THE PREDICTIVE VALUE OF NEWLY DEFINED CHA_2DS_2-VASC-HSF SCORE FOR SEVERITY OF CORONARY ARTERY DISEASE IN NON ST SEGMENT ELEVATION MYOCARDIAL INFARCTION

Alaa Nabil Al-shorbagy, Montaser Mostafa Al-Cekelly, Ashraf Al-said Dwedar, Mohamed Hassan Soliman

Department of Cardiology, Faculty of medicine, Zagazig University, Egypt

ABSTRACT

Background: CHADS2 and CHA2DS2-VASc scores are widely used in clinical practice and include similar risk factors for the development of coronary artery disease (CAD). It is known that factors comprising the newly defined CHA2DS2-VASC-HSF score promote atherosclerosis and are associated with severity of CAD [1].

Aim: To investigate the association of CHA2DS2-VASc-HSF score with severity of Coronary Artery Disease as assessed by Syntax Score (SxS) in patients with Non ST Segment Elevation Myocardial Infarction.

Subjects and methods: A total of 50 patients with NSTEMI (37 males and 13 females, their age ranged from 35 to 77 years old with a mean age of 57.8 years old) who underwent coronary angiography were included in our study. The patients were divided into 2 groups according to SxS score (SxS ≤22 and SxS > 22).

Results: This study showed a statistically significant positive correlation between CHA2DS2-VASC-HSF score and Syntax score I of patients. There is a statistically significant positive correlation between CHA2DS2-VASC-HSF score and serum cholesterol levels of patients. A statistically significant positive correlation was found between CHA2DS2-VASC-HSF score and serum LDL levels of patients. Our study also showed a statistically significant negative correlation between CHA2DS2-VASC-HSF score and ejection fraction (EF%) of patients.

Conclusions: A newly defined CHA2DS2-VASC-HSF score predicts the severity of atherosclerosis in patients with NSTEMI.

Keywords: CHA2DS2-VASC-HSF score, severity, syntax score, coronary artery disease, NSTEMI

Corresponding author: Alaa Nabil Al-shorbagy, 01117170749, mellnart1990@gmail.com

INTRODUCTION

Coronary artery disease (CAD) is the leading cause of morbidity and mortality in the present world. Risk factor assessment, prevention and treatment of CAD are an important aspect of present day research. Stable angina, often referred to as angina of effort, and its principal cause, reduction of the lumen of epicardial coronary arteries, have been recognized for >2 centuries [2].

Acute myocardial infarction (AMI), its clinical picture, and the importance of coronary thrombosis in its origin were described a century ago [3]. These 2 conditions, stable angina and AMI, although manifestations of the same underlying disease process, that is, coronary atherosclerosis, were initially considered to be quite distinct [4].

The MB fraction of creatine kinase (CK-MB) was considered to be the most sensitive and specific such biomarker [5]. Because serial determinations of CK-MB were not routinely obtained in patients with NSTE-ACS, NSTEMI was not excluded in many patients who were considered to have unstable angina (UA) [4].

Although CK-MB was superior to previously available enzymes, it lacked both optimal sensitivity and specificity [6]. The introduction by [7] of an assay for cardiac-specific troponin I (cTnI) and by [8] for cardiac-specific troponin T shortly thereafter provided 2 closely related biomarkers that were considerably more sensitive and specific than CK-MB [9].

CHADS2 score has been proven to be effective in the evaluation of the risk of stroke in patients with non-valvular atrial fibrillation. A high score indicates a greater risk of stroke. The score helps to plan further management of the non-valvular atrial fibrillation patient with respect to use of antiplatelets or anticoagulants. CHA2DS2-VASc score has recently replaced the traditional score as it has better stratification in low risk patients. In all past literature CHADS2 and CHA2DS2-VASc scores have been proven effective for assessing prognostic

risk of thromboembolism in non-valvular atrial fibrillation patients [2].

A new score CHA2DS2-VASc-HSF was formulated to be included more variables like Hyperlipidemia (H), Smoking (S) and Family history of CAD(F) in addition to the previous risk factors to assess the risk of CAD. We evaluated these scores as multivariable risk assessment tools to determine the severity of CAD in all patients undergoing coronary angiography (CAG) [10].

