

# The role of syntax score on survival in young acute coronary syndrome patients

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**Abstract. – OBJECTIVE:** The study aimed to evaluate the effect of the SYNTAX score (SS) calculated before percutaneous intervention on survival in a group of young patients with acute coronary syndrome (ACS).

**PATIENTS AND METHODS:** Our study is a retrospective study. Patients between the ages of 18 and 45 who applied to Private Yalova Atakent Hospital Cardiology Clinic with ACS and underwent percutaneous coronary intervention between 01.01.2017 and 01.12.2023 were included in the study. Patients aged 45 and under who presented with acute syndrome and underwent coronary angiography were evaluated. Patients' history of major cardiac adverse events (MACE) was evaluated. Demographic characteristics, laboratory findings, echocardiographic parameters, and SS of the patients were recorded. SS was calculated from the coronary angiography images of the patients.

**RESULTS:** 140 patients were included in the study. 70.0% (n=98) of the cases were diagnosed with ST-elevation myocardial infarction (STE-MI), 28.6% (n=40) with non-ST-elevation myocardial infarction (NSTEMI)-unstable angina pectoris (USAP), and 1.4% with cardiac arrest (n=2). 28.6% (n=40) of the patients had MACE. There was a statistically significant correlation between SS and MACE ( $r=0.525$   $p=0.001$ ). An SS value of 23.15 had 77.5% sensitivity and 60.8% specificity in predicting MACE. There was a statistically significant negative correlation between SS and ejection fraction (EF) ( $r=-0.584$ ,  $p=0.001$ ).  $EF<40.5$  predicted mortality with 77.7% sensitivity and 69.4% specificity (AUC 0.710,  $p=0.01$ , 95% CI 0.615-0.825).

**CONCLUSIONS:** SYNTAX Score and EF have predictive value in predicting MACE and mortality in young ACS patients. Different scoring systems are needed to predict MACE and mortality after ACS in young patients.

*Key Words:*

Acute coronary syndrome, Major adverse cardiac event, SYNTAX score, Ejection fraction, Survival.

## Introduction

Coronary artery disease (CAD) is the leading cause of death worldwide<sup>1,2</sup>. Acute coronary syndrome (ACS) is a clinical syndrome that occurs following myocardial ischemia as a result of a sudden decrease in blood flow in the coronary vessels. The clinical presentation of acute coronary syndromes is very different and can range from a patient without chest pain to a patient developing cardiac arrest<sup>3</sup>. ST-elevation myocardial infarction (STE-MI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina pectoris (USAP) are the three basic clinics that make up ACS. Clinical manifestations of ACS generally occur in the 5<sup>th</sup> to 7<sup>th</sup> decades<sup>4</sup>. Only 2-10% of ACS patients are under 40 years of age<sup>5</sup>. Studies<sup>6</sup> conducted on young ACS patients have shown that family history, hyperlipidemia, sedentary life, obesity and smoking are common risk factors. ST-elevation myocardial infarction is more common in young people compared to older patients<sup>7</sup>. Multivessel disease and left main coronary lesions are observed less frequently in young patients, while left anterior descending artery disease is observed more frequently<sup>8</sup>.

The gold standard in the diagnosis of coronary artery disease is coronary angiography. Some scoring systems have been developed to grade atherosclerotic lesions detected in coronary angiography. One of these is the SYNTAX [SYnergy between a percutaneous coronary intervention (PCI) with TAXUS and Cardiac Surgery] scoring system<sup>9,10</sup>. A score is calculated for each lesion, and the total SYNTAX score (SS) is equal to the sum of the scores for each lesion. The calculated result is defined as low if between 0-22, medium between 22-32, and high between 33 and above. A high SYNTAX score, that is, values of 33 and above, indicates difficulties in the percutaneous

coronary intervention (PCI) technique and a poor prognosis. A higher SS indicates the presence of a more complex atherosclerotic lesion and has been shown<sup>11-14</sup> to be associated with a worse prognosis, especially in patients undergoing percutaneous intervention. However, there are few studies showing a relationship between SYNTAX score and major cardiac adverse events.

