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Coronary atherosclerotic burden assessed by SYNTAX scores and outcomes in surgical, percutaneous or medical strategies: a retrospective cohort study

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ABSTRACT

Introduction Coronary atherosclerotic burden and SYNTAX Score (SS) are predictors of cardiovascular events.

Objectives To investigate the value of SYNTAX scores (SS, SYNTAX Score II (SSII) and residual SYNTAX Score (rSS)) for predicting cardiovascular events in patients with coronary artery disease (CAD).

Design Retrospective cohort study.

Setting Single tertiary centre.

Participants Medicine, Angioplasty or Surgery Study database patients with stable multivessel CAD and preserved ejection fraction.

Interventions Patients with CAD undergoing coronary artery bypass graft (CABG), percutaneous coronary intervention (PCI) or medical treatment (MT) alone from January 2002 to December 2015.

Primary and secondary outcomes Primary: 5-year all-cause mortality. Secondary: composite of all-cause death, myocardial infarction, stroke and subsequent coronary revascularisation at 5 years.

Results A total of 1719 patients underwent PCI (n=573), CABG (n=572) or MT (n=574) alone. The SS was not considered an independent predictor of 5-year mortality in the PCI (low, intermediate and high SS at 6.5%, 6.8% and 4.3%, respectively, p=0.745), CABG (low, intermediate and high SS at 5.7%, 8.0% and 12.1%, respectively, p=0.194) and MT (low, intermediate and high SS at 6.8%, 6.9% and 6.5%, respectively, p=0.993) cohorts. The SSII (low, intermediate and high SSII at 3.6% vs 7.9% vs 10.5%, respectively, p<0.001) was associated with a higher mortality risk in the overall population. Within each treatment strategy, SSII was associated with a significant 5-year mortality rate, especially in CABG patients with higher SSII (low, intermediate and high SSII at 1.8%, 9.7% and 10.0%, respectively, p=0.004) and in MT patients with high SSII (low, intermediate and high SSII at 5.0%, 4.7% and 10.8%, respectively, p=0.031). SSII demonstrated a better predictive accuracy for mortality compared with SS and rSS (c-index=0.62).

Conclusions Coronary atherosclerotic burden alone was not associated with significantly increased risk of all-cause mortality. The SSII better discriminates the risk of death.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This is the only study that evaluated the three SYNTAX scores (SYNTAX Score, SYNTAX Score II (SSII) and residual SYNTAX Score) in patients with multivessel coronary artery disease undergoing one of three treatment strategies (coronary artery bypass graft, percutaneous coronary intervention or medical treatment).
⇒ This analysis focused on the evaluation of atherosclerotic burden through the SYNTAX scores as a predictor of cardiovascular events.
⇒ The addition of clinical variables to SSII discriminated increased risk of death in this sample.
⇒ The main limitations of this study were the small sample size and the involvement of a single centre.

Trial registration number ISRCTN66068876.

INTRODUCTION

Historically, the number of diseased vessels and the location and extension of the coronary atherosclerotic lesions have been considered predictors of cardiovascular events in the short term and long term[1] among patients with stable coronary artery disease (CAD). In fact, studies have shown that as the coronary atherosclerosis burden rises, a continued increase in coronary events occurs.[2]

The SYNTAX Score (SS) was proposed to quantify the complexity and extent of CAD. The score became a surrogate of atherosclerotic burden and a tool to help selecting candidates for percutaneous or surgical treatment.[3] The residual SYNTAX Score (rSS) was derived from the SS to quantify the atherosclerotic burden of residual CAD after percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG), and

has been validated as an independent predictor of clinical adverse events.[4 5] More recently, the SYNTAX Score II (SSII) was developed to increase the prognostic predictive accuracy with the addition of clinical variables.[6] These three scores have not been evaluated concomitantly among patients with CAD undergoing a coronary revascularisation procedure or only medical treatment (MT). The aim of the present study was to assess the prognostic value of coronary atherosclerotic burden through the calculation of the SYNTAX scores (SS, rSS and SSII) in patients with stable multivessel CAD undergoing PCI, CABG or MT alone.

METHODS

Study design

This is a single-centre retrospective study that enrolled patients from the Medicine, Angioplasty or Surgery Study unit database at the Heart Institute of the University of São Paulo, Brazil. Patients with multivessel CAD (defined as stenosis ≥70% in at least two of the three main coronary arteries) and preserved left ventricular ejection fraction (LVEF) who underwent CABG, PCI or medical treatment (MT) between January 2002 and December 2015 were included in this study (see online supplemental table S1).