The CHADS2 and CHA2 DS2 -VASc scores are clinical predictors used to evaluate the risk of cardiac thromboembolism and to guide antithrombotic therapy [11]. CHADS2 and CHA2 DS2 -VASc scores are widely used in clinical practice and include similar risk factors for the development of coronary artery disease (CAD). These scores have been demonstrated to have predictive value in terms of the risk of death after stroke [1], the risk of stroke or death after coronary artery bypass grafting (CABG) [12], and the risk of stroke and death in patients with stable CAD [13] and acute coronary syndrome [14].

Recently, [15] reported that the CHADS2, CHA2DS2-VASc, and newly defined CHA2DS2-VASc-HS scores could predict CAD severity using the Gensini score in patients who underwent diagnostic coronary angiography.

C	Congestive heart failure	1 point
H	Hypertension	1 point
A2	Age > 75 years	2 point
D	Diabetes mellitus	1 point
S2	Previous stroke or TIA	2 point
V	Vascular disease	1 point
A	Age 65–74 years	1 point
Sc	Sex category (male gender)	1 point
H	Hyperlipidaemia	1 point
S	Smoking	1 point
F	Family history of CAD	1 point

Maximum score = 12 points; CAD — coronary artery disease; TIA — transient ischaemic attack

The CHA2 DS2 -VASc-HSF score was formulated [heart failure (signs/symptoms of heart failure confirmed with objective evidence of cardiac dysfunction), hypertension (HT) (defined as measurements of systolic and diastolic blood pressure ≥ 140/90 mm Hg or taking antihypertensive medications), age, diabetes mellitus (DM) (defined as a fasting blood glucose level > 126 mg/dL or blood glucose ≥ 200 mg/dL or using antidiabetic drugs), previous ischemic stroke or transient ischemic attack (TIA), vascular disease (defined as myocardial infarction [MI] and peripheral artery disease including prior revascularization, amputation or angiographic evidence or aortic plaque), male and female sex, hyperlipidemia (defined as increased level of low density lipoprotein cholesterol (LDL-C) according to the National Cholesterol Education Program-3 recommendations and history of using lipid lowering medications), smoking status (defined as smoking > 10 cigarettes a day for at least one year without a quit attempt), and family history of CAD (defined as MI before 55 years of age for men or 65 years of age for women in first-degree relatives). Compared to the CHA2 DS2 -VASc score, male gender instead of female as sex category, hyperlipidemia, smoking, and family history of CAD was added in this score. Our aim was to investigate the association of the CHA2 DS2 -VASc-HSF score with the severity of CAD as assessed by SYNTAX score (SxS) in patients with ST segment elevation MI (STEMI) [10].

SUBJECTS AND METHODS

A cross sectional study on 50 patients undergoing coronary angiography with or without percutaneous coronary intervention (PCI) at Cardiology Department, Zagazig University Hospitals, from September 2017 to March 2018.

Patients who have Ischemic Heart Disease advanced to coronary angiography were included in this study to calculate their CHA2DS2-VASC-HSF score.

Patients with history of Coronary Artery Bypass Graft (CABG) surgery, severe renal or liver disease, infectious or inflammatory disease, Previous or current neoplasm and haematological disorders were excluded from this study.

Data were collected for all patients performing Coronary Angiography. The data collection includes: complete history taking with special emphasis on age, sex, history of CAD, risk factors including (hypertension, diabetes mellitus, smoking, dyslipiaemia, history of previous TIA or stroke, vascular diseases and family history of ischemic heart disease). Physical examination (Full general and local examination, With special emphasis on pulse rate, rhythm and blood pressure). Echocardiography was done using Vivid 7 GE Medical System to calculate left ventricular ejection fraction (LVEF) using Simpson's method, Fasting & Random blood glucose level, Lipid Profile {Cholesterol level, High Density Lipoprotien (HDL) level, Low Density Lipoprotien (LDL) level and TriGlycerides level (TG)} were estimated and Coronary Angiography was done also using the judkins technique.

According to statistical analysis, Level of significance for all above mentioned tests done, the threshold of significance was fixed as 5% level student t-test (t) and the probability (*P* value): P value of > 0.05 indicates non-significant results, P value of < 0.05 indicates significant results, P value of < 0.01 indicates highly significant results and P value of < 0.001 indicates very highly significant results. Final results were collected and tabulated and then comparison with correlation with each other was performed.