Therefore, our study aimed to evaluate the relationship between the SYNTAX score calculated before percutaneous intervention and major cardiac adverse events (MACE) and the effect of the SYNTAX score on survival in the patient group admitted to our hospital with ACS.

## Patients and Methods

### *Ethics Statement and Clinical Design*

The study was designed retrospectively. Ethical approval was obtained from the Local Ethics Committee of Diskapi Teaching and Research Hospital. Informed consent was obtained from all subjects. Patients between the ages of 18 and 45 who applied to Private Yalova Atakent Hospital Cardiology Clinic with ACS and underwent percutaneous coronary intervention between 01.01.2017 and 01.12.2023 were included in the study. Patients aged 45 and under who presented with acute coronary syndrome and underwent coronary angiography were evaluated. Patients' history of MACE was evaluated. Acute MI (STEMI and NSTEMI) consists of patients presenting with the acute coronary syndrome and death due to cardiovascular causes within one year, cardiac shock, high-grade atrioventricular block or ventricular arrhythmia, hospital readmission related to a cardiac event, and repeated cardiac revascularization procedures. When any of these were present, MACE formation was considered positive. Patients considered as exitus were defined as patients who presented with acute coronary syndrome, underwent coronary angiography and died during the 1-year follow-up. A total of ten patients were considered as exitus.

Patients aged 45 and under who presented with acute coronary syndrome were included in the study. Patients over 45 years of age, patients with a history of malignancy, patients with a history of heart failure, patients with advanced valve disease, patients who have previously undergone coronary artery bypass grafting (CABG), and patients with chronic renal failure receiving dialysis were not included in the study.

Demographic characteristics, laboratory findings, echocardiographic parameters, and SS of the patients were recorded. SS was calculated from the coronary angiography images of the patients.

### *Statistical Analysis*

GraphPad Prism 9.0 (GraphPad Software, San Diego, CA, USA) program was used for statistical evaluation of the data, and the Shapiro-Wilk test was used to evaluate whether the distribution of the data was normal. Numerical variables were expressed as mean  $\pm$  standard deviation (SD), and categorical variables were expressed as numbers and percentages. Pearson's correlation test was used to determine the correlation of the data. Receiver Operating Characteristics (ROC) curve analysis was performed to find cut-off values for SS in predicting mortality. Values below  $p < 0.05$  were considered statistically significant.

## Results

140 patients between the ages of 18-45 who applied to Private Yalova Atakent Hospital Cardiology Clinic with ACS and underwent percutaneous coronary intervention between 01.01.2017 and 01.12.2023 were included in the study. SS was calculated from the coronary angiography images of the patients.

Ten percent ( $n=14$ ) of the patients in the study were female and 90% ( $n=126$ ) were male. The demographic characteristics, laboratory findings, echocardiographic parameters, and SYNTAX scores of the patients are shown in Table I.

Patients were compared in terms of SS according to the status of comorbidities [CAD, diabetes mellitus (DM), hypertension (HT), chronic renal failure (CRF)]. There was no statistically significant difference in terms of SS between cases with and without comorbid disease ( $p > 0.05$ ).

A comparison of patients who developed MACE and those who did not develop MACE is shown in Table II. Compared to patients who did not develop MACE, SYNTAX score and troponin levels were statistically significantly higher in patients who developed MACE ( $p < 0.001$  and  $p < 0.01$ , respectively). However, EF was statistically significantly lower in patients who developed MACE ( $p < 0.01$ ) (Table II).