Data collection and criteria

SS and SSII were calculated by scoring all coronary lesions with a diameter stenosis ≥50%, in vessels with a diameter ≥1.5 mm, using the SS algorithm, which is described in full elsewhere.[3 7] Two experienced clinical cardiologists and two interventional cardiologists blinded to clinical outcomes calculated the SS retrospectively for each patient. Clinical data were obtained from the medical records for the calculation of SSII. Intraobserver variability and interobserver variability for the SS were performed for 100 coronary angiograms according to the kappa (k) coefficient. Coefficients ranging from 0.21 to 0.40 are considered fair, from 0.41 to 0.60 moderate, from 0.61 to 0.80 substantial and over 0.81 excellent. For ordinal variables, the weighted kappa coefficient was used to express the degree of agreement interobserver and intraobserver.

For the SS and SSII calculation of the MT group, we used the CABG group as a reference. This option assumed that surgery is the strategy that provides the most complete revascularisation in patients with multivessel CAD. The rSS was calculated for each coronary lesion that was evaluated with the SS but was not treated.[8] The coronary angiogram performed immediately after the percutaneous intervention or the surgical report of the CABG patients was used to calculate the rSS. For the MT group, the rSS is similar to the SS. A higher value of rSS suggests that more CAD lesions were untreated. Finally, patients were categorised within each score as low, intermediate and high (see online supplemental table S2).

Treatment

Patients were categorised according to three coronary revascularisation strategies: MT, PCI and CABG. Patients in the three groups received intensive secondary prevention with lifestyle and pharmacological interventions using 'treat-to-target' algorithms. All patients were treated according to the current guidelines at the time of study enrolment.

Among patients undergoing PCI, target lesion revascularisation was always attempted, and complete revascularisation was performed as clinically appropriate. Subjects in the PCI group received plain bare metal stents, or drug-eluting stents, as available. A successful PCI was defined as a normal coronary artery flow or less than 20% stenosis in the luminal diameter after coronary stent implantation, as assessed by visual estimation of the angiograms before and after the procedure. Clinical success was defined as angiographic success plus the absence of in-hospital myocardial infarction (MI), emergency CABG or death.

CABG was performed in accordance with the best current practices. The use of cardiac extracorporeal circulation was defined at the discretion of the surgical team, but the surgical team had experience in both on-pump and off-pump surgeries.

Study endpoints

The primary endpoint was death from any cause at 5 years. Secondary endpoint was major adverse cardiac and cerebrovascular events (MACCE), defined as the composite of all-cause death, MI, stroke and subsequent coronary revascularisation measured.

Statistical analysis

Continuous variables were summarised as mean±SD and compared using the Student's unpaired t-test or the Mann-Whitney test, as appropriate. The normality assumption for continuous variables was evaluated using the Kolmogorov-Smirnov test. Categorical variables were summarised as counts and percentages and compared with the χ^2 test when appropriate. Otherwise, the Fisher's exact test was used. Cox regression analysis was used to find independent predictors of mortality in the PCI, CABG and MT groups. The variables with a probability value of <0.20 in the univariate analyses were included in the backward stepwise multivariable model. Only variables with statistical significance ($p<0.05$) remained in the Cox multivariable model. No correction was made for multiple tests. Receiver operating characteristic curves were created to evaluate the capacity of each score to discriminate MACCE in the PCI, CABG and MT groups. Survival curves were constructed using Kaplan-Meier estimates and compared by using the log-rank test at 5 years of follow-up. A two-sided p value <0.05 was considered statistically significant. All analyses were conducted using the statistical package SPSS V.25.0 (IBM) software for Windows.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

Overview of patient characteristics

From January 2002 to December 2015, a total of 2176 patients with stable multivessel CAD were screened and 1719 were included in this study. The reasons for exclusion of the remaining 457 patients are listed in online supplemental figure S1. A total of 136 patients were lost to follow-up. A total of 573 patients underwent PCI, 572 underwent CABG and 574 received MT alone. The overall clinical, laboratory and angiographic characteristics of the three groups are depicted in table 1. Compared with the PCI and MT patients, those who underwent CABG were more frequently smokers, had more peripheral artery disease, chronic obstructive pulmonary disease, presented more frequently with a positive treadmill test and had more left main coronary artery diseases. The SS was significantly higher in the CABG group compared with the MT and PCI groups (24.18±8.20 vs 17.22±6.55 vs 19.46±7.56, respectively, p<0.001). Conversely, the SSII was significantly higher in the PCI and CABG groups compared with the MT group (28.13±7.97 vs 25.03±10.52 vs 21.69±8.53, respectively, p<0.001). The rSS was significantly higher in the MT group compared with the PCI and CABG groups (19.46±7.56 vs 8.43±6.39 vs 4.31±4.92, respectively, p<0.001).

