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THE PREDICTIVE VALUE OF THE AGE, CREATININE, AND EJECTIONFRACTION (ACEF) SCORE IN PATIENTS WITH ACUTE CORONARY SYNDROMES (ACS)

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ABSTRACT

Background: Acute coronary syndrome ACS remains a major burden of morbidity andmortality worldwide. Despite impressive advances in medical and interventional strategies patient with ACS are at a particularly high risk of major cardiovascular complications which could be end with death, so that it is important to have a predictivescore to determine the highest risk group of those patients to help getting right medicaland interventional therapy during hospitalization**. Aim & Objective:** Study the Predictive value of the age, creatinine, and ejection fraction (ACEF) score in patients with acute coronary syndromes (ACS) directly during hospitalization (morbidity and mortality) and indirectly after hospitalization by compared with TIMI risk score. **Material & Methods:** A Cohort Prospective study of 191 patients with ACS were enrolled. Patients were monitored and evaluated clinically on admission and ACEF score was calculated and the patients were divided into two groups, first group(ACEF≤1,45) and second one (ACEF>1,45). We also calculate TIMI risk score for all enrolled patients, the end point was: death for any cardio cerebrovascular events, developing of heart failure, cardiogenic shock, CVA/TIA, discharge without any previous complication**. Results:** Rates of developing of heart failure were significantly higher among patientsin the second group(7% in first group vs 60% in second one, p=0,0001), cardiogenic shock were only seen in second group (6,6% of those patients), rates of death were alsohigher in second group(1,7% vs 9,2%, p=0,01), while the rates of discharging without any previous complication were much higher in first group(89,6% vs 27,6% p=0,0001), there was no difference in rates of CVA/TIA events between both groups (1,3% vs 0,9% p=0,7). There was also a positive correlation between ACEF score and TIMI risk score**. Conclusion:** ACEF score was an independent predictor of death and major cardiac complications during hospitalization and it has a positive correlation with TIMI risk score.

KEYWORDS: Acute coronary syndrome, Age, Ejection Fraction, Creatinine.

INTODUCTION

Acute coronary syndromes (ACS) remain a major burden of morbidity and mortality worldwide. Despite impressive advances in medical therapy and interventional strategies over the last decades, patients with ACS are at a particularly high risk of recurrent major cardiovascular events which could be lead to death. The risk of adverse events in patients presenting with ACS varies greatly according to the presence of comorbidities such as diabetes, chronic kidney disease, or age….etc, so that it is important to have a predictive score to determine the highest risk group of those patients to help getting right medical and interventional therapy during hospitalization.[1,12] The age, creatinine, and ejection fraction (ACEF) score is a simple risk assessment tool, it was first used by Ranucci et al, in patients undergoing elective coronary artery bypass surgery(CABG), it has been reported to show similar or better predictive value for mortality compared to more complex risk scores.[4] Data on the predictive valueof the ACEF score in patients presenting with ACS are little and upcoming.

The aim of this study was therefore to assess the predictive value of the age, creatinine, and ejection fraction (ACEF) score in patients with acute coronary syndromes (ACS) directly during hospitalization (morbidity and mortality) and indirectly after hospitalization by compared with TIMI risk score.

METHODS

Study population

This was a single center, Cohort Prospective study of a total 191 patients with ACS whom admitted in Tishreen University Hospital between December 2021 and December 2022.

Inclusion criteria: all patients above 18 years who admitted with acute coronary syndrome according to the ESC definition as,[9,10] acute chest discomfort described as pain, pressure, tightness, burning and Chest pain-equivalent symptoms may include dyspnea, epigastric pain, and pain in the left arm. We divided them into the three types of ACS (Unstable angina UA / Non ST Elevation Myocardial Infarction NSTEMI /ST Elevation Myocardial Infarction STEMI) according to previous symptoms, ECG changes and cardiac biomarker level. The diagnosis of NSTEMI was defined as patients with pervious symptoms and increased cardiac biomarker level (troponin-I >0.06 ng/mL) without ST-segment elevation criteria on electrocardiography (ECG). The UA diagnosis was defined as patients with normal cardiac biomarker level (troponin-I <0,06 ng/ml), without ST-segment elevation criteria on ECG, and with typical angina.[3,9]