Correlation analysis between SYNTAX score, troponin, and ejection fraction is shown in Table III. While there was a significant positive correla-

**Table I.** Demographic and clinical characteristics of the patients.

Parameters	Patients (N, %), Mean±SD
Age	39.25±4.15 (18-45)
Gender	
Male	126 (90.0%)
Female	14 (10.0%)
Diagnosis	
STE-MI	98 (70.0%)
NSTE-MI-USAP	40 (28.6%)
Cardiac Arrest	2 (1.4%)
Comorbid diseases	
Coronary artery disease (CAD)	18 (12.9%)
Diabetes mellitus (DM)	20 (14.3%)
Hypertension (HT)	24 (17.1%)
Chronic renal failure (CRF)	4 (2.9%)
Exitus	10 (7.1%)
MACE	40 (28.6%)
Syntax score (SS)	18.50±5.4
Hgb (g/dl)	14.75±1.3
CRP (mg/dl)	10.30±9.5
Urea (mg/dl)	27.50±10.6
Creatinine (mg/dl)	1.65±5.6
Troponin (ng/L)	7,450.50±21,105.6
Ejection fraction (EF) (%)	48.50±9.4

STE-MI: ST-segment elevation myocardial infarction, NSTE-MI: non-ST segment elevation myocardial infarction, USAP: unstable angina pectoris, MACE: major adverse cardiac events.

tion between the SYNTAX score and troponin, there was a significant negative correlation between the SYNTAX score and ejection fraction.

According to the results of ROC analysis in patients with MACE (+), sensitivity 77.5%, and specificity 60.8% for SYNTAX score (AUC 0.740, 95% CI 0.615-0.881,  $p=0.001$ ); sensitivity 74.7%, and specificity 64.2% for EF (AUC 0.610, 95% CI 0.514-0.642,  $p=0.033$ ); sensitivity 80.0% and specificity 60.8% for troponin (AUC 0.655, 95% CI 0.544-0.742,  $p=0.002$ ) were found. The cut-off points for these values were >23.15, <47.5, and >0.58, respectively (Figure 1).

At the end of one year of follow-up, 7.1% (n=10) of the patients were determined to be exitus. According to ROC curve analysis, a SS value of 23.15 predicted mortality with 74.0% sensitivity and 70.4% specificity (AUC 0.824,  $p=0.002$ , 95% CI 0.700-0.915). Ejection fraction <40.5 predicted mortality with 77.7% sensitivity and 69.4% specificity (AUC 0.710,  $p=0.01$ , 95% CI 0.615-0.825). Troponin was not found to be significant in predicting mortality (AUC 0.450,  $p=0.058$ , 95% CI 0.321-0.530).

## Discussion

In this study, we evaluated the role of SS before PCI in predicting MACE and mortality in young ACS patients. For this purpose, we retrospectively evaluated ACS patients aged 45 and under who had applied to Cardiology Clinic and had undergone PCI for six years. Unlike other studies in the literature, we found that SS and EF were significant in predicting mortality and MACE in the young patient population. In our study, the average age was determined as 39.25±4.15 years. There was a statistically significant relationship between patients' SS, EF and MACE.

In a study conducted by Akgun et al<sup>15</sup>, including 2,993 STEMI patients who underwent primary PCI, it was found that high SS predicted all major cardiovascular adverse events. In a study conducted by Garg et al<sup>16</sup>, including 807 STEMI patients, mortality, reinfarction, MACE, and stent thrombosis were found to be significantly higher in the group with a high SYNTAX score after one year of follow-up. In a study by Kul et al<sup>17</sup>, which included 646 STEMI patients who underwent primary PCI, it was shown that in-hospital MACE and mortality were significantly higher in the group with a high SYNTAX score than in the group with a low score. Longer-term follow-up was performed in a study by Yang et al<sup>18</sup>, which included 141 STEMI patients who underwent primary PCI. In the analysis made in terms of

**Table II.** Comparison of patients who developed and did not develop MACE.

	MACE (+) N=40	MACE (-) N=100	p-value
Syntax score	25.5±4.7	12.5±8.2	<0.001
Ejection fraction (%)	41.4±7.2	55.8±6.4	<0.01
Troponin (ng/L)	10,450.5±31,505.3	2,450.4±6,105.1	<0.01

MACE: major adverse cardiac events.

