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**Clinical Usefulness of the SYNTAX Score For Predicting Outcomes after Coronary
Intervention for Chronic Total Occlusion**

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3 **Abstract:**
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6 **Background:**Chronic total occlusion (CTO) lesions remain a challenging issue. When dealing with
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9 complex CTOs in patients undergoing percutaneous coronary intervention (PCI), it is important to
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12 evaluate not only the CTO lesion itself but also atherosclerotic lesions of the whole coronary artery
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15 tree. The utility of the SYNTAX score in patients having CTO undergoing PCI is unclear.
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19 **Methods:**This retrospective study included 304 consecutive patients with CTO lesions who
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22 underwent PCI. Primary endpoints were procedural failure and major adverse cardiac events
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25 (MACE) within 30 days. The SYNTAX and J-CTO scores were assessed before the procedures, and
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28 patients were divided into 2 groups according to SYNTAX criteria: high (>22 ; $n=158$) and low (≤ 22 ;
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31 $n=146$).
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35 **Results:**Procedural success was obtained in 252 patients (82.9%). Patients with a high SYNTAX
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38 score had significantly lower procedural success than those with a low SYNTAX score (74.7%
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41 versus 91.8%, $p < 0.0001$). There were 13 MACE (8.2%) in patients with high SYNTAX scores and
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44 2 MACE (1.4%) in those with low scores. Both the SYNTAX and J-CTO scores had odds ratios of
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47 3.33 (95%CI, 1.44–7.74) and 3.64 (95%CI, 1.24–10.66) for procedural failure. Higher SYNTAX
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50 scores (>22) was also an independent predictor of 30-day MACE after PCI (Odds ratio 4.80, 95%CI
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53 1.03–22.42).
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57 **Conclusion:**The SYNTAX score is predictive of procedural failure, as with the J-CTO score.
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Furthermore, a higher SYNTAX score is strongly associated with an increased risk of 30-day MACE.

The SYNTAX score is useful for clinical decision making in patients with complex CTO.

Key words: chronic total occlusion, SYNTAX score, J-CTO score, percutaneous coronary intervention, procedural failure

INTRODUCTION

In clinical practice, patients with a chronic total occlusion (CTO) represent roughly 20% of those undergoing percutaneous coronary interventions (PCI).^{1,2} Despite advances in revascularization techniques and devices, the management of CTO lesions remains a challenging issue because the procedural success rates vary widely in patients with CTO lesions (74% to 97.5%), and a high incidence of PCI-related adverse events are observed.³⁻⁸ Although successful PCI is largely dependent on experience of PCI operator, it is very important to evaluate aspects of lesion morphology, such as occluded lesion length, the degree of calcification, whether there is a blunt stump in the culprit lesion, the presence of a side branch and bridging collaterals at the point of occlusion, and whether the occlusion is situated within a tortuous part of the vessel.⁸⁻¹⁰ The Multicenter CTO Registry in Japan (J-CTO) score, which quantified those factors, has demonstrated usefulness for the prediction of successful guide wire crossing within 30 min in patients undergoing CTO-PCI.¹¹ However, the score is evaluated on the basis of only on the findings of the culprit lesion and/or target vessel artery of the CTO lesion. The major cause of unsuccessful CTO-PCI is that guide-wire is not able to pass through the occluded lesion, such as a guide-wire strays into a false lumen. A retrograde approach through collateral channels is one of PCI techniques to improve the success rate of CTO-PCI. If favorable collaterals existed on the distal of CTO lesion, retrograde wiring may be useful and permits a bilateral approach from both the right and left coronary arteries.⁸

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3 It is essential to pay close attention to the anatomy and atherosclerotic lesions of the whole coronary
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6 artery tree to ensure prompt treatment if procedure-related complications, such as coronary
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9 dissection or perforation by the guide catheter and wires, occur.
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12 The SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery
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14 (SYNTAX) Trial was the first to compare coronary artery bypass graft surgery and drug-eluting
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16 stents (DES) in patients with left main and/or 3-vessel disease.¹² The SYNTAX score is a new
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19 angiographic tool that can quantify the degree of atherosclerosis in the entire coronary arterial tree,
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22 including the culprit lesions.¹³ The SYNTAX score may be capable of aiding preprocedural risk
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25 stratification in patients with complex CTOs treated via modern PCI strategies. Therefore, the
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28 SYNTAX score has not been fully investigated in CTO patients. This study aimed to assess whether
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31 the SYNTAX score is associated with clinical outcomes in patients with CTO within 30 days of
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34 undergoing PCI.
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44 **METHODS**

45 **Patient population**

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48 We retrospectively analyzed 2524 consecutive coronary artery disease patients treated with PCI from
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51 January 2005 through April 2013. During this period, PCI was performed for CTO lesions in 331
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57 patients with proven myocardial ischemia, as evidenced by echocardiography and stress tests with
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3 electrocardiography (ECG) and scintigraphy. We excluded the following 4 categories of patients;
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6 patients with hemodynamic instability before procedures, patients with CTO lesions in vein grafts,
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9 patients with repeat PCI for CTO lesions, and those unable to be evaluated using the SYNTAX score
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12 or angiogram. A total of 304 patients who underwent PCI were finally enrolled in this study.
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16 **Intervention for CTO lesions**