ST Elevation Myocardial Infarction STEMI defines cardiomyocyte necrosis in a clinical setting consistent with acute myocardial ischemia. A combination of criteria is required to meet the diagnosis of STEMI, namely the detection of an increase and/or decrease of a cardiac biomarker, preferably high-sensitivity cardiac troponin I, with at least one value above the 99th percentile of the upper reference limit and new ischemic ECG changes (ST-elevation of at least 0.1 mV in two contiguous limb leads OR ST elevation of at least 0.2 mV in two contiguous precordial leads), in patients with left bundle branch block (LBBB), specific ECG criteria (Sgarbossa's criteria) may help in the detection of acute infarction.[9,10]

Exclusion criteria included

1. Patients whom arrived to emergency depaetment with cardiac arrest becauseof ACS.
2. Patients with hospitalization less than 48 hour.
3. Life expectancy of < 1 year due to severe non-cardiac disease. 4-Inability to give written informed consent.

In this study, a total of 191 patients with available baseline creatinine values and the left ventricular ejection fraction (LVEF) was calculated by echocardiography using the standard biplane Simpson method. In case of multiple LVEF values available, the lowest LVEF value was considered.

ACEF, and TIMI risk scores

The ACEF score was calculated according to the following formula: age/left ventricular ejection fraction +1 (if creatinine was >176 µmol/L) and the patients were divided into two groups, first group (ACEF≤1,45) and second one (ACEF>1,45).

TIMI risk score was calculated for STEMI patients and for (UA/ NSTEMI) patients at the time of admitting.

Laboratory analyses

Venous blood was collected to detect the glucose level, blood lipid, liver function, kidney function, myocardial enzyme, etc. All patients were immediately examined by echocardiography.

Endpoint definitions

Cardiogenic shock: refers to the clinical syndrome of insufficient perfusion of tissues and organs due to the obvious decrease of cardiac output without hypovolemic situation. The main manifestations include: (I) persistent hypotension (systolic blood pressure <90 mmHg for more than 30 min); (II) there were signs of organ perfusion injury (at least one item): mental state change, skin dampness and coldness, oliguria and elevated serum lactic acid level.[8,19]

Developing of heart failure: refer to developing (or altered) of heart failure's signs and symptoms during hospitalization based on clinical indicators (like Killip classification, jugular venous dilatation) associated with decreased systolic function measured by echocardiography and disappearance of symptoms and signs with appropriate treatment. (8)(19)

Cerebrovascular accident CVA: was defined as an episode of neurological dysfunction persisting > 24 hour or until death due to disabling vascular brain injury caused by cerebral ischemia or hemorrhage.[18]

Statistical analysis

Continuous variables are given as mean ± standard deviation (SD), or median and interquartile range, and categorical variables as frequencies (percentages).

SPSS 20.0 statistical software was used for data analysis (SPSS Inc., Chicago, IL, U.S.). The normally distributed measurement data were expressed as mean ± standard deviation (SD). Student t-test was employed for comparison between two groups. The counting data were expressed as the percentage (%) and chi-square test were adopted. The ROC curve was delineated to evaluate the ACEF scoring system to predict the hospitalization mortality rate. Cox regression model using univariate analysis was carried out. A P value of less than 0.05 was considered as statistical significance.

RESULTS

Baseline characteristics

Patient's study (191) were divided according to the both level of ACEF score: Low ACEF group (ACEF≤1,45) 115 patients (60,2%), and High ACEF group (ACEF>1,45) 76 patients (39,8%). The distribution of demographic findings and Basic clinical features according to ACEF risk groups is shown in Table 1. Patients with increased ACEF score were more likely to be older, lower EF upon admission to the hospital and with a higher average of creatinine. Patientsin the higher ACEF score group had a higher prevalence of DM, Hypertension, and previous CAD. Males were the most prevalent in both groups and there were no difference in prevalent between both groups in smoking, hypercholesterolemia and family history of CAD. Most of the patients in the higher ACEF group had STEMI ACS, while most of the patients in the lower ACEF group had UA ACS.

Table 1: Demographic and Basic clinical features according to ACEF Score.