RESULTS

In our study, cardiac signs and symptoms belong to CHA2DS2-VASc-HSF score showed that CHF ± reduced ejection fraction (EF) was found in 12% of the patients. Hypertension (HT) was found in 58% of the patients. Diabetes mellitus (DM) was found in 42% of our sample. Stroke or TIA was found in 6% of the patients. Vascular diseases were found in 64% of the patients. Hyperlipidemia (HL) was found in 58% of the sample. Smoking was positive in 60% of the patients. Family history was present in 58% of the sample.

Table (1): Cardiac signs & symptoms belong to CHA_2DS_2-VASc-HSF score

Cardiac signs and symptoms	PATIENT SAMPLE (n=50)	
	No.	%
CHF or reduced EF%	6	12.0
Hypertension	29	58.0
Diabetes	21	42.0
Stroke or TIA	3	6.0
Vascular diseases	32	64.0
Hyperlipidemia	29	58.0
Smoking	30	60.0
Family history	29	58.0

Table (2): Cardiac risk according to SYNTAX score in the studied group

SYNTAX	PATIENTS	
	> 22	≤ 22
I	19	31
II for PCI	31	19
II for CABG	12	38

Syntax > 22 = high risk, Syntax ≤ 22 = low risk

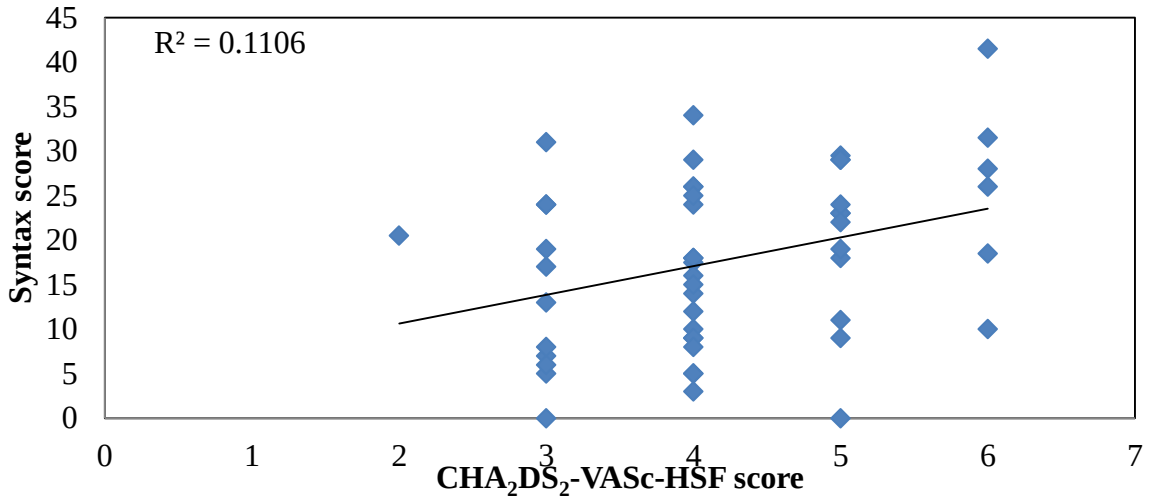

Fig. (1): Correlation coefficient (r) between CHA_2DS_2-VASc-HSF score and Syntax score I of patients in the sample (r = 0.4811, P <0.01).

