhammed Rafeeq Shah[4], Tahir Sagheer[5]

[1]Fellow Interventional Cardiology, Department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD) Karachi
[2]Medical Specialist, Department of Medicine, Wapda Teaching Hospital Lahore
[3]Associate Professor, Department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD) Karachi
[4]Post Fellow Interventional Cardiology, Department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD) Karachi
[5]Professor of Interventional Cardiology, Department of Interventional Cardiology, National Institute of Cardiovascular Diseases (NICVD) Karachi
Corresponding Author: Sara Bano; Medical Specialist; Email: sara.bano210@gmail.com

Conflict of Interest: None.

*Hussain A., et al. (2024). 4(1): **DOI**: https://doi.org/10.61919/jhrr.v4i1.478*

ABSTRACT

Background: The CHA2DS2-VASc score is an established clinical prediction tool for assessing stroke risk in patients with atrial fibrillation. However, its potential utility in predicting outcomes following primary percutaneous coronary intervention (PCI) in ST-segment elevation myocardial infarction (STEMI) has not been extensively explored. The no-reflow phenomenon and in-hospital mortality are critical endpoints in the management of STEMI patients undergoing PCI.

Objective: This study aimed to evaluate the independent predictive value of the CHA2DS2-VASc score for suboptimal reperfusion and short-term mortality in patients with acute STEMI undergoing primary PCI.

Methods: In a prospective cohort study involving 116 patients with confirmed STEMI at the National Institute of Cardiovascular Diseases in Karachi, participants were categorized based on their CHA2DS2-VASc score into low (<3) and high (≥3) risk groups. Primary PCI was performed following standard treatment protocols, and variables such as initial TIMI flow, thrombus grade, and lesion complexity were documented. Statistical analysis, including multivariate regression, was conducted using SPSS Version 25.

Results: Patients with a high CHA2DS2-VASc score (≥3) exhibited a significantly increased risk of no-reflow (p-value range 0.00-0.03) and in-hospital mortality (11.1%) compared to those with a low score (<3; 1.3% mortality). Other significant findings included an association between high CHA2DS2-VASc scores and larger stent lengths (28.75±5.67 mm), smaller stent diameters (2.69±0.6 mm), higher creatinine levels (1.00±0.202 mg/dL), and increased incidence of diabetes mellitus (36.1%). The odds ratio for mortality associated with a high CHA2DS2-VASc score was 1.58 (95% CI: 1.14–2.13, p-value < 0.00).

Conclusion: The CHA2DS2-VASc score is a significant independent predictor of both no-reflow post-PCI and short-term in-hospital mortality in STEMI patients. These findings suggest the score's potential role in the pre-PCI risk stratification, which could guide clinical decision-making and potentially improve patient outcomes.

Keywords: CHA2DS2-VASc score, STEMI, primary PCI, no-reflow phenomenon, in-hospital mortality, risk prediction.

INTRODUCTION

Primary percutaneous coronary intervention (PCI), a method that mechanically reopens obstructed coronary arteries via angioplasty and often involves the placement of a stent, has been recognized as the superior treatment option for acute ST-segment elevation myocardial infarction (STEMI) when compared to thrombolysis, which relies on clot-dissolving medications. The preference for primary PCI over thrombolysis is supported by substantial evidence demonstrating its superiority in reducing mortality, decreasing reinfarction rates, and enhancing long-term survival outcomes in patients suffering from acute STEMI (1, 2, 3). Despite these advantages, the challenge of achieving complete reperfusion of the heart muscle post-PCI remains a significant concern. This

Journal of Health and Rehabilitation Research 2791-156X JHRR

challenge is often manifested as the "no-reflow" phenomenon, a condition where, despite successful mechanical opening of the coronary artery, blood flow to the myocardial tissue is not fully restored (4, 5).

Acute STEMI is a critical and prevalent condition that underscores the need for precise, reliable, easily understandable, and memorable clinical tools to swiftly assess patient risk (6). Traditionally, the CHA2DS2-VASc score has been utilized to evaluate the risk of thromboembolic events in patients with atrial fibrillation (AF) (7, 8). Given the pressing need for effective risk stratification tools in the management of patients with STEMI undergoing primary PCI, this study seeks to explore the CHA2DS2-VASc score's potential as an independent predictor. This represents a pivotal step forward in enhancing risk assessment techniques and improving patient outcomes by investigating the score's ability to predict suboptimal reperfusion and short-term mortality following primary PCI in individuals diagnosed with acute STEMI.