The degree of agreement for intraobserver and interobserver reproducibility according to the tertile analysis (≤22, 23–32, ≥33) of the SS was substantial (k=0.606, 95% CI 0.456 to 0.741, p<0.001 and k=0.656, 95% CI 0.498 to 0.811, p<0.001, respectively). The intraobserver and interobserver weighted kappa scores according to SS tertile (≤22, 23–32, ≥33) were 0.68 and 0.61, respectively, indicating a substantial agreement.

Compared with the other revascularisation groups, patients in the MT group were more likely to have diabetes, and patients in the CABG group a positive treadmill test. The distribution of SS categories according to the treatment strategies is shown in table 2.

Mortality in the overall cohort according to the SYNTAX scores

In the overall cohort, there were not statistically significant differences in mortality between low, intermediate and high SS (7.5%, 7.5% and 12.3%, respectively, p=0.148, figure 1A) at 5 years. Compared with patients with low SSII, those with intermediate and high SSII (figure 1B) had a higher incidence of death at 5 years (3.6% vs 7.9% vs 10.5%, respectively, p<0.001). Higher rSS as well as higher SS also did not significantly increase the mortality rate (low: 7.5%, intermediate: 7.5%, high: 8.2%, p=0.990, figure 1C).

Mortality in the PCI, CABG and MT groups according to different SYNTAX score categories

No statistically significant difference for death was observed among patients in the three SS groups within the PCI, CABG and MT cohorts (figure 2A–C). There was a higher incidence of death in PCI (1.7% with low, 4.6% with intermediate and 8.9% with high SSII, p=0.046) and MT (5.0% with low, 4.7% with intermediate and 10.8% with high SSII, p=0.031) patients with higher SSII values compared with those with lower SSII values. Additionally, the rate of death was lower in CABG patients with low SSII than those with intermediate and high SSII (1.8%, 9.7% and 10.0%, respectively, p=0.004) (figure 2D–F). The incidence of death was lower in patients of CABG group with low rSS than intermediate and high rSS (5.0%, 10.1% and 10.8%, respectively, p=0.048), with no differences in the PCI and MT cohorts (figure 2G–I).

Long-term follow-up predictors of mortality in PCI, CABG and MT groups

In a multivariate analysis of the PCI cohort, diabetes (HR 5.50; 95% CI 1.23 to 24.54; p=0.025) was an independent predictor of mortality at 5 years (table 3).

In the CABG group, after adjustment for potential confounding biases by multivariate logistic Cox regression, intermediate SSII (HR 3.93; 95% CI 1.21 to 12.78; p=0.023) and high rSS (HR 3.48; 95% CI 1.32 to 9.17; p=0.012) were independent risk factors for mortality at 5 years (table 3).

In the MT group, diabetes (HR 2.14; 95% CI 1.04 to 4.38; p=0.037) and high SSII (HR 2.35; 95% CI 1.10 to 5.02; p=0.026) were independently associated with mortality at 5 years (table 3).

SSII combining clinical and anatomical variables had better discrimination ability compared with that of SS and rSS to predict death in patients with multivessel CAD (figure 3A). The area under the curve (AUC) in the PCI group was 0.486 (95% CI 0.393 to 0.579, p=0.758), 0.640 (95% CI 0.559 to 0.720, p=0.002) and 0.443 (95% CI 0.352 to 0.534, p=0.207) for SS, SSII and rSS, respectively (figure 3B). In the CABG group, the AUC was 0.601 (95% CI 0.519 to 0.684, p=0.019), 0.615 (95% CI 0.543 to 0.687, p=0.008) and 0.625 (95% CI 0.545 to 0.705, p=0.004) for SS, SSII and rSS, respectively (figure 3C). In the MT group, the AUC was 0.488 (95% CI 0.398 to 0.577, p=0.046), 0.625 (95% CI 0.542 to 0.710, p=0.043) and 0.488 (95% CI 0.398 to 0.577, p=0.046) for SS, SSII and rSS, respectively (figure 3D).

