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Association of Syntax Score with Short-Term Outcomes among Acute ST Elevation Myocardial Infarction Patients Undergoing Primary PCI

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Abstract:

Background: Acute ST-elevation myocardial infarction (STEMI) demands rapid intervention, with primary percutaneous coronary intervention (PCI) playing a pivotal role. While existing risk models focus on clinical factors, the SYNTAX score assesses coronary lesion complexity. This study aimed to assess SYNTAX scores' association with short-term outcomes in STEMI patients undergoing primary PCI and compare it with SYNTAX Score II. **Methods:** This prospective observational study was conducted on 110 Egyptian patients diagnosed with STEMI undergoing primary PCI. Patients were evaluated based on SYNTAX scores and divided into low (≤16), intermediate (16-22), and high (>22) SYNTAX score groups. Short-term outcomes including all-cause mortality, cardiac mortality, reinfarction, and revascularization were assessed over a 1-year follow-up period. **Results:** Patients with higher SYNTAX scores (>31) exhibited significantly lower ejection fractions ($p<0.001$), longer duration of chest pain ($p<0.05$), higher GRACE scores ($p<0.05$), and increased rates of failed PCI ($p=0.036$) and multivessel disease ($p<0.01$). In-hospital mortality, all-cause mortality, and major adverse cardiac and cerebrovascular events (MACCE) during follow-up were significantly higher in patients with higher SYNTAX scores ($p<0.005$). Survival rates were significantly lower in patients with higher SYNTAX scores compared to lower scores ($p<0.005$). **Conclusion:** The SYNTAX score, along with its derivatives SYNTAX Score II (SSII) and Clinical SYNTAX Score (cSS), demonstrated a significant association with short-term outcomes in STEMI patients undergoing primary PCI. Higher SYNTAX scores correlated with increased rates of adverse events, emphasizing its potential utility in risk stratification.

Keywords: Syntax Score; Acute ST Elevation; Myocardial Infarction; Primary PCI.

Introduction

Acute ST-elevation myocardial infarction (STEMI) treatment prioritizes early blood flow restoration through primary percutaneous coronary intervention (PCI) for improved outcomes. However, scoring systems for predicting adverse events in acute coronary syndrome (ACS), such as TIMI and GRACE, focus on clinical variables like age and blood pressure, omitting coronary lesion characteristics [(1)].

The anatomical SYNTAX (Synergy between percutaneous coronary intervention with taxus and cardiac surgery) score (SXS) is an angiographic scoring system for assessing the complexity of coronary artery disease (CAD) [(2)].

Advocated for decision making in the latest ESC/EACTS guidelines on myocardial revascularization [(3)].

Originally, the SxS was introduced to predict clinical outcomes in stable patients with 3-vessel and/or left main disease undergoing percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG), respectively, based on data from the SYNTAX trial [(4)].

Later on, the SxS was applied to a variety of patient populations with diverse clinical presentations including those with acute coronary syndromes (ACS) undergoing primary PCI [(5)].

However, sub analyses of the SYNTAX trial and results from different studies have implied that the purely anatomy-based risk stratification of the SxS score made it prone to misclassification of patient's true risk, particularly for all-cause mortality and cardiac death in patients with stable CAD or ACS treated by PCI [(6)].

The SYNTAX score II (SxSII) enhances risk stratification by integrating the SYNTAX score with seven prognostic variables—age, creatinine clearance, left ventricular ejection fraction, presence of unprotected left main coronary artery disease, peripheral vascular disease, female gender, and chronic obstructive pulmonary disease. This development aims for more precise patient risk categorization by considering the impact of varied clinical parameters on long-term outcomes [(7)].

So far, the SxSII was validated in patients with left main and multivessel disease showing more accurate patient stratification than SxS [(8)].

The purpose of this study was to evaluate the association of SYNTAX scores with short-term outcomes in STEMI patients undergoing primary PCI and to assess the predictive performance of the clinical SYNTAX score II (SxSII) in ACS patients undergoing PCI, comparing it with the previously validated SYNTAX score.

Patients and methods

This prospective observational study was carried out on 110 Egyptian patients admitted to Benha University Hospital and Police Hospitals with the diagnosis of ST-segment elevation MI (STEMI) and underwent primary percutaneous intervention (PCI) during the period from May 2021 to September 2023.

An informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number.

Inclusion criteria were patients aged >18 years of both sexes and undergoing primary PCI for acute STEMI.