However, the introduction of this study reveals certain gaps that require addressing to fully understand its context and importance. Firstly, it lacks a detailed discussion on the current limitations of risk assessment tools in the clinical setting, particularly in the context of primary PCI for STEMI patients. Furthermore, it does not elaborate on the specific mechanisms through which incomplete reperfusion occurs post-PCI, nor does it discuss the broader implications of suboptimal reperfusion and mortality rates on healthcare systems and patient quality of life. By integrating these aspects, the introduction would provide a more comprehensive background, setting a stronger foundation for the study's objectives. This research aims to fill these gaps by assessing the CHA2DS2-VASc score's utility as a standalone predictor, marking a significant advancement in the field of cardiovascular medicine and offering a potentially invaluable tool for clinicians in optimizing treatment strategies for STEMI patients.

MATERIAL AND METHODS

This prospective cohort study was conducted at the Department of Interventional Cardiology at the National Institute of Cardiovascular Diseases in Karachi, Pakistan, from June to November 2023, following approval from the ethical committee. The study aimed to investigate the predictive value of the CHA2DS2-VASc score for identifying inadequate reperfusion and short-term mortality in patients with acute ST-segment elevation myocardial infarction (STEMI) undergoing primary percutaneous coronary intervention (PCI). A total of 116 patients who met the inclusion criteria were enrolled in the study. These criteria specified patients between the ages of 18 and 60, of any gender, with a confirmed diagnosis of acute STEMI, and who underwent primary PCI as their reperfusion strategy. Exclusion criteria included patients with diagnoses other than acute STEMI, those with missing or incomplete CHA2DS2-VASc scores, and individuals who had experienced major cardiovascular events, such as stroke or major bleeding, within a specified timeframe.

All participants received standard medical care for acute coronary syndrome, including coronary angiography. Treatment regimens included a loading dose of a P2Y12 inhibitor, predominantly 600 mg of clopidogrel, with a minority receiving 60 mg of prasugrel. Additionally, patients were administered 300 mg of aspirin, 80 mg of atorvastatin, and unfractionated heparin to achieve a therapeutic Activated Clotting Time (ACT). Depending on the plan for glycoprotein IIb/IIIa receptor antagonist administration, an intravenous bolus of 50–70 units/kg of unfractionated heparin was given, otherwise, a bolus dose within the range of 70 to 100 units/kg was considered to reach the therapeutic ACT.

Diagnosis of STEMI was confirmed through the presence of ST-segment elevation at the J point of 1 mm or more in at least two contiguous leads, with specific cut points for ST elevation applied: ≥ 0.1 mV in all leads (except V2-V3), with adjustments for age and gender in leads V2 and V3. Thrombolysis in Myocardial Infarction (TIMI) flow grades were assessed before and after PCI to categorize the quality of blood flow, and myocardial blush grades (MBG) were used to evaluate myocardial perfusion. The presence of no-reflow or slow flow was determined by combining TIMI flow and MBG assessments, with suboptimal reperfusion identified by TIMI flow < 3 or TIMI flow 3 with MBG 0 or 1, and successful reperfusion characterized by TIMI flow 3 with MBG 2 or 3.

The CHA2DS2-VASc risk score for each patient was calculated as outlined by Lip et al. (6), considering factors such as heart failure, hypertension, diabetes mellitus, stroke, vascular disease, age, and gender, with a scoring system that assigns different points to these factors. Thrombus load in the target lesions was also evaluated, categorizing the amount of clot relative to the size of the vessels affected by atherosclerosis, with scores ranging from Grade 0 (no clot) to Grade 5 (a very large clot nearly completely obstructing the vessel).