MACCE in the PCI, CABG and MT groups according to SYNTAX score categories

No statistically significant differences in MACCE were observed among patients in the three SS groups within the PCI, CABG and MT cohorts. No differences were observed in the incidence of MACCE among patients in the three SSII groups within the PCI and MT population. Patients in the lower SSII categories treated with CABG experienced lower incidence of MACCE at 5 years (11.4% vs 20.0% vs 20.4% in the low, intermediate and high SSII groups, respectively, p=0.042). The incidence of MACCE was similar among all rSS categories, regardless of the revascularisation strategy. There was a higher incidence of stroke among patients of the PCI group with high SS (2.4% vs 3.8% vs 28.6% with low, intermediate and high SS categories, respectively, p<0.001). The rates

Table 1 Baseline and procedure variables in PCI, CABG and MT patient groups

	PCI (n=573)	CABG (n=572)	MT (n=574)	P value
Age at randomisation (years)	59.78±8.8	61.75±8.97	60.69±8.59	0.222
Male	378 (66.0)	397 (69.4)	383 (66.7)	0.428
Current smoker	124 (21.6)	163 (28.5)	126 (22.0)	<0.001
Hypertension	488 (85.2)	469 (82.0)	453 (78.9)	0.023
Diabetes	292 (51.0)	294 (51.4)	334 (58.2)	0.023
Previous MI	269 (46.9)	242 (42.3)	222 (38.7)	0.018
COPD	4 (0.7)	26 (4.5)	15 (2.6)	<0.001
PAD	15 (2.6)	64 (11.2)	19 (3.3)	<0.001
BMI (kg/m^2)	27.74±4.55	27.70±4.09	27.92±4.41	0.547
Systolic blood pressure (mm Hg)	126.4±16.1	127.8±16.0	128.0±15.4	0.487
Diastolic blood pressure (mm Hg)	72.7±10.7	73.1±10.6	74.2±11.0	0.097
Heart rate (bpm)	69.5±11.3	68.7±10.7	69.0±10.8	0.234
Total cholesterol (mg/dL)	197.85±55.16	197.50±50.92	194.60±49.28	0.466
LDL cholesterol (mg/dL)	122.30±43.30	122.48±42.35	120.69±42.64	0.684
HDL cholesterol (mg/dL)	38.57±10.25	39.46±10.66	40.06±11.40	0.068
Triglycerides (mg/dL)	183.71±151.51	176.55±109.93	172.67±123.99	0.175
Glucose (mg/dL)	131.07±52.70	131.08±55.66	138.10±61.32	0.147
Glycated haemoglobin (%)	6.81±1.70	6.70±1.64	7.01±1.81	0.004
Creatinine (mg/dL)	1.04±0.26	1.07±0.26	1.07±0.40	0.107
LVEF (%)	61.3±9.3	61.1±8.7	60.9±9.8	0.725
Positive treadmill test	391 (68.2)	378 (66.1)	347 (60.5)	<0.001
Angina CCS class				
I	69 (12.0)	60 (10.5)	124 (21.6)	<0.001
II	293 (51.2)	367 (64.2)	314 (54.7)	
III	193 (33.7)	121 (21.2)	127 (22.1)	
IV	18 (3.1)	24 (4.2)	9 (1.6)	
Coronary anatomy				
2-vessel disease	229 (40.0)	135 (23.6)	155 (27.0)	<0.001
3-vessel disease	344 (60.0)	437 (76.4)	419 (73.0)	
LAD disease	535 (93.4)	547 (95.6)	557 (97.0)	0.012
LMCAD	20 (3.5)	158 (27.6)	13 (2.3)	<0.001
SYNTAX Score	17.22±6.55	24.18±8.20	19.46±7.56	<0.001
SYNTAX Score II	28.13±7.97	25.03±10.52	21.69±8.53	<0.001
Residual SYNTAX Score	8.43±6.39	4.31±4.92	19.46±7.56	<0.001
Surgery off-pump	NA	249 (43.7)	NA	–
Left internal thoracic artery	NA	559 (97.7)	NA	–
BMS use	369 (64.4)	NA	NA	–
DES use	204 (35.6)	NA	NA	–
Number of graft vessels	NA	2.9±0.7	NA	–
Total number of stents	2.1±1.0	NA	NA	–

Values are presented as mean±SD, median (IQR) or number (%).
BMI, body mass index; BMS, bare metal stent; CABG, coronary artery bypass graft; CCS, Canadian Cardiovascular Society; COPD, chronic obstructive pulmonary disease; DES, drug-eluting stent; HDL, high-density lipoprotein; LAD, left anterior descending artery; LDL, low-density lipoprotein; LMCAD, left main coronary artery disease; LVEF, left ventricular ejection function; MI, myocardial infarction; MT, medical treatment; NA, not available; PAD, peripheral artery disease; PCI, percutaneous coronary intervention.