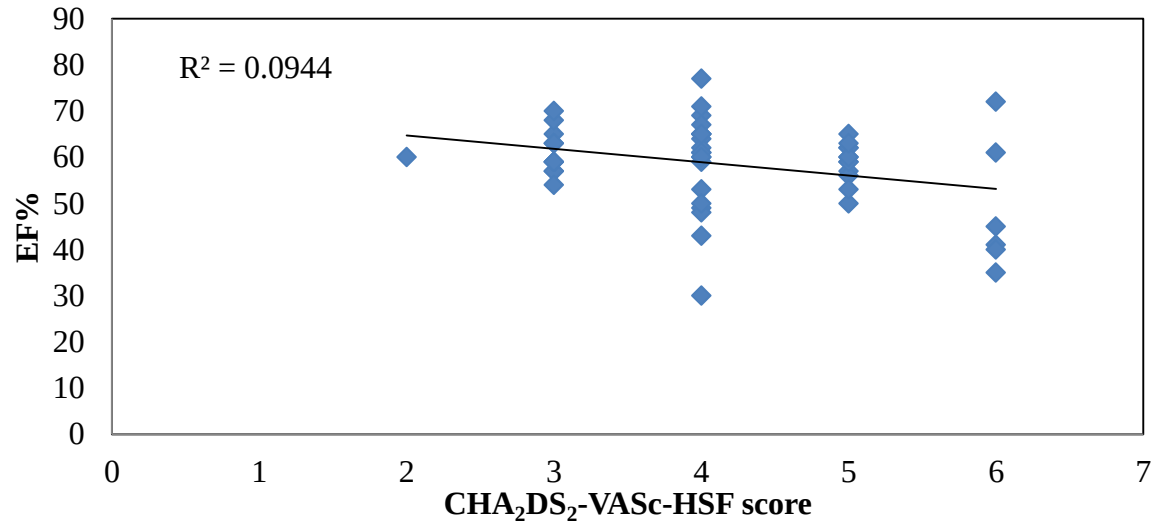

Fig. (2): Correlation coefficient (r) between CHA_2DS_2-VASc-HSF score and EF% of patients in the sample (r = -0.3072, P <0.01).

Table (3): Correlation coefficient (r) between CHA2DS2-VASc-HSF score and serum lipids

Serum Lipids	SAMPLE
Cholesterol	0.2179
Triglyceride	0.1204
HDL	-0.5244
LDL	0.4826

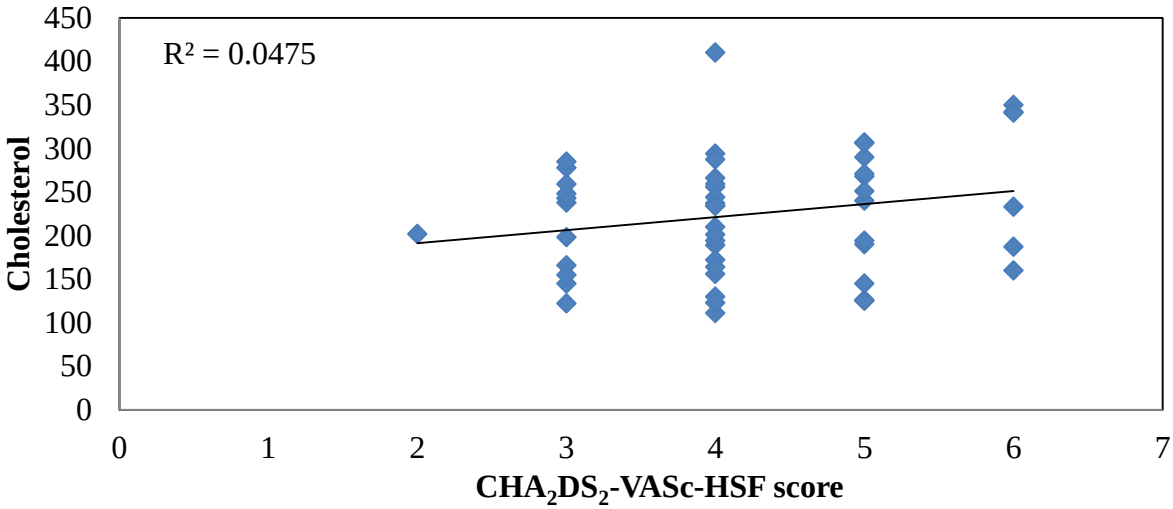

Fig.(3): Correlation coefficient (r) between CHA2DS2-VASc-HSF score and serum cholesterol levels of patients in the sample (r = 0.2179, P <0.05).