Exclusion criteria were patients with prior CABG, secondary troponin elevations without obstructive coronary lesions, severe physical disability, and inability to comprehend study or having severe non cardiac diseases, myocardial infarction with non-obstructive coronary arteries (MINOCA – MI in normal coronary artery) and those who were unable to provide follow-up angiographic results.

All studied cases were subjected to the following:

Detailed history taking including personal history as age, sex, residence, occupation, and special habits including smoking (with smoking index) or alcohol consumption, past history of any medical condition including coronary artery disease, previous MI or PCI and risk factors including hypertension, hyperlipidemia and diabetes mellitus.

Full clinical examination including general examination as vital signs (pulse, blood pressure, respiratory rate, and temperature), signs of heart failure as lower limb edema and routine laboratory investigations as complete blood count (Hemoglobin, White Blood Cells, Platelets), fasting glucose level, liver function tests ALT, AST, lipid profile (Cholesterol, Triglycerides, LDL, and HDL), kidney function testes (Serum creatinine, Urea, and GFR), and troponin and CK-MB.

Clinical parameter as Killip Classification: This system categorizes heart failure risk based on physical examination findings into four classes. Class I indicates no evidence of heart failure, with a 6% mortality rate. Class II signifies mild to moderate heart failure, associated with a 17% mortality rate. Class III reflects pulmonary edema and a mortality rate of 38%. Lastly, Class IV represents cardiogenic shock, with severe hypoperfusion signs and a mortality rate of 67% [9].

GRACE score: It is useful for guiding clinical decisions, such as the urgency of interventions and the intensity of monitoring and medical therapy. In the context of STEMI patients undergoing primary percutaneous coronary intervention (PCI), the GRACE score can help clinicians evaluate the risk profile of patients and potentially tailor treatment strategies to improve short-term outcomes. The robustness and accuracy of the GRACE score in predicting outcomes across different populations and healthcare settings make it an essential component of ACS management protocols.

Radiological evaluation:

Serial 12-lead ECG after initial diagnostic ECG: After initial diagnostic ECG was performed for all patients following admission to the emergency department, patients were transferred to Cath-Lab to undergo diagnostic coronary angiography followed by primary PCI of the infarct-related artery using Seldinger technique with femoral artery or radial artery approaches and using DES.

Primary PCI procedure: All patients underwent selective coronary angiography using the Judkins percutaneous trans-femoral technique with the Philips Allura Xper FD20 imaging system. The choice of stent (bare metal or drug-eluting) and the decision to use tirofiban were at the operator's discretion. Culprit lesions received treatment with stent implantation and balloon angioplasty as needed. Digital angiograms were recorded for quantitative analysis and evaluated independently by two experienced interventional cardiologists, with any disagreements resolved by a third cardiologist. LMCA, LAD, Cx, and RCA were considered large coronary vessels for analysis. X-ray fluoroscopy was used to introduce contrast material into the coronary artery, visualize stenosis or occlusion, and guide the placement of guidewires and catheters for angioplasty or stent placement. After positioning the stent over the balloon, it was expanded to open the stent, and images were taken to confirm the correct placement and resolution of stenosis. Finally, SYNTAX score, Grace score and TIMI grade flow were assessed.

Follow up: Follow-up period was 1-year and done by serial ECG, clinic visits, and phone calls to assess outcome parameters of the study including all-cause mortality, cardiac mortality, reinfarction and revascularization.

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Statistical analysis

Statistical analysis utilized SPSS v28, with the normality of data distribution assessed via the Shapiro-Wilks test and histograms. Quantitative parametric data were expressed as mean and standard deviation (SD) and analyzed using ANOVA (F) test with Tukey's post hoc test. Qualitative variables were presented as frequency and percentage (%) and analyzed with the Chi-square test. A two-tailed P value < 0.05 was considered significant. The Kaplan-Meier curve illustrated survival rate and time to the incidence of MACCE. Additionally, logistic regression was employed to evaluate the relationship between dependent and independent variables, either univariate or multivariate.