Table 2 Distribution of SYNTAX score categories according to the treatment strategy

SYNTAX scores	Subgroups	Treatment						P value
		PCI		CABG		MT		
		n	%	n	%	n	%	
SS	<22	433	75.6	230	40.2	367	63.9	<0.001
	22–33	133	23.2	266	46.5	176	30.7	
	>33	7	1.2	76	13.3	31	5.4	
SSII	<18.7	59	10.3	167	29.2	219	38.2	<0.001
	18.7–25.7	197	34.4	155	27.1	170	29.6	
	>25.7	317	55.3	250	43.7	185	32.2	
rSS	<4	137	23.9	302	52.8	0	0.0	<0.001
	4–8	189	33.0	159	27.8	20	3.5	
	>8	247	43.1	111	19.4	554	96.5	

CABG, coronary artery bypass graft; MT, medical treatment; PCI, percutaneous coronary intervention; rSS, residual SYNTAX Score; SS, SYNTAX Score; SSII, SYNTAX Score II.

of subsequent revascularisation and MI were similar in all SS, SSII and rSS categories of the PCI, CABG and MT groups (see online supplemental table S3).

DISCUSSION

This study evaluated the impact of the coronary atherosclerotic burden on cardiovascular events through the application of SYNTAX scores in patients with stable multivessel CAD who underwent CABG, PCI or MT alone. The main finding of this study is that atherosclerotic burden alone was not able to discriminate the occurrence of death in these patients at a follow-up of 5 years regardless of the therapeutic strategy while the SSII predicted mortality as angiographic and clinical variables were taken into account.

Even in the MT group atherosclerotic burden was not associated with increased risk of death and cardiovascular events. Moreover, most of our patients (70%) had documented myocardial ischaemia and even in this high-risk population the burden of coronary disease was not associated with a worse cardiovascular prognosis. These findings support the hypothesis that in patients with stable CAD, a conservative strategy with optimised MT is associated with good long-term cardiovascular prognosis, particularly in patients with preserved LVEF, as shown by the Clinical Outcomes Utilizing Revascularization and Aggressive Drug Evaluation trial.[9]

The maximum expression of the myocardium at risk observed in the MT group did not reflect a worse prognosis when MT was compared with the CABG or PCI. Our findings are in line with the International Study of Comparative Health Effectiveness with Medical and Invasive Approaches (ISCHEMIA) trial that did not find differences in cardiovascular outcomes among patients with documented moderate or severe myocardial ischaemia and stable CAD who underwent invasive or conservative treatment.[10] In concordance with Garzillo and colleagues, our results showed that regardless of the therapeutic strategy applied, the presence of documented myocardial ischaemia and distinct atherosclerotic burden were not associated with an increased occurrence of cardiovascular events in patients with multivessel CAD.[11]

Recently, a substudy of the ISCHEMIA trial showed a greater association of more severe CAD, assessed by coronary CT angiography, with increased risk of death and MI.[12] However, the assessment of atherosclerotic burden was performed only through the number of compromised

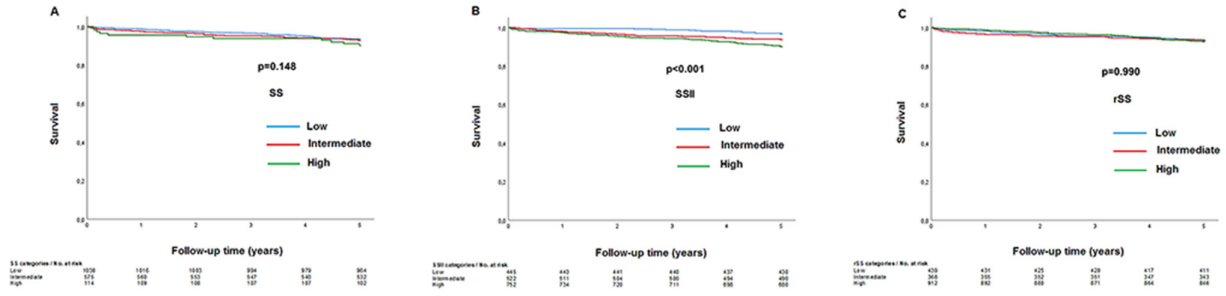

Figure 1 Kaplan-Meier survival curves for all-cause mortality according to SYNTAX scores. Kaplan-Meier curves for mortality stratified by SYNTAX Score (SS; A), SYNTAX Score II (SSII; B), and residual SYNTAX Score (rSS; C) regardless of strategy of treatment (percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG) or medical treatment (MT)).