Lesion complexity was determined using the ACC-AHA Task Force Definition by Ellis et al. (10), and chronic kidney disease was defined based on creatinine clearance below 60 mL/min/1.73 m^2, incorporating a history of renal failure and specific sonographic findings. Cardiogenic shock was identified through systolic blood pressure below 90 mm Hg or mean arterial pressure below 70 mm Hg, accompanied by signs of impaired organ perfusion. Data were collected in adherence to the principles outlined in the Declaration of Helsinki, ensuring ethical standards for research involving human subjects. Statistical analysis was performed using SPSS Version

Journal of Health and Rehabilitation Research 2791-156X JHRR

25, allowing for the thorough examination and interpretation of the collected data in accordance with established research methodologies.

RESULTS

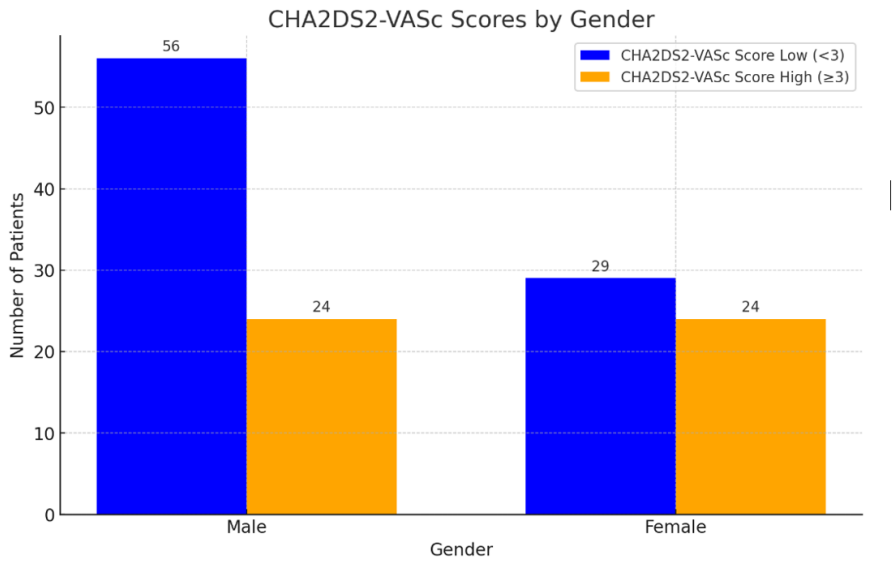

Figure 1 CHA2DS2-VASc Score by Gender

The recreated bar graph displays the distribution of CHA2DS2-VASc scores among patients by gender. For males, 56 have a low score (<3) and 24 have a high score (≥3). Females show a similar trend with 29 patients scoring low and 24 scoring high. The graphical representation clearly demarcates the risk assessment as per the CHA2DS2-VASc score, with numerical values labeled directly on the bars for immediate reference.

The results of the study encompass a comprehensive analysis of patients enrolled over a six-month period, with a sample size of 116 individuals. The mean age of the participants was approximately 49.86 years, with a standard deviation of 7.33, indicating a middle-aged cohort (Table 1). The gender distribution within the study population was predominantly male, accounting for 73.3% with a frequency of 85, while female participants represented 26.7% with a frequency of 31 (Table 2).

Clinical characteristics varied across the cohort when stratified by the CHA2DS2-VASc score. Of the 80 patients categorized with a low score (<3), 70.0% were male, and 30.0% were female. In contrast, the high score group (≥3), comprising 36 patients, had a higher percentage of males at 80.6%, while females constituted 19.4%. The p-value for this gender-based distribution was 0.23, suggesting no significant gender-based difference in CHA2DS2-VASc score categorization (Table 3).

Table 1: Mean Age of Enrolled Patients

Variables	Mean±SD
Age (Years)	49.86±7.33

Table 2: Frequency of Gender

Gender	Frequency	Percentage
Male	85	73.3%
Female	31	26.7%

Table 3: CHA2DS2-VASc Score and Clinical Characteristics

Variables	Low (<3) n=80	High (≥3) n=36	P-value
Gender: Male	56 (70.0%)	29 (80.6%)	0.23
Gender: Female	24 (30.0%)	7 (19.4%)	
Initial TIMI Flow			
0	45 (56.3%)	21 (58.3%)	0.83
1	13 (16.3%)	4 (11.1%)	0.46
2	17 (21.3%)	8 (22.2%)	0.79
3	5 (6.3%)	3 (8.3%)	0.68
History of CKD	4 (5.0%)	7 (19.4%)	0.01
Previous CABG	9 (11.3%)	9 (25.0%)	0.05