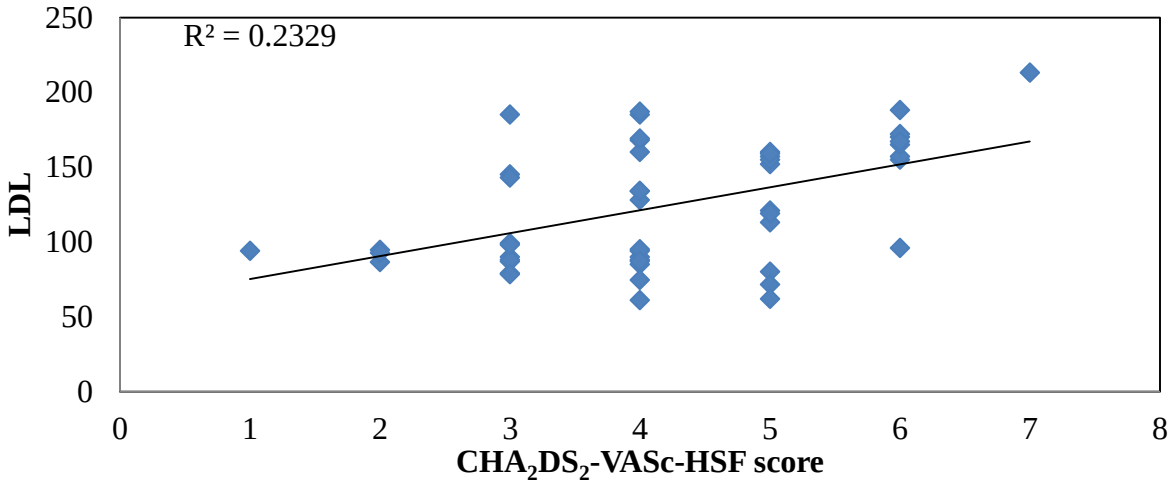

Fig.(4): Correlation coefficient (r) between CHA2DS2-VASc-HSF score and serum LDL levels of patients in the sample (r = 0.4826, P <0.01).

DISCUSSION

Acute myocardial infarction (MI) is a leading cause of death worldwide. Globally, of those dying from cardiovascular diseases, 80% are in developing countries and not in the Western world. Evidence shows serum uric acid as a negative prognostic marker in heart failure. Furthermore there is a need to find a simple, less expensive yet accurate marker that could be useful in prognosticating acute myocardial infarction patients [16].

Atherosclerotic cardiovascular disease, especially coronary artery disease (CAD), remains the leading cause of premature death worldwide. Risk stratification and prevention by modification of risk factors is an important aspect of management of CAD. CHADS2 and CHA2DS2-VASc scores are useful for assessing risk of thromboembolism in non-valvular atrial fibrillation (AF). They include similar risk factors for the development of CAD and may be useful for the assessment of the severity of coronary artery lesions. To increase the likelihood of determining CAD severity, the CHA2DS2-VASc-HS and CHA2DS2-VASc-HSF scores have been used comprising male instead of female gender, hyperlipidemia, smoking and family history in addition to the components of the CHA2DS2-VASc score. The SYNTAX Score is an established angiographic tool for grading the anatomic severity of coronary artery disease [17].

Also this study showed that males and females were nearly matched, however males are more affected than males. As males were presented by 74% of all cases. Statistically with multivariate ANOVA test showed statistically non-significant values ($P > 0.05$), while females were presented by 26% of all cases. Statistically with multivariate ANOVA test showed statistically non-significant values ($P > 0.05$).

In contrary to our study, [18] stated that women constituted the main bulk of the patients of CAD and this is probably due to the fact that gender affects cardiac remodeling. When confronted with pressure overload, the LV hypertrophies more and dilates less in women than in men. A reduced rate of myocyte loss in women and transcriptional regulation by estrogens of genes implicated in cardiac hypertrophy may contribute to persistent gender related differences in cardiac remodeling [19]. They had a population of Acute Heart Failure (AHF) patients as strictly defined by validated Framingham criteria, preserved ejection fraction and elevated natriuretic peptides, and they were studied at admission with AHF and during hospital admission till discharge. They were elderly (59 ± 8), and showed a high proportion of female gender 55%, dyslipidemia, diabetes, hypertension and high mean weight.

The presence or absence of aggravating risk factors, capable of re-stratifying cardiovascular risk was assessed. The following aggravating risk factors were considered: family history of premature coronary artery disease (male first-degree relative < 55 years or female first-degree relative < 65 years); metabolic syndrome and subclinical atherosclerosis [20].

In this study, patients were divided into 2 groups as patients with a high SYNTAX score (> 22), and patients with low SYNTAX score (≤ 22). Patients with high SYNTAX score were significantly older and had more comorbidities (diabetes, dyslipidemia and smoking) [21].

Our study also found that there is statistically significant positive correlation coefficient (r) between CHA_2DS_2-VASc-HSF score and serum cholesterol levels of the patients ($r = 0.2179$, $P < 0.05$). While there was statistically non-significant positive correlation between CHA_2DS_2-VASc-HSF score and serum triglycerides levels of the patients ($r = 0.1204$, $P > 0.05$).

This study found that there was a statistically significant negative correlation between CHA_2DS_2-VASc-HSF score and serum HDL levels of the patients ($r = -0.5244$, $P < 0.05$). While there was a statistically highly significant positive correlation between CHA_2DS_2-VASc-HSF score and serum LDL levels of the patients ($r = 0.4826$, $P < 0.01$).