Results

Concerning the baseline characteristics, patients with an SS-II score greater than 31 were significantly older compared to those with an SS-II score of 22 or less and those with scores between 22 and 31 (P<0.001 for both comparisons). Additionally, the age was significantly higher in patients with SS-II scores between 22 and 31 compared to those with scores of 22 or less (P<0.001). Sex and smoking were significantly different among the studied groups (P=0.011, 0,046) with high prevalence of males and smokers in SS-II>31. Weight, height, and BMI were insignificantly different among the studied groups. Table 1

The ejection fraction was significantly lower in patients with SS-II>31 compared to patients with SS-II ≤22 and those with SS-II >22-31 (P<0.001, <0.001) and was significantly lower in patients with SS-II >22-31 compared to patients with SS-II ≤22 (P<0.001). Figure 1

Duration of chest pain, syntax score, syntax score II, and GRACE score were significantly higher in patients with SS-II>31 compared to patients with SS-II ≤22 and those with SS-II >22-31 (P<0.05) and was significantly higher in patients with SS-II >22-31 compared to patients with SS-II ≤22 (P<0.05). Killip class was significantly different among the studied groups (P=0.002). Table 2

Total stent length in IRA was significantly higher in patients with SS-II>31 compared to patients with SS-II ≤22 and those with SS-II >22-31 (P=0.004, 0.026) and was insignificantly different between patients with patients with SS-II ≤22 and those with SS-II >22-31. Contrast volume was significantly higher in both patients with SS-II >22-31 and those with SS-II>31 compared to patients with SS-II ≤22 (P<0.001, <0.001) and was insignificantly different between patients with SS-II >22-31 and those with SS-II>31. Failed PCI was significantly higher in patients with SS-II>31 compared to patients with SS-II ≤22 and those with SS-II >22-31 (P=0.036). Number of diseased vessels and infarct related artery were significantly different among the studied groups (0.008, 0.002). There were insignificant differences among the studied groups regarding the average stent diameter in IRA and stent type. Table 3

Table 1: Baseline characteristics of the studied groups

		SS-II ≤22 (n=38)	**SS-II >22-31 (n=35)**	**SS-II>31 (n=37)**	**P value**	**Post hoc**
Age (years)	Mean± SD	46.32 ± 4.2	60.71 ± 3.39	72.16 ± 4.92	<0.001*	P1<0.001* P2<0.001* P3<0.001*
	Range	40 - 59	55 - 67	65 - 80		
Sex	Male	17 (44.7%)	21 (60%)	29 (78.4%)	0.011*	---
	Female	21 (55.3%)	14 (40%)	8 (21.6%)		
Weight (Kg)	Mean± SD	68.24 ± 7.8	65.83 ± 8.02	65.49 ± 7.47	0.252	---
	Range	56 - 80	55 - 79	55 - 79		
Height (m)	Mean± SD	1.65 ± 0.06	1.65 ± 0.07	1.65 ± 0.06	0.951	---
	Range	1.56 - 1.75	1.55 - 1.75	1.55 - 1.75		
BMI (Kg/m^2)	Mean± SD	25.19 ± 3.55	24.28 ± 3.57	24.02 ± 3.15	0.306	---
	Range	18.5 - 31.65	17.96 - 32.47	18.29- 29.59		
Smoking		17 (44.7%)	20 (57.1%)	27 (73%)	0.046*	---

SS: syntax score, BMI: body mass index, *: statistically significant as P value <0.05, P1: p value between SS-II ≤22 and SS-II >22-31, P2: p value between SS-II ≤22 and SS-II>31, P3: p value between SS-II >22-31 and SS-II>31.

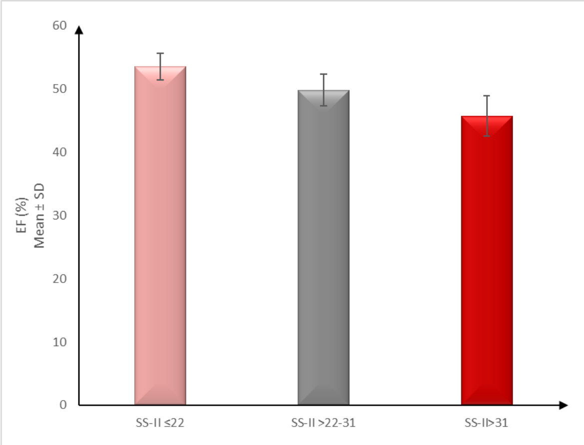

Figure 1: Ejection fraction of the studied groups.

Table 2: Clinical data of the studied groups.