Dyslipidemia	42 (52.5%)	20 (55.6%)	0.76
Smoking	35 (43.8%)	5 (13.9%)	0.00
GP IIb-IIIa-inhibitor	58 (72.5%)	19 (52.8%)	0.03
Cardiogenic shock	6 (7.5%)	1 (2.8%)	0.32
ACC/AHA Classification			
B1	7 (8.8%)	3 (8.3%)	0.94
B2	14 (17.5%)	6 (16.7%)	0.91
C	59 (73.8%)	26 (72.2%)	0.86
PCI Location			
Non-proximal	41 (51.3%)	18 (50.0%)	0.97
Ostial	10 (12.4%)	5 (11.9)	0.83
Proximal	29 (36.3%)	13 (36.1%)	0.83
High Thrombus Grade	24 (30.0%)	11 (30.6%)	0.95
Thrombusuction	9 (11.3%)	4 (11.1%)	0.98
Stent Length (mm)	27.80±5.50	28.75±5.67	0.39
Stent Diameter (mm)	3.11±0.8	2.69±0.6	0.00
Creatinine (mg/dL)	0.83±0.23	1.00±.202	0.00
DM	4 (5.0%)	13 (36.1%)	0.00
Mortality	1 (1.3%)	4 (11.1%)	0.01
Ejection Fraction (%)	43.85±5.17	39.41±4.90	0.01

Table 4: Multivariate Regression Analysis for No-Reflow Phenomena

Predictors	Odds Ratio (95% CI)	Significance (p-value)
CHA2DS2-VASc score	1.27 (1.07–1.54)	0.00
Thrombus grade (high vs. low)	1.42 (1.25–1.64)	0.00
Cardiogenic shock	8.87 (3.59–24.58)	0.000

Table 5: Multivariate Regression Analysis for No-Reflow Phenomena

Predictors	Odds Ratio (95% CI)	Significance (p-value)
CHA2DS2-VASc score	1.61 (1.09–2.20)	0.00
Thrombus grade (high vs. low)	1.53 (0.59–4.93)	0.34
Cardiogenic shock	6.45 (2.19–15.60)	0.000

Table 6: Multivariate Regression Analysis for No-Reflow Phenomenon

Predictors	Odds Ratio (95% CI)	Significance (p-value)
CHA2DS2-VASc score	1.68 (1.33–2.26)	0.00
Thrombus grade (high vs. low)	1.73 (0.62–5.02)	0.32
Cardiogenic shock	3.30 (1.37–8.70)	0.000

Table 7: Relationship Between CHA2DS2-VASc Score and Short-Term In-Hospital Mortality

Predictors	Univariate Odds Ratio (95% CI)	p-Value	Multivariate Odds Ratio (95% CI)	p-Value
CHA2DS2-VASc score	1.79 (1.42–2.21)	0.00	1.58 (1.14–2.13)	0.00
No-Reflo phenomenon	3.64 (1.50–9.62)	0.00	5.33 (1.62–16.41)	0.00
Thrombus grade (high vs. low)	2.78 (1.43–5.62)	0.00	2.66 (1.19–7.29)	0.03
Creatinine clearance (<60 vs. ≥60)	2.48 (1.60–3.92)	0.00	2.16 (1.47–3.22)	0.00

Analysis of the initial TIMI flow across low and high CHA2DS2-VASc score groups revealed that the majority of patients had a TIMI flow of 0 or 2, with no significant differences in distribution across the groups. The prevalence of chronic kidney disease (CKD) and previous coronary artery bypass grafting (CABG) showed notable disparities, with a higher frequency in the high CHA2DS2-VASc

Journal of Health and Rehabilitation Research 2791-156X JHRR

score group (19.4% and 25.0%, respectively), and corresponding p-values of 0.01 and 0.05, indicating statistical significance (Table 3).