Secondary causes of elevated LDL-C include diseases such as biliary obstruction, chronic kidney disease, type 2 diabetes mellitus, high blood pressure, and hypothyroidism. Medications such as diuretics, cyclosporine, and glucocorticoids can also contribute to elevated LDL-C levels. Data related to the role of race and gender in the development of hyperlipidemia have been conflicting; however, some risk factors may be more prevalent in specific races, such as obesity in non-Hispanic blacks, and thus an increased incidence of hyperlipidemia within that population [22].

The study found a statistically highly significant positive correlation between CHA2DS2-VASc-HSF score and Syntax score I of the patients (r = 0.3326, P <0.01) and Syntax score II for PCI (r = 0.3869, P <0.01), while there was a statistically non-significant positive correlation between CHA2DS2-VASc-HSF score and Syntax score II for CABG of patients in group III (r = 0.1015, P >0.05).

The SxS also helps to stratify patients with multivessel and/or left main CAD to either CABG or PCI and reflects the technical difficulty of PCI [23]. The CHADS2 and CHA2 DS2 -VASc scores are clinical predictors used to determine the risk of thromboembolism [11].

This study found that there was a statistically significant negative correlation between CHA_2DS_2-VASc-HSF score and EF% of the patients (r = -0.3072, P <0.05).

[2] stated that the existing scoring systems have some common disadvantages: (1) The scoring models have not yet been adequately tested in clinical practice, (2) They focus on short-term risk for CVD (absolute risk for CVD in the next 10 years), (3) While evaluating a patient, they require a digital or non-digital chart of scoring schemes to determine the risk in clinical practice, and (4) Most importantly, their results may change according to race and may vary with each visit. In addition, these scoring systems are not practical for use by physicians in daily practice because of multiplicity and complexity.

CONCLUSION

CHADS2, CHA2DS2-VASc, and especially CHA2DS2-VASc-HS and CHA2DS2-VASc-HSF scores could be considered predictive of the risk of severe CAD in patients with NSTEMI with CHA2DS2-VASc-HSF the best scoring scheme to predict CAD severity. The risk scoring systems may play an important role as predictive models because they are simple and can be easily applied by physicians without any additional costs in routine practice.

REFERENCES

[1] Henriksson KM, Farahmand B, Johansson S.: Survival after stroke - the impact of CHADS2 score and atrial fibrillation. Int J Cardiol, 2010; 141: 18–23.

[2] Modi R, Patted SV, Halkati PC, Porwal S, Ambar S, Mr P, Metgudmath V, Sattur A: CHA2DS2-VASc-HSF score - New predictor of severity of coronary artery disease in 2976 patients. Int J Cardiol., 2017; 228:1002-1006.

[3] Herrick JB: Clinical features of sudden obstruction of the coronary arteries. JAMA, 1912; 59:2015–2020.

[4] Braunwald E and Morrow DA: Unstable angina: is it time for a requiem? Circulation, 2013; 127(24):2452-7.

[5] TIMI III B Investigators: Effects of tissue plasminogen activator and a comparison of early invasive and conservative strategies in unstable angina and non-Q-wave myocardial infarction: results of the TIMI III B Trial. Circulation, 1994; 89:1545–1556.

[6] Morrow DA, Cannon CP, Jesse RL, Newby LK, Ravkilde J, Storrow AB, Wu AH, Christenson RH, Apple FS, Francis G, Tang W; National Academy of Clinical Biochemistry: National Academy of Clinical Biochemistry laboratory medicine practice guidelines: clinical characteristics and utilization of biochemical markers in acute coronary syndromes. Clin Chem., 2007; 53:552–574.

[7] Cummins B, Auckland ML, Cummins P: Cardiac-specific troponin-I radioimmunoassay in the diagnosis of acute myocardial infarction. Am Heart J. 1987; 113:1333–1344.

[8] Katus HA, Remppis A, Looser S, Hallermeier K, Scheffold T, Kübler W : Enzyme linked immuno assay of cardiac troponin T for the detection of acute myocardial infarction in

patients. J Mol Cell Cardiol., 1989; 21:1349–1353.

[9] Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD: Joint ESC/ACCF/AHA/WHF Task Force for the Universal Definition of Myocardial Infarction. Third universal definition of myocardial infarction. Eur Heart J., 2012;33:2551–67.