		SS-II ≤22 (n=38)	SS-II >22-31 (n=35)	SS-II>31 (n=37)	P value	Post hoc
Duration of chest pain (hrs.)	Mean± SD	1.58 ± 0.5	2.43 ± 0.5	3.43 ± 0.5	<0.001*	P1<0.001* P2<0.001* P3<0.001*
	Range	1 - 2	2 - 3	3 - 4		
Killip class	1	3 (7.9%)	6 (17.1%)	15 (40.5%)	0.002*	---
	2	35 (92.1%)	29 (82.9%)	22 (59.5%)		
Syntax score	Mean± SD	11.21 ± 3.35	20.17 ± 1.79	26.43 ± 2.38	0.001*	P1<0.001* P2<0.001* P3<0.001*
	Range	6 - 17	18 - 23	23 - 30		
Syntax score II	Mean± SD	16.74 ± 3.92	27.49 ± 2.56	40.97 ± 5.64	0.001*	P1<0.001* P2<0.001* P3<0.001*
	Range	11 - 22	23 - 31	32 - 50		
GRACE score	Mean± SD	132.6 ±11.9	142.7 ± 11.4	168.2 ± 20.9	0.001*	P1<0.001* P2<0.001* P3<0.001*
	Range	116 - 155	120 - 160	130 - 200		

SS: syntax score, GRACE: global registry of acute coronary events, *: statistically significant as P value <0.05, P1: p value between SS-II ≤22 and SS-II >22-31, P2: p value between SS-II ≤22 and SS-II>31, P3: p value between SS-II >22-31 and SS-II>31.

Table 3: Angiographic and procedural data of the studied groups.

		SS-II ≤22 (n=38)	SS-II >22-31 (n=35)	SS-II>31 (n=37)	P value	Post hoc
Average stent diameter in IRA (mm)	Mean± SD	2.83 ± 0.27	2.83 ± 0.27	2.77 ± 0.27	0.580	---
	Range	2.4 - 3.2	2.4 - 3.2	2.4 - 3.2		
Total stent length in IRA (mm)	Mean± SD	21.25 ± 4.19	21.46 ± 5.55	24.02 ± 3.89	0.017*	P1=0.857 P2=0.004* P3=0.026*
	Range	14.6 - 27.6	12.6 - 29.5	17.9 - 30.7		
Contrast volume (ml)	Mean± SD	218.8 ± 28.3	264.1 ± 61.9	283.2 ± 58.4	<0.001*	P1<0.001* P2<0.001* P3=0.181
	Range	181 - 270	151 - 362	193 - 390		
Number of diseased vessels	1 vessel	19 (50%)	12 (34.3%)	6 (16.2%)	0.008*	---
	2 vessels	16 (42.1%)	17 (48.6%)	18 (48.6%)		
	3 vessels	3 (7.9%)	6 (17.1%)	13 (35.1%)		
Infarct related artery	LMCA	0 (0%)	0 (0%)	5 (13.2%)	0.002*	---
	LAD	13 (34.2%)	15 (39.5%)	20 (52.6%)		
	CX	6 (15.8%)	11 (28.9%)	6 (15.8%)		
	RCA	20 (52.6%)	19 (50%)	7 (18.4%)		
Stent type	DES	33 (86.8%)	29 (82.9%)	31 (83.8%)	0.884	---
	BMS	5 (13.2%)	6 (17.1%)	6 (16.2%)		
Failed PCI		1 (2.6%)	1 (2.9%)	6 (16.2%)	0.036*	---

SS: syntax score, IRA: infarct related artery, LMCA: Left main coronary artery, LAD: Left anterior descending, CX: Circumflex artery, RCA: right coronary artery, DES: drug eluting stent, BMS: bare metal stent, PCI: percutaneous coronary intervention, *: statistically significant as P value <0.05, P1: p value between SS-II ≤22 and SS-II >22-31, P2: p value between SS-II ≤22 and SS-II>31, P3: p value between SS-II >22-31 and SS-II>31.