	ACEF≤1,45	ACEF>1,45	P value
Male, n (%)	91 (79,1%)	60(78,9%)	0,9
Age, y	55[34-76]	68,5[47-87]	0,0001
LVEF, (%)	55[35-68]	40[15-65]	0,0001
Creatinine, mg	1[0,6-1,7]	1,4[0,6-2,6]	0,0001
STEMI patients, n (%)	27(23,5%)	46(60%)	0,0001
NSTEMI patients, n(%)	21(18.3%)	7(9,2%)	0,0001
UA patients, n (%)	67(58%)	23(30%)	0,0001
Hypertension, n (%)	70(60,9%)	70(92%)	0,0001
Diabetes Mellitus, n(%)	25(21,7%)	31(40,8%)	0,005
Previous CAD, n (%)	14(12,2%)	27(35,5%)	0,001
Current Smoker, n (%)	96(83,5%)	63(82,9%)	0,9
Family History, n (%)	36(31,3%)	21(27,6%)	0,5
Hypercholesterolemia,n (%)	20(17,4%)	20(26,3%)	0,1

Relationship between ACEF score and major cardiac and cerebrovascular event during hospitalization:

Patients with higher ACEF group had more incidence of major cardiac events and death during hospitalization. There was a statistically significant differencebetween the two groups in cardiogenic shock, developing of heart failure and death. Rates of developing of heart failure were significantly higher among patients with high ACEF group (60% in high group vs 7% in low one, p=0,0001), cardiogenic shock were only seen in higher ACEF group (6,6% of those patients), rates of death were also higher among patients with high ACEFgroup (9,2% vs 1,7%, p=0,01), while the rates of discharging without any previous complication were much higher in low ACEF group comparing to high one (89,6% vs 27,6% p=0,0001). There was no difference in rates of CVA events between both groups (1,3% vs 0,9% p=0,7).

Table 2: Comparison of endpoint between both groups.

	ACEF≤1,45	ACEF>1,45	P value
Developing of heart failure, n(%)	8(7%)	46(60%)	0,0001
Cardiogenic shock, n (%)	0(0%)	5(6,6%)	0,005
Cerebrovascularaccident CVA, n (%)	1(0,9%)	1(1,3%)	0,7
Death, n (%)	2(1,7%)	7(9,2%)	0,01
discharging without any previous complication, n (%)	103(89,6%)	21(27,6%)	0,0001

Relationship between ACEF score and TIMI risk score:

There were statistically significant differences between the two groups of ACEF score with respect to the average value of TIMI risk score in all types ofACS.

Table 3: Distribution differences between both ACEF groups and TIMI risk score in all types of the ACS.

TIMI	ACEF≤1,45	ACEF>1,45	P value
UA/NSTEMI Median[range]	3[2-6]	5[2-7]	0,0001
STEMI Median[range]	4[2-10]	8[4-12]	0,0001

An average value of TIMI risk score equal to 3 in UA/NSTEMI is correspond with adverse cardiovascular events of 13% at two weeks which is considered medium risk according to Mayo Clinic cardiology [(12)], while average TIMI risk score value of 5 is correspond with adverse cardiovascular events of 26,2% at two weeks which isconsidered high risk with statistically significant differences between both groups of ACEF score , thus we note that the high risk group according to ACEF score correspond to a high-risk possibility of developing cardiovascular complications during the next two weeks after hospitalization.

Also it has been shown that the average value of TIMI risk score in STEMI patients was 4 in low ACEF group which correspond with 7,3% mortality rate during 30 days, while the average value of TIMI risk score in high ACEF group was 8 which correspondwith 27% mortality rate during 30 days with statistically significant differences between both groups, thus we note that the high risk group according to ACEF score correspond to a higher risk possibility of death during 30 days.

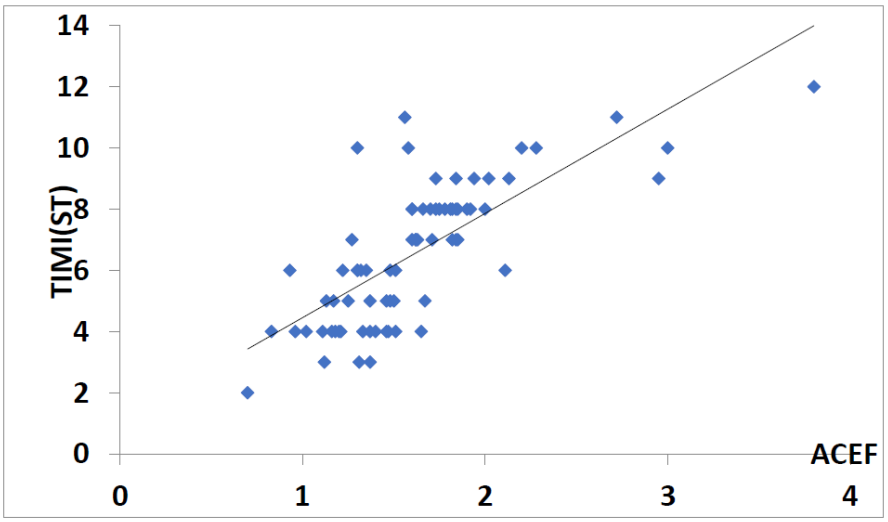

Figure 1: Correlation coefficient between the ACEF score and TIMI score inpatients with STEMI ACS.