**Table III.** Correlation analysis between syntax score and troponin and ejection fraction.

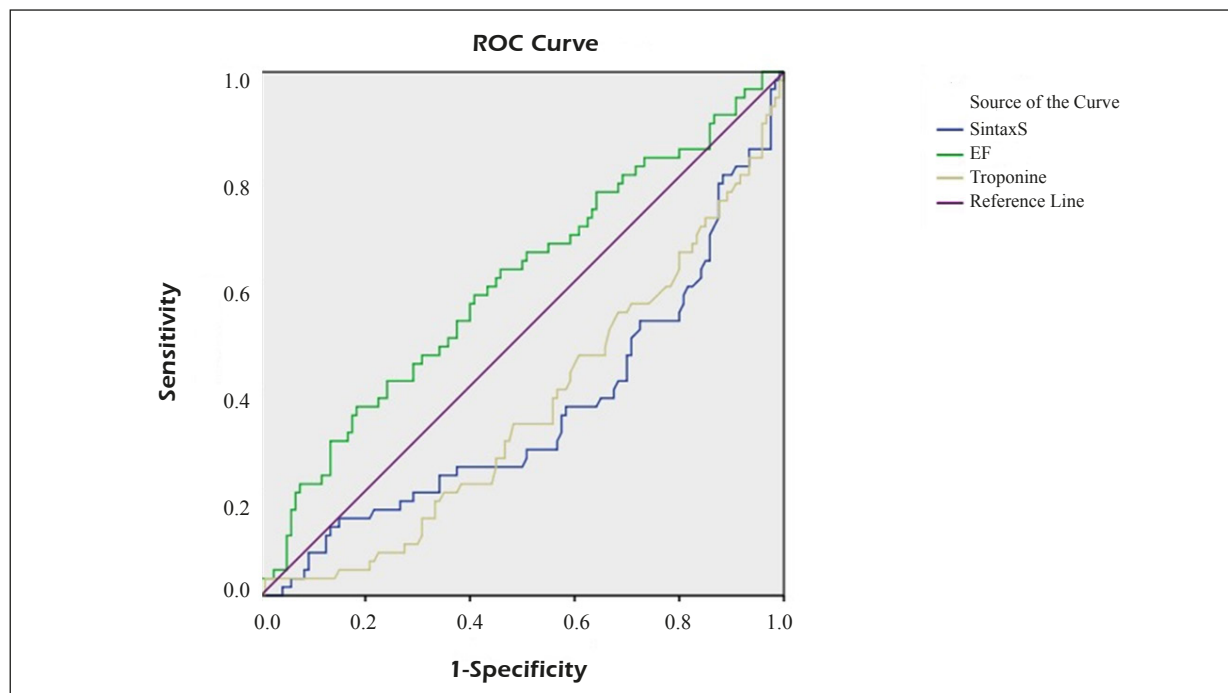
	r	p-value
Troponin	0.052	0.041
Ejection fraction	-0.584	<0.01

MACE: major adverse cardiac events.

1-year and 2-year mortality incidence, it was found to be higher in the medium and high-risk group (SD>22) than in the low-risk group. In a study conducted on 151 STEMI patients, Yang et al<sup>19</sup> showed that the SYNTAX score could be used to predict short-term mortality. Compared to studies<sup>15-19</sup> in the literature, although our study included a younger patient group aged 45 and under, the SYNTAX score similarly has a statistically significant value in predicting MACE and mortality. The difference between our study and these studies<sup>15-19</sup> is that the age of our patients is 45 and below. We thought that the reason why we did not obtain similar statistically significant results might be the effect of the COVID-19 pandemic, the lack of a similar comparable study, and the examination of a young patient group.