The incidence of in-hospital mortality, all-cause mortality and MACE during follow-up were significantly higher in patients with SS-II>31 compared to patients with SS-II ≤22 and those with SS-II >22-31 (P=0.002, <0.001, 0.003). Table 4

The time to occurrence of any type of MACCE after PCI was significantly earlier in patients with SS-II>31compared to patients with SS-II ≤22 with (HR= 0.1285 (95%CI) 0.04948 to 0.3336, P<0.001) and compared to patients with SS-II >22-31 with (HR= 0.2351 (95%CI) 0.08874 to 0.6227, P<0.001). Figure 2

The survival rate was significantly lower in patients with SS-II>31compared to patients with SS-II ≤22 with (HR= 0.08422 (95%CI) 0.02226 to 0.3187, P=0.001) and compared to patients with SS-II >22-31 with (HR= 0.1876 (95%CI) 0.04792 to 0.7348, P=0.001). Figure 3

The results of pairwise comparisons in the AUCs where we found that EF was the best score for predicting the incidence of MACCE during follow-up compared to Syntax and Syntax II scores, whereas there was an insignificant difference between EF and GRACE score. There were insignificant differences between syntax, syntax II and GRACE scores in prediction of MACCE during follow-up. Table 5

On univariate logistic regression analysis, we found that HR, EF, Killip class, SS>31 and failed PCI were significant predictors of the in-hospital mortality. On multivariate logistic regression analysis, we found that Killip class, SS>31 and failed PCI were the only significant predictors of the in-hospital mortality. Table 6

Table 4: Outcome of the studied groups.

	SS-II ≤22 (n=38)	SS-II >22-31 (n=35)	SS-II>31 (n=37)	P value
In-hospital mortality	1 (2.6%)	2 (5.7%)	10 (27%)	0.002*
All-cause mortality	1 (2.6%)	3 (8.6%)	14 (37.8%)	<0.001*
MACCE during follow-up	3 (7.9%)	5 (14.3%)	18 (48.6%)	0.003*

SS: syntax score, MACCE: major adverse cardiac and cerebrovascular events, *: statistically significant as P value <0.05, P1: p value between SS-II ≤22 and SS-II >22-31, P2: p value between SS-II ≤22 and SS-II>31, P3: p value between SS-II >22-31 and SS-II>31.

Table 5: Pairwise comparisons of the AUC in prediction of MACCE during follow-up.

	Difference between areas	SE	95% CI	Z Statistic	P value
EF % vs Syntax score	0.0952	0.0392	0.018 to 0.172	2.431	0.015*
EF % vs Syntax score II	0.0849	0.040	0.007 to 0.163	2.124	0.034*
EF % vs GRACE	0.0536	0.0556	-0.055 to 0.163	0.964	0.335
Syntax score vs Syntax score II	0.0103	0.0274	-0.043 to 0.063	0.377	0.706
Syntax score vs GRACE	0.0417	0.0491	-0.054 to 0.138	0.849	0.396
Syntax score II vs GRACE	0.0314	0.0549	-0.076 to 0.139	0.571	0.568

EF: ejection fraction, GRACE: global registry of acute coronary events, SE: standard error, CI: confidence interval, AUC: area under the curve.

Table 6: Logistic regression analysis for prediction of in-hospital mortality.

	Univariate			Multivariate		
	OR	**95% CI**	**P value**	**OR**	**95% CI**	**P value**
Age	0.962	0.9247 to 1.0022	0.064	0.963	0.9205 to 1.0081	0.106
Sex	0.308	0.0646 to 1.4690	0.139	0.663	0.1216 to 3.6221	0.636
Smoking	0.282	0.0731 to 1.0881	0.067	0.433	0.1012 to 1.8597	0.261
Hypertension	0.270	0.0701 to 1.0442	0.058	0.278	0.0575 to 1.3513	0.113
Diabetes mellitus	0.528	0.1649 to 1.6943	0.283	0.762	0.1896 to 3.0689	0.703
Previous MI	0.259	0.0673 to 1.0020	0.865	0.261	0.0678 to 1.0123	0.052
SBP (mmHg)	0.983	0.9339 to 1.0364	0.540	1.004	0.9518 to 1.0596	0.876
DBP (mmHg)	1.039	0.9629 to 1.1223	0.321	1.056	0.9754 to 1.1445	0.177
HR (beats/min)	1.147	1.0339 to 1.2741	0.009*	1.117	0.9858 to 1.2656	0.082
EF (%)	0.855	0.7440 to 0.9845	0.029*	0.911	0.7624 to 1.0896	0.308
Duration of chest pain	1.205	0.6604 to 2.1986	0.543	1.185	0.6402 to 2.1960	0.588
Killip class	0.011	0.0014 to 0.0988	<0.001*	0.011	0.0013 to 0.0985	<0.001*
SS>31	8.642	2.2081 to 33.8226	0.002*	13.92	3.1858 to 60.8432	<0.001*
Number of diseased vessels	0.423	0.1620 to 1.1075	0.080	0.403	0.1539 to 1.0580	0.065
Failed PCI	0.041	0.0103 to 0.1654	<0.001*	0.038	0.0089 to 0.1676	<0.001*

SS: syntax score, MI: myocardial infarction, PCI: percutaneous coronary intervention, OR: odds ratio, CI: confidence interval, *: statistically significant as P value <0.05.