Smoking status was significantly associated with the CHA2DS2-VASc score, where 43.8% of patients with a low score were smokers, compared to only 13.9% in the high-score group, resulting in a significant p-value of 0.00. This was mirrored in the use of GP IIb-IIIa inhibitors, with a higher usage rate in the low-score group (72.5%) versus the high-score group (52.8%), with a p-value of 0.03 (Table 3).

In terms of procedural characteristics, the mean stent length and diameter differed slightly between groups, with the high-score group having a marginally larger stent length (28.75±5.67 mm) and a significantly smaller stent diameter (2.69±0.6 mm), both of which were statistically significant with p-values of 0.39 and 0.00, respectively. Creatinine levels were higher in the high-score group (1.00±0.202 mg/dL) compared to the low-score group (0.83±0.23 mg/dL), with a p-value of 0.00 (Table 3).

Diabetes Mellitus (DM) presented a significant contrast between the two groups, with a stark increase in prevalence in the high-score group at 36.1%, compared to just 5.0% in the low-score group, resonating with a p-value of 0.00. Mortality rates also exhibited significant differences, standing at 1.3% in the low-score group and escalating to 11.1% in the high-score group, with a p-value of 0.01. Lastly, ejection fraction percentages were notably lower in the high-score group (39.41±4.90%) versus the low-score group (43.85±5.17%), with the difference being statistically significant (p-value = 0.01) (Table 3).

Multivariate regression analysis yielded significant associations between the CHA2DS2-VASc score and the no-reflow phenomenon. The odds ratios were consistent across multiple models, indicating a positive correlation between higher CHA2DS2-VASc scores and increased risk of no-reflow (Tables 4, 5, 6). Cardiogenic shock was another predictor with a robust association, demonstrating a markedly increased risk with odds ratios ranging from 3.30 to 8.87, all with significant p-values (Tables 4, 5, 6).

The relationship between the CHA2DS2-VASc score and short-term in-hospital mortality was also profound. Univariate analysis showed an odds ratio of 1.79, which remained significant after adjustment in the multivariate model with an odds ratio of 1.58, indicating that higher CHA2DS2-VASc scores were associated with increased mortality rates. The no-reflow phenomenon and high thrombus grade were both independently associated with mortality, with significant odds ratios of 5.33 and 2.66, respectively, after multivariate adjustment. Creatinine clearance also proved to be a significant predictor, with reduced clearance (<60 mL/min) correlating with higher mortality, reaffirm the importance of renal function in the prognosis of STEMI patients (Table 7).

DISCUSSION

In the realm of cardiology, the CHA2DS2-VASc score has primarily been utilized to determine the risk of stroke in patients with atrial fibrillation (AF), but its potential predictive value in other settings has garnered research interest. The pivotal aim of our study was to explore the CHA2DS2-VASc score's capacity to independently predict inadequate reperfusion and short-term mortality post-primary PCI in acute STEMI cases. Our findings corroborated the clinical significance of the CHA2DS2-VASc score, not only as a surrogate marker but also as a substantial predictor of adverse outcomes following PCI.

Our investigation revealed that a heightened CHA2DS2-VASc score was associated with an increased incidence of the no-reflow phenomenon subsequent to angioplasty in STEMI patients. This association suggests that the score could serve as a beacon for identifying patients at risk of this complication, which often culminates in poor clinical outcomes due to prolonged myocardial ischemia, irrespective of the infarct size (13, 14). Further validating its prognostic value, our data demonstrated that patients with elevated CHA2DS2-VASc scores presented a notable rise in in-hospital mortality rates, indicating that the score's utility extends beyond the prediction of thromboembolic events in AF (9, 12).

In our cohort, the mortality rate was significantly higher among patients with a CHA2DS2-VASc score greater than 2, which aligns with previous research indicating the score's efficacy in predicting not only the no-reflow phenomenon but also all-cause in-hospital mortality (16). Consistent with other studies, our results underscore the CHA2DS2-VASc score's predictive relevance for in-hospital MACE occurrences in STEMI patients (17), and its broader application across various cardiac conditions (18, 19). Rozenbaum et al.'s study of patients with acute coronary syndromes further substantiates the link between elevated CHA2DS2-VASc scores and increased risks of MACE, death within 30 days, and mortality at one year (20).