In a study conducted by Saklecha et al<sup>20</sup>, it was reported that SS had a significant value in predicting MACE in patients diagnosed with

acute coronary syndrome, with an average age of 66.4 years. However, they reported that left ventricular EF did not have a significant value in predicting MACE. In a study by Li et al<sup>21</sup>, EF and MACE were evaluated in ACS patients. It has been shown that low EF is associated with MACE and indicates poor prognosis in ACS. In a study by Erkan et al<sup>22</sup>, it was reported that age, SS, and EF were associated with MACE in patients with ACS after a 1-year follow-up. In a study by Lomakin et al<sup>23</sup>, a 30-day MACE evaluation was conducted in patients with ACS. It has been reported that MACE, low EF, and the presence of comorbid diseases were associated with mortality at 30-day follow-up. In our study, the evaluation was made after one year of follow-up. Unlike studies in the literature, we included a young ACS patient group (39.25±4.15) and 70.0% had STE-MI. SYNTAX score and troponin level were statistically significantly higher in patients who developed MACE. However, ejection fraction was statistically significantly lower in patients who developed MACE. While there was a significant positive correlation between the SYNTAX score and troponin, there was a significant negative correlation between the SYNTAX score and ejection fraction. According to the results of ROC analysis in patients with MACE (+), a sensitivity of 77.5%, and specificity of 60.8% for SYNTAX



**Figure 1.** ROC curve analysis of syntax score, ejection fraction, and troponin in predicting MACE.

score (AUC 0.740, 95% CI 0.615-0.881), a sensitivity of 74.7%, and specificity of 64.2% for EF (AUC 0.610, 95% CI 0.514-0.642) and sensitivity of 80.0% and specificity of 60.8% for troponin (AUC 0.655, 95% CI 0.544-0.742) were found. The cut-off points for these values were  $>23.15$ ,  $<47.5$ , and  $>0.58$ , respectively. At the end of one year of follow-up, 7.1% ( $n=10$ ) of the patients were determined to be exitus. According to ROC curve analysis, an SS value of 23.15 predicted mortality with 74.0% sensitivity and 70.4% specificity (AUC 0.824,  $p=0.002$ , 95% CI 0.700-0.915). Ejection fraction  $<40.5$  predicted mortality with 77.7% sensitivity and 69.4% specificity (AUC 0.710,  $p=0.01$ , 95% CI 0.615-0.825). Troponin was not found to be significant in predicting mortality.

### Limitations

Our study has some limitations. One limitation is its retrospective design. Although a detailed examination was carried out, it was done by scanning the patients' files. We think that the small number of patients in our study and, therefore, the low number of endpoints may have prevented the results from being statistically significant.

### Conclusions

In conclusion, there is a relationship between SYNTAX score and ejection fraction in MACE and mortality in young ACS patients. In terms of MACE and mortality, while there was a significant relationship between SYNTAX score and ejection fraction and MACE and mortality, there was no significant relationship with troponin level. The fact that our results were seen in young ACS patients probably suggests that it may be a side effect of the COVID-19 pandemic or the COVID-19 vaccine. Therefore, we think that there may be a need for new studies to predict MACE and mortality in young ACS patients with more study groups and perhaps new scoring systems to be developed as a result of these studies.

### Conflict of Interest

The authors declare no conflicts of interest.

### Informed Consent

The authors declare that the patients included in the study signed informed consent forms to use their medical information in research.

### Authors' Contributions

Conceptualization: M.B. and R.D.; design: M.B. and R.D.; supervision: R.D.; funding: M.B.; materials: M.B. and R.D.; data: M.B. and R.D.; analysis: M.B. and R.D.; literature search: M.B. and R.D.; writing: M.B.; critical revision: M.B. All authors have read and agreed to the published version of the manuscript.

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### Ethics Approval

The study protocol was approved by the Ethics Committee of the Clinic Research Ethics Committee of the Diskapi Teaching and Research Hospital (approval No.: 2016/27/33 date: 22.03.2016).

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### AI Disclosure

We hereby disclose that no artificial intelligence or assisted technologies were used in the production of this study, including the creation of any figures or illustrations.

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