Person Correlation=0.74 / P-value=0.0001
It was found that there is a positive correlation between the two risk scores in patientswith STEMI ACS.

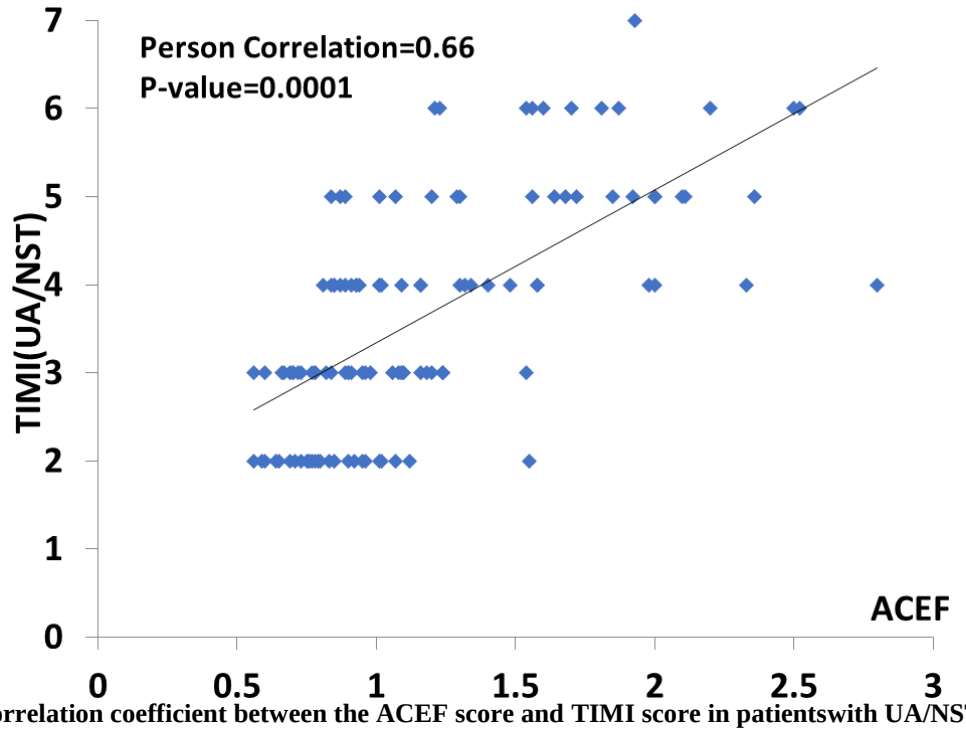

Figure 2: Correlation coefficient between the ACEF score and TIMI score in patientswith UA/NSTEMI ACS.

It was found that there is a positive correlation between the two risk scores in patientswith UA/NSTEMI ACS.

ROC curve analysis
As demonstrated in Figure 3, the area under the ROC curve of the ACEF scoring system in predicting complications in patients with ACS during hospitalization was calculated as 0.89. In addition, the sensitivity of the ACEF scoring system in predicting cardiac complications during hospitalization was 88,1% and the specificity of the ACEF scoring system in predicting cardiac complications during hospitalization was assessedas 81,5%.