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18 CTO is defined as a total occlusion with complete interruption of antegrade blood flow as assessed
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21 by coronary angiography [Thrombolysis In Myocardial Infarction (TIMI) flow grade 0] and with an
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24 estimated occlusion duration >3 months. The occlusion duration was determined by the interval from
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27 either the last acute coronary syndrome episode, the first episode of effort-induced angina consistent
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30 with the location of the occlusion, or the previous coronary angiography results. The individual
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33 CTO-PCI strategies, specifically regarding the technical details and the selection of devices, were
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36 left to the discretion of experienced operators. Antiplatelet agent regimens consisted of indefinite
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39 administration of aspirin, and administration of either ticlopidine (200 mg daily) or clopidogrel (75
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42 mg daily) for at least 12 months after DES procedures and at least 1 month after bare-metal stents or
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45 balloon angioplasty.
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49 **Endpoints**

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52 The primary endpoints of this study were procedural failure (unsuccessful PCI) and major adverse
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55 cardiac events (MACE) within 30 days of the procedure. The secondary endpoints were procedural
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3 complications and total radiation time. PCI success was defined as successful balloon dilatation of
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6 the lesion with or without stent placement and <40% residual stenosis. MACE was defined as a
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9 composite of death, non-fatal myocardial infarction, and target vessel revascularization (including
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12 both repeat PCI and coronary artery bypass grafting).^{14, 15} Procedural complications were recorded as
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15 coronary perforation, cardiac tamponade, and additional stent implantation due to major collateral
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18 vessel injury with flow limited. The J-CTO score was calculated on the basis of 5 selected factors:
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21 previously failed lesion, blunt stump type, bending, calcification, and occlusion lesion >20 mm.¹¹
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24 The diagnosis of myocardial infarction required the presence of new Q-waves on ECG and/or
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27 elevation of creatine kinase (CK)-MB isoenzyme (or total CK if CK-MB was not available) ≥ 3 times
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30 the upper limit of the normal range.¹⁶ The clinical course was evaluated by chart review for each
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35 patient.

36 37 38 **Evaluation with the SYNTAX score** 39 40

41 On the basis of the diagnostic angiograms, each coronary lesion with 50% diameter stenosis in
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44 ≥ 1.5 -mm vessels was scored separately, and the sum of these scores provided the overall SYNTAX
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47 score using the SYNTAX score algorithm.¹⁷ The SYNTAX score of patients was independently
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50 assessed by 2 experienced interventional cardiologists who were blinded to the procedural success.
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53 The residual SYNTAX score also calculated after PCI. They had experience with calculating the
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56 SYNTAX score of >100 patients prior to our study. The κ value for interobserver variability and
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3 intraobserver variability in the estimation of the SYNTAX score were 0.75 and 0.86, respectively.¹⁸

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6 In cases of disagreement regarding the SYNTAX score, the average of the values from the 2 readers
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9 was used as the final value.
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11 12 **Statistical analysis**

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15 The data are presented as mean \pm standard deviation (SD) or as percentages (%). Differences
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18 between groups were assessed using either the unpaired 2-tailed Student *t* tests test or the chi-square
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21 test for continuous and categorical variables, respectively. Univariate and multivariate logistic
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24 regression analyses were used to assess the independent correlates of procedural failure and the
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27 30-day MACE. All variables summarized in Tables 1 and 2 were entered into the models. With
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30 regard to the SYNTAX score and glomerular filtration rate, each were measured against per 10-unit
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33 change. The J-CTO score was calculated as 1 unit of measurement. The odds ratio (OR) and 95%
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36 confidence intervals (CI) for clinically relevant variables with $p < 0.05$ following univariate analyses
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39 were presented in the table for the final multivariate model. An area under the receiver-operator
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42 characteristic curve (AUC) analysis was calculated to determine the ability of the SYNTAX and
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45 J-CTO scores to distinguish between patients with and without the primary endpoints. All analyses
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48 were performed with the IBM-SPSS statistics version 19 (IBM Corporation, Armonk, New York).
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57 58 **RESULTS**

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3 In the present study involving 304 patients treated with PCI, procedural success was obtained in 252
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6 patients (82.9%). The potential range of SYNTAX scores was 3 to 71.5, with a median value [25th to
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9 75th percentiles] of 24 [17.0–34.8]. The mean J-CTO score was 1.6 ± 1.1 . Difficult (2 point) and very
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12 difficult (≥ 3 point) J-CTO subset scores were 30% and 23%, respectively.