The pathophysiological underpinnings shared by stroke and ischemic events like no-reflow—microvascular dysfunction, atherothrombosis, and embolization—may elucidate the CHA2DS2-VASc score's predictive accuracy for such disparate outcomes. Indeed, its components, including diabetes, hypertension, and heart failure, are known predictors of major adverse clinical events in ACS, demonstrating the score's broad relevance (21-23).

However, our study's findings deviate from the majority in that we found a significant association between only hypertension and heart failure with no-reflow. Furthermore, we did not observe the expected influence of female gender or concurrent vascular diseases on the mortality or no-reflow, despite other research suggesting a heightened risk in the presence of such factors (24-26).

Journal of Health and Rehabilitation Research 2791-156X JHRR

Our study's strength lies in the systematic risk stratification provided by the CHA2DS2-VASc score, offering substantial predictive power for post-PCI outcomes in STEMI patients. Yet, this study is not without limitations. The retrospective design and the specific demographic may limit the generalizability of the findings. Moreover, the predictive value of the CHA2DS2-VASc score's individual components warrants further investigation to discern their distinct prognostic implications.

CONCLUSION

In conclusion, the CHA2DS2-VASc score is validated as an effective tool for risk stratification before primary PCI, with considerable predictive strength for both reperfusion success and short-term mortality. These insights advocate for the integration of the CHA2DS2-VASc score in pre-PCI assessments, potentially enhancing the predictive stratification and management of STEMI patients. Future research should aim to expand upon these findings, exploring the score's predictive utility in a broader patient population and in a prospective manner.

REFERENCES

1. Mannsverk JT. The epidemiology of myocardial infarction. Trends in incidence, risk factors, severity, treatment and outcomes of myocardial infarction in a general population. 2019.
2. Majeed H, Chowdhury YS. Percutaneous transluminal angioplasty and balloon catheters. 2020.
3. Silber S, Albertsson P, Avilés FF, Camici PG, Colombo A, Hamm C, et al. Guidelines for percutaneous coronary interventions: the Task Force for Percutaneous Coronary Interventions of the European Society of Cardiology. European heart journal. 2005;26(8):804-47.
4. Praljak M. Suboptimal reperfusion after primary percutaneous coronary intervention: University of Zagreb. School of Medicine; 2017.
5. Gupta S, Gupta MM. No reflow phenomenon in percutaneous coronary interventions in ST-segment elevation myocardial infarction. Indian heart journal. 2016;68(4):539-51.
6. Addison D, Bhatt DL, Fonarow FGC, Gokak FS, Grady KL, Green FLA, et al. 2017 AHA/ACC Clinical Performance and Quality Measures for Adults With ST-Elevation and Non–ST-Elevation Myocardial Infarction. JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY. 2017;70(16).
7. Noubiap Nzeale JJ. Screening, risk stratification, and management of atrial fibrillation 2023.
8. Lip GY, Connolly S, Yusuf S, Shestakovska O, Flaker G, Hart R, et al. Modification of outcomes with aspirin or apixaban in relation to CHADS2 and CHA2DS2-VASc scores in patients with atrial fibrillation: a secondary analysis of the AVERROES study. Circulation: Arrhythmia and Electrophysiology. 2013;6(1):31-8.
9. Lip GY, Nieuwlaat R, Pisters R, Lane DA, Crijns HJ. Refining clinical risk stratification for predicting stroke and thromboembolism in atrial fibrillation using a novel risk factor-based approach: the euro heart survey on atrial fibrillation. Chest. 2010;137(2):263-72.
10. Ellis SG, Vandormael MG, Cowley MJ, DiSciascio G, Deligonul U, Topol EJ, et al. Coronary morphologic and clinical determinants of procedural outcome with angioplasty for multivessel coronary disease. Implications for patient selection. Multivessel Angioplasty Prognosis Study Group. Circulation. 1990;82(4):1193-202.
11. Cockcroft DW, Gault H. Prediction of creatinine clearance from serum creatinine. Nephron. 1976;16(1):31-41.
12. Gage BF, Waterman AD, Shannon W, Boechler M, Rich MW, Radford MJ. Validation of clinical classification schemes for predicting stroke: results from the National Registry of Atrial Fibrillation. Jama. 2001;285(22):2864-70.
13. Harrison RW, Aggarwal A, Ou F-s, Klein LW, Rumsfeld JS, Roe MT, et al. Incidence and outcomes of no-reflow phenomenon during percutaneous coronary intervention among patients with acute myocardial infarction. The American journal of cardiology. 2013;111(2):178-84.
14. Ndrepepa G, Tiroch K, Fusaro M, Keta D, Seyfarth M, Byrne RA, et al. 5-year prognostic value of no-reflow phenomenon after percutaneous coronary intervention in patients with acute myocardial infarction. Journal of the American College of Cardiology. 2010;55(21):2383-9.
15. Ben-Nun L. Medical Research in Biblical Times from the Viewpoint of Contemporary Perspective.
16. Ashoori A, Pourhosseini H, Ghodsi S, Salarifar M, Nematipour E, Alidoosti M, et al. CHA2DS2-VASc score as an independent predictor of suboptimal reperfusion and short-term mortality after primary PCI in patients with acute ST segment elevation myocardial infarction. Medicina. 2019;55(2):35.
17. Fang C, Chen Z, Zhang J, Jin X, Yang M. Association of CHA2DS2-VASC Score with in-Hospital Cardiovascular Adverse Events in Patients with Acute ST-Segment Elevation Myocardial Infarction. International Journal of Clinical Practice. 2022;2022.