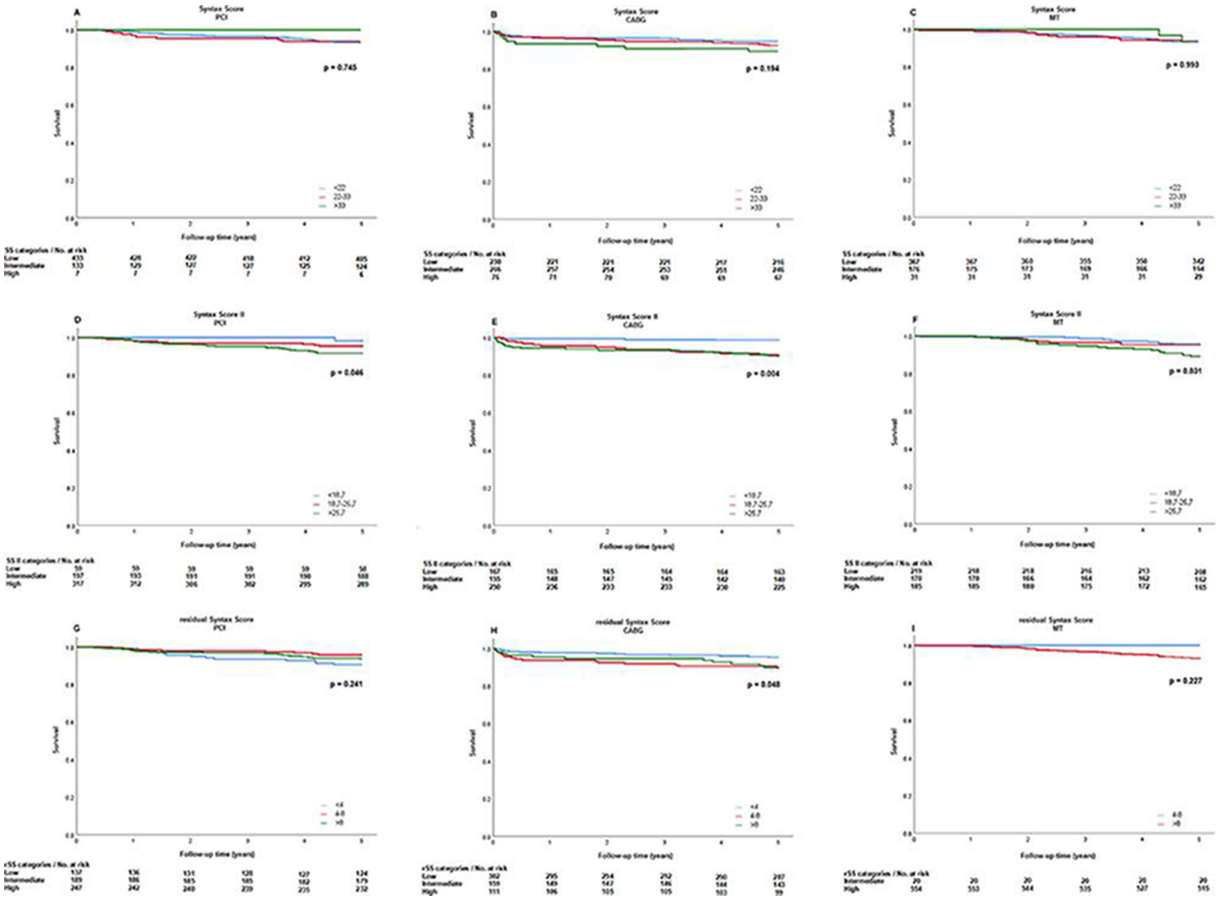

Figure 2 Kaplan-Meier curves for 5-year all-cause mortality. Kaplan-Meier estimates for death in patients assigned to medical treatment (MT), percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) over 5 years of follow-up according to SYNTAX scores (SS: PCI (A), CABG (B) and MT (C); SSII: PCI (D), CABG (E) and MT (F); rSS: PCI (G), CABG (H) and MT (I)). rSS, residual SYNTAX Score; SS, SYNTAX Score; SSII, SYNTAX Score II.