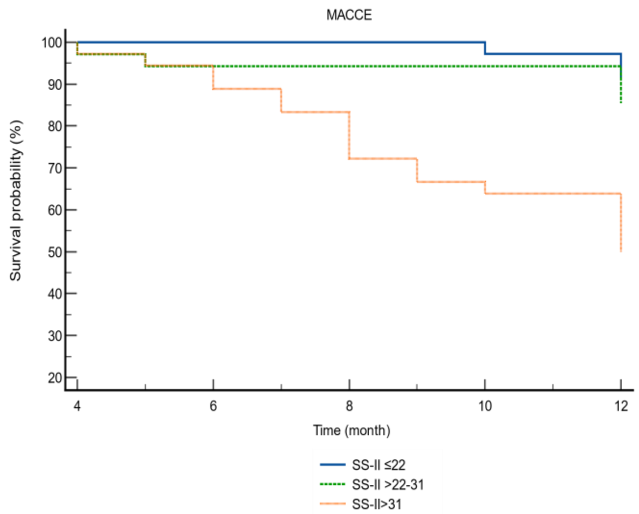

Figure 2: Time to occurrence of any type of MACCE after PCI for 1-year follow-up the studied groups.

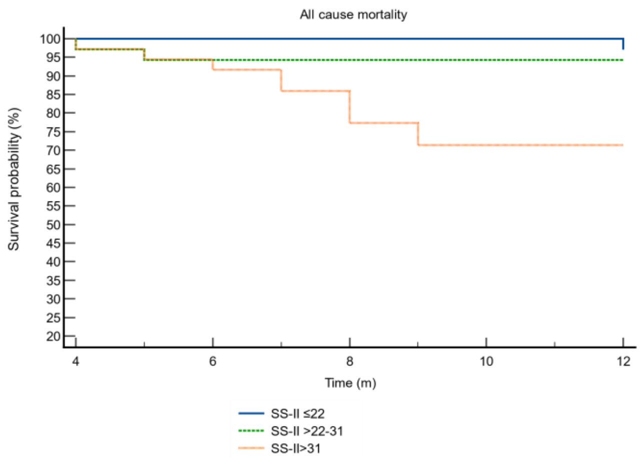

Figure 3: Survival rate for 1-year follow-up the studied groups.

Discussion

This study aimed to investigate the correlation between the SYNTAX score and short-term outcomes in patients presenting with acute STEMI undergoing primary PCI. Additionally, this study seeks to assess the predictive accuracy of the SYNTAX Score II (SSII), Clinical SYNTAX Score (cSS), and clinical variables in this patient population.

This prospective observational study included 110 Egyptian patients diagnosed with STEMI undergoing primary PCI. Patients were divided into three distinct groups based on their SYNTAX scores, categorizing them as low (≤16), intermediate (16-22), and high (>22) SYNTAX score groups. Short-term outcomes, including all-cause mortality, cardiac mortality, re-infarction, and revascularization, were evaluated over a 1-year follow-up period.

Regarding ejection fraction, our results were compatible with findings of who reported that there were higher rates of left anterior descending as the culprit vessel in SX high group (70.4% vs 43.3% vs 24.25, p = 0.012). Triple vessel disease (37.1% vs 20% vs 6.1%, p = 0.014) and number of stents implanted (1.6 vs 1.3 vs 1.1, p < 0.001) were higher in SX high group than SX low and mid groups [(10)].

Additionally, it was reported that the prevalence of multivessel disease (p < 0.001), initial TIMI thrombus grade 4/5 (p = 0.002), initial TIMI flow grade 0/1 (p = 0.008), and APOB (p = 0.038) were higher but creatinine clearance rate (p = 0.016) was lower in the mediate-high SS group [(11)].