Journal of Health and Rehabilitation Research 2791-156X JHRR

18. Zhu W, Wu Y, Zhou Y, Liang W, Xue R, Wu Z, et al. CHA2DS2-VASc and ATRIA scores and clinical outcomes in patients with heart failure with preserved ejection fraction. Cardiovascular Drugs and Therapy. 2020;34:763-72.
19. Berkovitch A, Mazin I, Younis A, Shlomo N, Nof E, Goldenberg I, et al. CHA2DS2-VASc score performance to predict stroke after acute decompensated heart failure with and without reduced ejection fraction. EP Europace. 2019;21(11):1639-45.
20. Rozenbaum Z, Elis A, Shuvy M, Vorobeichik D, Shlomo N, Shlezinger M, et al. CHA2DS2-VASc score and clinical outcomes of patients with acute coronary syndrome. European Journal of Internal Medicine. 2016;36:57-61.
21. Hochman JS, Tamis JE, Thompson TD, Weaver WD, White HD, Van de Werf F, et al. Sex, clinical presentation, and outcome in patients with acute coronary syndromes. New England Journal of Medicine. 1999;341(4):226-32.
22. Chua S-K, Lo H-M, Chiu C-Z, Shyu K-G. Use of CHADS2 and CHA2DS2-VASc scores to predict subsequent myocardial infarction, stroke, and death in patients with acute coronary syndrome: data from Taiwan acute coronary syndrome full spectrum registry. PloS one. 2014;9(10):e111167.
23. Poci D, Hartford M, Karlsson T, Herlitz J, Edvardsson N, Caidahl K. Role of the CHADS2 score in acute coronary syndromes: risk of subsequent death or stroke in patients with and without atrial fibrillation. Chest. 2012;141(6):1431-40.
24. Al-Thani HA, El-Menyar A, Zubaid M, Rashed WA, Ridha M, Almahmeed W, et al. Peripheral arterial disease in patients presenting with acute coronary syndrome in six middle eastern countries. International Journal of Vascular Medicine. 2011;2011.
25. Goldberg RJ, McCormick D, Gurwitz JH, Yarzebski J, Lessard D, Gore JM. Age-related trends in short-and long-term survival after acute myocardial infarction: a 20-year population-based perspective (1975–1995). The American journal of cardiology. 1998;82(11):1311-7.
26. Roger VL, Jacobsen SJ, Weston SA, Goraya TY, Killian J, Reeder GS, et al. Trends in the incidence and survival of patients with hospitalized myocardial infarction, Olmsted County, Minnesota, 1979 to 1994. Annals of internal medicine. 2002;136(5):341-8.