Table 3 Multivariable Cox model for death in the PCI, CABG and MT groups

Predictor	HR (95% CI)	P value
PCI		
Diabetes mellitus	5.50 (1.23 to 24.54)	0.025
Positive treadmill test	5.74 (0.75 to 43.92)	0.092
CABG		
Intermediate SSII	3.93 (1.21 to 12.78)	0.023
High SSII	2.79 (0.91 to 8.57)	0.072
Intermediate rSS	2.50 (0.97 to 8.57)	0.056
High rSS	3.48 (1.32 to 9.17)	0.012
MT		
Diabetes mellitus	2.14 (1.04 to 4.38)	0.037
High SSII	2.35 (1.10 to 5.02)	0.026

CABG, coronary artery bypass graft; MT, medical treatment; PCI, percutaneous coronary intervention; rSS, residual SYNTAX Score; SSII, SYNTAX Score II.

vessels, and not through the anatomical complexity and extent.

The addition of clinical variables to the SS has provided a significant improvement in the process of risk stratification. The SSII had moderate predictive accuracy for death, clinical characteristics were important predictors of cardiovascular events and death and were more suitable to predict death in patients with stable CAD. These results found with SSII suggested that angiographic variables alone did not suffice to accurately stratify the risk of cardiovascular outcomes in this population. In fact, recent studies have also shown a better prognostic value of SSII compared with SS for the risk of mortality and MACE (major adverse cardiovascular events).[13–16]

Of note, the presence of diabetes mellitus was associated with a higher incidence of death in PCI and MT groups. This finding is in agreement with a recent analysis by Tam *et al* that showed better long-term survival and decreased risk of MACCE in patients with diabetes with multivessel CAD undergoing CABG compared with PCI.[17] Additionally, a recent study conducted by Kurtul *et al* identified a strong correlation between diabetic