Regarding outcome of the procedure, our study was compatible with the findings that reported that patients within the SxSII High tertile had a significantly higher incidence of all-cause mortality, MACE, and MACCE compared with patients in lower tertiles. There was also a higher rate of clinically driven revascularization, in $SxSII_{High}$ (8.6% p=0.002) with a trend for excess cerebrovascular events, p=0.134. All-cause mortality (9.4% versus 1.2% versus 0.8%), MACCE (17.6% versus 8.6% versus 2.4%), and MACE (14.3% versus 8.2% versus 2%) occurred at a significantly higher rate among patients in $SxSII_{High}$ compared to $SxSII_{Mid}$ and $SxSII_{Low}$, respectively (p (log rank) <0.001) [(7)].

Additionally, it was noted that the rates of all-cause mortality, cardiac mortality and MACCE was 7.5%, 5.8% and 13%, respectively. All-cause mortality was 1.9%, 5.9%, and 14.7% in low, intermediate, and high tertiles of SS-II for PCI, respectively (P = 0.002). Cardiac mortality was 1%, 3.9%, and 12.7% (P = 0.001) and MACCE was 6.7%, 16.7%, and 15.7% (P = 0.065) [(12)].

Regarding survival rate, it was found that Kaplan-Meier curves showed higher event rates for all-cause mortality and cardiac mortality in higher tertile of SS-II for PCI (Log-Rank test P = 0.002 for all-cause mortality and Log-Rank test P = 0.001 for cardiac mortality).These results suggest that, in octogenarian, scoring system like SS-II which incorporated clinical variable with angiographic variable was more accurate in risk stratifying and predicting mortality [(12)].

Furthermore, found similar results reported as follows: The incidence of major adverse cardiac and cerebro-vascular events (MACCE) was the highest in patients with SS_{HIGH} (13.5%), comparing to 6.8% in SS_{MED} and 0% in SS_{LOW} (p < 0.0001). The Cox multivariable analysis showed that the SS and CSS were both strong independent predictors for MACCE [1.100 (1.069–1.133), 1.017 (1.010–1.025), both p < 0.0001] [(13)].

Regarding Pairwise comparisons of the AUC in prediction of MACCE during follow-up, our study was parallel to who found that, the AUC for CSS was significantly larger compared to that of SS regarding all-cause death (0.66 vs. 0.58, p < 0.001) suggesting better accuracy. These findings further validate the finding of better prediction of MACCE using EF rather than Syntax and Syntax II scores [(14)].

MACE was more common in patients with SX high group compared to SX mid and SX low group. In our study patients with high syntax score had higher rates of any repeat revascularization than those with intermediate and low score further explaining the correlation between EF and MACCE incidence [(14)].

Contra wise, it was proved that improvement was statistically significant at an AUC difference of 0.145 (95% CI 0.049–0.246, p=0.0045). Compared with the GRACE risk score (calculated in 500 patients), SxSII showed a persistently higher prognostic accuracy for all-cause mortality. Conversely, prognostic accuracy for MACE during 1-year follow-up (AUC (0.657 (0.621–0.691) versus 0.684 (0.649–0.718), p Difference=0.475) was not different between SxS and SxSII [(7)].

Concerning Logistic regression analysis for prediction of in-hospital mortality, our findings were parallel to a study which confirmed that a high SYNTAX score was associated with a 6.2-fold hazard of in-hospital death (OR 6.2, 95% CI 2.6–14.1, $P < 0.001$) and was an independent prognostic marker of in-hospital outcomes in patients with ST elevation myocardial infarction (STEMI). ROC analysis showed that the best cut-off value of the SSII to predict in-hospital mortality was 45.5 with 74% sensitivity and 71% specificity (AUC 0.78; 95% CI 0.74–0.82; $p < 0.001$) and the best cut-off value of the syntax score to predict in-hospital mortality was 23.2 with 60% sensitivity and 59% specificity (AUC 0.64; 95% CI 0.59–0.69; $p < 0.001$). SSII connects several well-accepted clinical parameters which include age, CrCl, LVEF, gender, COPD, and PAD [(15)].

This underscores the importance of considering multiple factors simultaneously in assessing mortality risk among acute ST-elevation myocardial infarction patients undergoing primary PCI, with Killip class, high SYNTAX score, and unsuccessful PCI emerging as the most influential factors in predicting adverse in-hospital outcomes.

Conclusion

The SYNTAX score, along with its derivatives SYNTAX Score II (SSII) and Clinical SYNTAX Score (cSS), demonstrated a significant association with short-term outcomes in STEMI patients undergoing primary PCI. Higher SYNTAX scores correlated with increased rates of adverse events, emphasizing its potential utility in risk stratification.

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