[10] Uysal OK1, Turkoglu C, Duran M, Kaya MG, Sahin DY, Gur M, Cayli M: Predictive value of newly defined CHA2DS2-VASc-HSF score for severity of coronary artery disease in ST segment elevation myocardial infarction. Kardiol Pol., 2016; 74(9): 954-60.

[11] January CT, Wann LS, Alpert JS, Calkins H, Cigarroa JE, Cleveland JC Jr, Conti JB, Ellinor PT, Ezekowitz MD, Field ME, Murray KT, Sacco RL, Stevenson WG, Tchou PJ, Tracy CM, Yancy CW: "2014 AHA/ACC/HRS guideline for the management of patients with atrial fibrillation: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society". J Am Coll Cardiol., 2014; 64 (21): e1–76.

[12] Biancari F, Asim Mahar MA, Kangasniemi OP: CHADS(2) and CHA(2)DS(2)-VASc scores for prediction of immediate and late stroke after coronary artery bypass graft surgery. J Stroke Cerebrovasc Dis, 2013; 22: 1304–1311.

[13] Welles CC, Whooley MA, Na B et al.: The CHADS2 score predicts ischemic stroke in the absence of atrial fibrillation among subjects with coronary heart disease: data from the Heart and Soul Study. Am Heart J, 2011; 162: 555–561.

[14] Poci D, Hartford M, Karlsson T et al.: 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: 1431–1440.

[15] Cetin M, Cakici M, Zencir C et al.: Prediction of coronary artery disease severity using CHADS2 and CHA2DS2-VASc and a newly defined CHADS2-VASc-HS Score. Am J Cardiol, 2014; 113: 950–956.

[16] Patil P, Somannavar V, Kothiwale V, Katheria R: Prognostication of acute myocardial infarction by serum uric acid levels. Coronary artery disease/Indian Heart Journal, 2017; 69(2): S11–S36.

[17] Singh J, Khanra D, Singh S, Pandey U, Thakur R: Predictive value of CHA2DS2-VASc-HS and CHA2DS2-VASc-HSF scores for the severity of coronary artery disease in ST segment elevation myocardial infarction. Indian Heart Journal, 2017; 69(2): S11-S26.

[18] Donal E, Lund LH, Oger E, Hage C, Persson H, Reynaud A: Baseline characteristics of patients with heart failure and preserved ejection fraction included in the Karolinska Rennes (KaRen) study. Arch Cardiovasc Dis, 2014; 107: 112-121.

[19] Abohammar S, ElSaidy MA, Fathalla D, Aldosarri M: Baseline characteristics of patients with heart failure and preserved ejection fraction at admission with acute heart failure in Saudi Arabia. The Egyptian Heart Journal, 2017; 69(1): 21-28.

[20] Cesena FHY, Laurinavicius AG, Valente VA, Conceição RD, Santos RD, Bittencourt MS: Cardiovascular Risk Stratification and Statin Eligibility Based on the Brazilian vs. North American Guidelines on Blood Cholesterol Management. Arq Bras Cardiol., 2017; 108(6):508-517.

[21] Chang CC, Hsu CY, Huang PH, Chiang CH, Huang SS, Leu HB, Huang CC, Chen JW, Lin SJ: Association of Serum Bilirubin with SYNTAX Score and Future Cardiovascular Events in Patients Undergoing Coronary Intervention. Acta Cardiol Sin., 2016; 32(4):412-9.

[22] Karr S: Epidemiology and management of hyperlipidemia. Am J Manag Care, 2017; 23(9 Suppl): S139-S148.

[23] Garg S, Sarno G, Serruys PW et al.; Strategy and Multistrategy Investigators: Prediction of 1-year clinical outcomes using the SYNTAX score in patients with acute ST-segment elevation myocardial infarction undergoing primary percutaneous coronary intervention: a substudy of the Strategy (Single High-Dose Bolus Tirofiban and Sirolimus-Eluting Stent Versus Abciximab and Bare-Metal Stent in Acute Myocardial Infarction) and Multistrategy (Multicenter Evaluation of Single High-Dose Bolus Tirofiban Versus Abciximab With Sirolimus-Eluting Stent or Bare-Metal Stent in Acute Myocardial Infarction Study) trials. J Am Coll Cardiol Cardiovasc Interv, 2011; 4: 66–75.