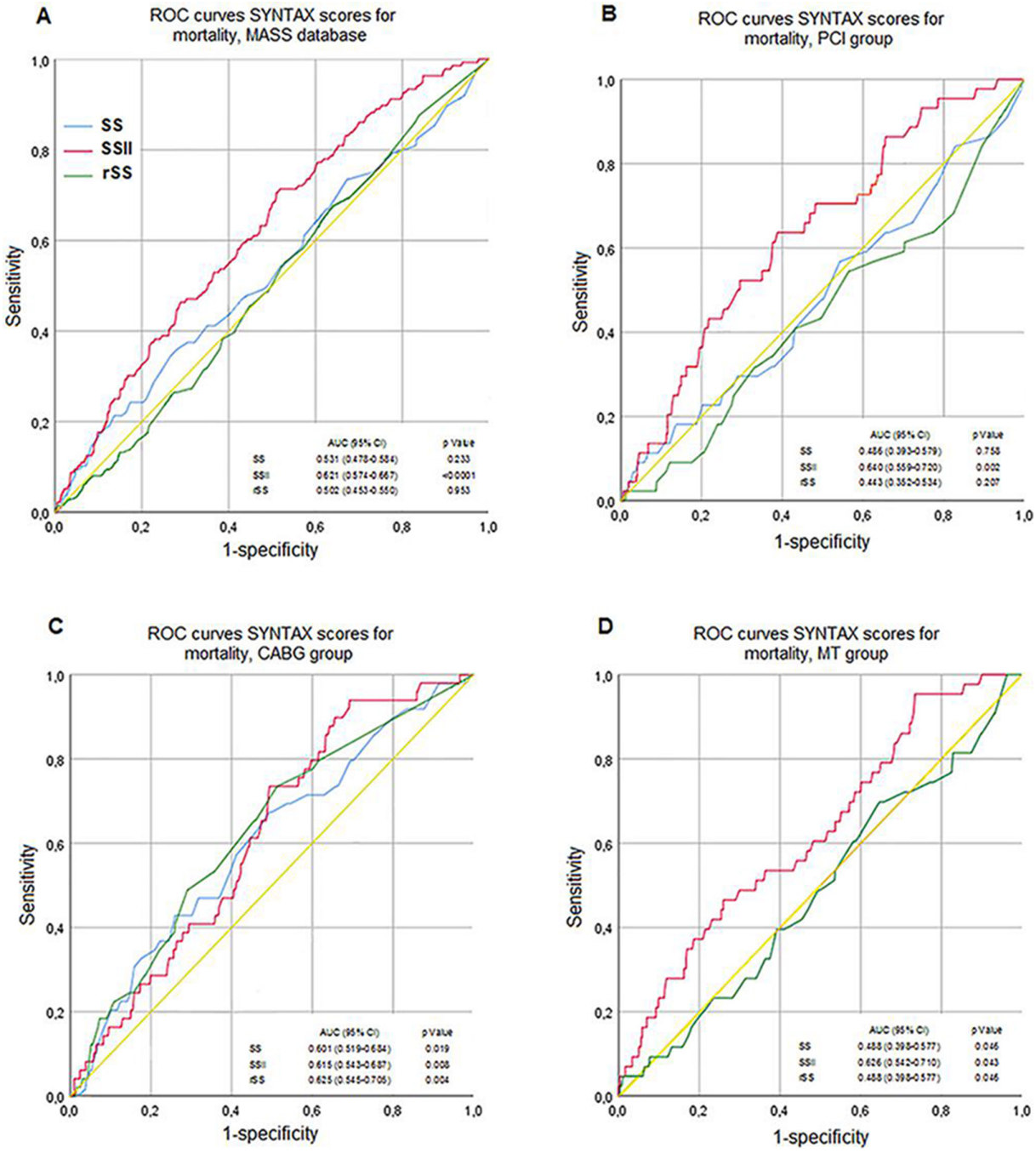

Figure 3 Receiver operating characteristic (ROC) curves for SYNTAX scores for discrimination of all-cause mortality in the percutaneous coronary intervention (PCI), coronary artery bypass graft (CABG) and medical treatment (MT) groups. ROC curves for SYNTAX scores for mortality in Medicine, Angioplasty or Surgery Study (MASS) database (A), PCI group (B), CABG group (C), and MT group (D). In the MT group, SYNTAX Score (SS) has the same value as residual SYNTAX Score (rSS). Therefore, the ROC curves are superimposed (D). AUC, area under the curve; SSII, SYNTAX Score II.

retinopathy and atherosclerotic burden measured by the SS.[18] Regarding completeness of revascularisation, we found a similar incidence of death even with higher tertiles of rSS, except in CABG patients with intermediate and high rSS who presented a higher rate of death. These findings possibly reflect the stability of CAD, previously confirmed by the Bypass Angioplasty Revascularization Investigation 2 Diabetes trial[19] and, more recently, by the ISCHEMIA trial[10] and are in agreement with those found by Kobayashi *et al* in patients from the fractional flow reserve (FFR)-guided PCI cohort of the Fractional Flow Reserve Versus Angiography for Multivessel Evaluation (FAME) trial.[20]

In light of the complexity of coronary disease, and with the results observed in this study, we can infer that death and MACCE were not directly related to the atherosclerotic burden. Therefore, it may be that the development of a MI and its consequences depend more on the

vulnerability of the plaque, and less on the overall atherosclerotic burden or myocardial ischaemia. These variables must be considered as aggravating conditions. MI is often associated with the local characteristics of the atherosclerotic plaque. However, the hypothesis that plaque rupture and its consequences are more frequent and accentuated in the presence of more extensive coronary disease is questionable. Symptoms of angina, frequently related to plaque instability, emerge in this intricate pathophysiological mechanism. However, the instability of the plaque cannot be assessed by the SS.

Finally, the current analysis indicates that the CAD stability, the strict control of symptoms of angina with optimised MT and preserved left ventricular function contributed to the favourable long-term results. In addition, the atherosclerotic burden alone did not influence the incidence of death and MACCE. Clinical characteristics are probably more important for clinical decision-making in patients with multivessel CAD.

Limitations

This study has a few limitations that need to be acknowledged. First, this was a retrospective study, with the intrinsic biases associated with this type of study. However, predictors and outcome variables were collected prospectively. Second, revascularisation strategies and standards of practice changed over time. These changes occurred in all study patients, irrespective of the therapeutic group they were placed in at the initiation of the study. Third, the sample size of our study is limited, which may compromise statistical power. Last, the data were collected in a single centre, which may limit the generalisability of our results. Nevertheless, the homogeneity of treatment reduces the limitations of the present study.

CONCLUSION

In patients with multivessel CAD and preserved ventricular function, the addition of clinical variables to anatomical information by means of the SSII significantly impacted the accuracy of predicting long-term prognosis. The coronary atherosclerotic burden evaluated by the SS alone was not able to predict mortality and MACCE in patients undergoing PCI, CABG or MT.

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