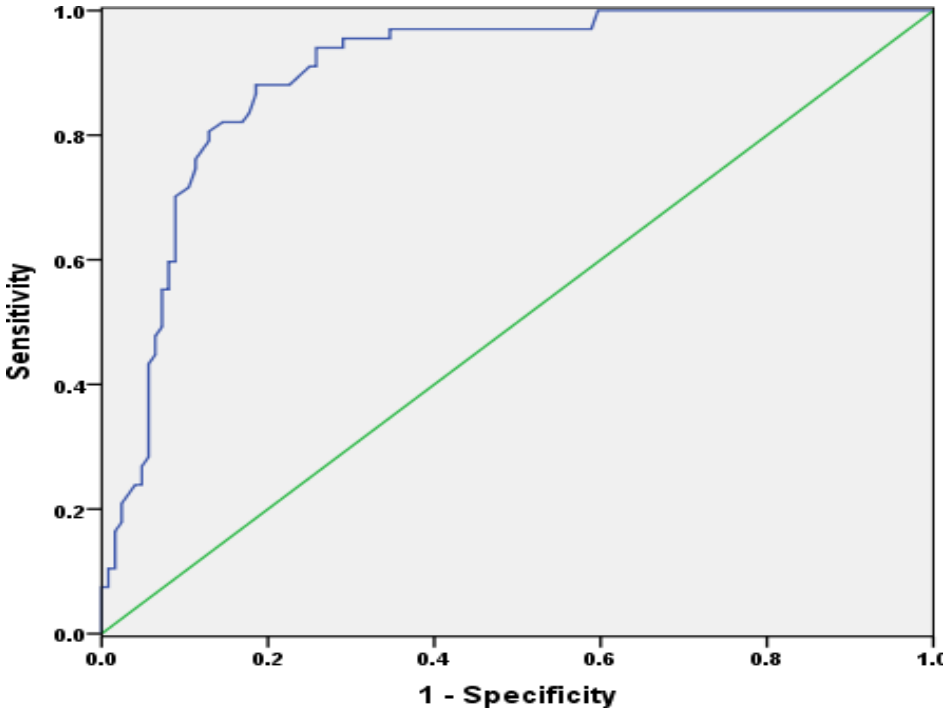

Figure 3: ROC curve of the ACEF scoring system in predicting cardiac complications during hospitalization. ACEF, age, creatinine and ejection fraction.

AUC=0.89 / Sensitivity = 88.1% / Specificity=81.5%

DISCUSSION

This study was conducted to evaluate the predictive value of the age, creatinine, and ejection fraction (ACEF) score in patients with acute coronary syndromes (ACS) directly during hospitalization (morbidity and mortality) and indirectly after hospitalization by compared with TIMI risk score. This study demonstrates that the ACEF score, incorporating the variables age, creatinine, and left ventricular ejection fraction, independently predicts during hospitalization survivals and adverse events in patients presenting with ACS, and it also has a positive correlation with both types of TIMI risk score. Based on the ACEF score, two different risk groups could be defined. Hence, this score may provide a novel and simple tool to stratify the risk of ACS patients for everyday clinical practice.

Clinical characteristics

In line with previous data in unselected patients the proportion of aged, diabetic and hypertension patients was increased in the higher ACEF score group. Further, the prevalence of prior coronary artery disease increased among high group-ACEF score.

Hence, the ACEF score, by only incorporating three easily obtainable variables, accurately mirrors the burden of comorbidities and cardiovascular disease encountered in these patients.

Clinical outcomes

The ACEF score was identified as an independent predictor of survival and adverse events in patients with ACS, represents a simple and easy applicable risk stratificationtool for the management of ACS patients. In this patient cohort study reflecting contemporary real-world ACS management, rates of all-cause and cardiovascular death increased among ACEF score groups, and a higher ACEF score was associated with an increased risk of developing of heart failure and cardiogenic shock. The ACEF score had a positive correlation with both types of TIMI risk score. These findings are supported by a previous of the prospective multicenter Swiss ACS cohort.[1] suggesting a high predictive accuracy of the ACEF score in ACS patients and similar predictive value as the GRACE and CRUSADE scores. AS well these findings are supported bya previous of prospective study in Beijing Friendship Hospital[4] which found that the simplified ACEF score performed well in predicting 1-year outcomes in ST-segment elevation myocardial infarction patients undergoing percutaneous coronary intervention and the patients with elevated ACEF score tended to have higher GRACE score and TIMI score, they also had higher Killip class.[4] In comparison to more complex risk prediction models, the ACEF score has the advantage of incorporating readily available variables and being easy to calculate.[1,4]

Clinical implications

A simple and user-friendly tool for acute risk stratification such as the ACEF score allows for the identification of patients at increased risk of future adverse events and could assist in clinical decision making. Patients at increased risk may have a particular benefit from immediate/early invasive management, more aggressive use of hemodynamic support devices,

meticulous reduction of the amount of contrast medium used, and close monitoring and follow-up.

LIMITATIONS

This was a single-center prospective study and the number of patients was relatively small, it is necessary to further expand the sample size and prolong the direct follow- up duration. We enrolled STEMI patients who received delayed PCI, it is hard to calculate the exact time from symptom onset to balloon, and the effect of reperfusion time was not analyzed.

CONCLUSIONS

The ACEF score using the risk factors age, creatinine, and left ventricular ejection fraction is a simple and valid risk stratification tool when applied to the patient's population with ACS. These findings strengthen the role of simple risk stratification models, easily applicable in clinical practice, in the prognostication of ACS patients, and may help to further improve clinical decision making in patients at increased risk.

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