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16 We set a SYNTAX score of 22 as a cutoff point because patients scoring >22 points had intermediate
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19 or high scores in the original SYNTAX trial. On the basis of this cutoff point, patients were divided
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22 into 2 groups: high SYNTAX score (>22 ; $n = 158$) and low SYNTAX score (≤ 22 ; $n = 146$). The
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25 differences in baseline clinical characteristics in patients with high and low SYNTAX scores are
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28 shown in Table 1. There were significant differences between the 2 groups with respect to several
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31 variables, including age, body mass index, and the presence of diabetes mellitus. Significant
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34 differences were observed in the angiographic findings between the 2 groups regarding lesion
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37 complexity. The following were more common in patients with high SYNTAX scores: left main
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40 coronary lesions, left anterior descending coronary lesions, 3-vessel disease, smaller reference vessel
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43 diameter, and severe calcification. Although the total stent length did not differ, DES were used less
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46 frequently in the high-SYNTAX-score group.

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54 Procedural success was significantly lower in patients with high SYNTAX scores when compared
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57 with those with low SYNTAX scores (Table 3). Patients with high SYNTAX scores required longer
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radiation time and a greater amount of contrast media. A major procedure-related complication occurred in 33 patients (10.9%). Of these, patients with high SYNTAX scores were more likely to require additional stent implantation for a major collateral vessel due to coronary injury when compared with those with a low SYNTAX score. During the first 30 days after the procedure, there were 13 (8.2%) and 2 (1.4%) MACE among patients with high and low SYNTAX scores, respectively ($p = 0.007$, figure 1). The corresponding myocardial infarction rates were 6.3% ($n = 10$) and 1.4% ($n = 2$), respectively, although there was no difference in the development of Q-wave myocardial infarction.

Risk factors of procedural failure of PCI for CTO

Several variables were associated with unsuccessful CTO-PCI on univariate analysis. After multivariate logistic regression, the SYNTAX score was identified as an independent predictor of unsuccessful PCI (SYNTAX score > 22 , OR 3.33, 95% CI 1.44–7.74, $p = 0.005$). The J-CTO score was also identified as an independent predictor of unsuccessful PCI (OR = 3.64, 95% CI 1.24–10.66, $P = 0.019$) for a 1-unit increase in the J-CTO score. The AUC analysis confirmed the discriminatory capacity of the SYNTAX score ($C = 0.687$, $p < 0.0001$) and the J-CTO score ($C = 0.736$, $p < 0.0001$) to distinguish between patients with and without procedure failure (Figure 2-A).

Risk factors for the 30-day MACE after PCI for CTO

The 30-day MACE after PCI were associated with a higher SYNTAX score, a left ventricular

ejection fraction of <40%, insulin use, and severe lesion calcification. The J-CTO score was not identified as a predictor of 30-day MACE. Multivariate analysis revealed that the SYNTAX score > 22 and left ventricular ejection fraction <40% were independent predictors of 30-day MACE after PCI. The SYNTAX score demonstrated an adequate discriminatory capacity to distinguish between patients with and without 30-day MACE (C = 0.75, p = 0.001, Figure 2-B)

DISCUSSION

The present study is the first study to evaluate SYNTAX score as a predictor of the risk of procedural failure and 30-day MACE in CTO-PCI, and identified the following are the major findings. Firstly, the SYNTAX score was significantly associated with an increased risk of unsuccessful PCI, though the J-CTO score demonstrated the more superiority for predicting unsuccessful CTO-PCI. A higher SYNTAX score (for each 10-unit increase) was independently predictive of procedural failure. Secondly, a higher SYNTAX score was also associated with a significant increase in the risk of 30-day MACE after PCI, although the J-CTO score failed to predict the occurrence of MACE.

Procedural failure and SYNTAX score

Regarding to cause of unsuccessful PCI in CTO patients, previous studies have reported several

factors, including the presence of severe calcification, side branches at the entry of an occlusion, tortuosity of the occluded vessel, longer occlusion length, and a poorly visualized distal vessel.⁸⁻¹⁰

On the basis of the lesion characteristics at the culprit site, the J-CTO score is a very simple and useful clinical tool when evaluating difficulty before embarking the procedure.¹¹ Consistent with previous studies, our study also supported the utility of the J-CTO score.^{11, 19} Revascularization from retrograde approach through collateral channels is one of PCI techniques to improve the success rate of CTO-PCI. Retrograde approach is performed with a microcatheter-supported slippery guide-wire from the collateral-supplying vessel through the collaterals into the distal vessel. Then, the guide-wire is advanced proximally through the CTO to the antegrade guiding catheter. If the retrograde guide-wire enters a false lumen, controlled antegrade and retrograde subintimal tracking (CART) technique is attempted. The technique allows creating limited subintimal tracking only in the area of the CTO lesion to connect retrograde and antegrade guidewires.^{20,21} Unlike the conventional antegrade approach, retrograde CTO-PCI must assess the entire coronary tree because the technique must gain access through well-developed collateral coronary arteries. The new SYNTAX score system is an angiographic tool that can quantify the degree of atherosclerosis in the entire coronary arterial tree, including that in the culprit lesions.¹⁷ Therefore we postulated that in current CTO-PCI strategies, preprocedural anatomical evaluation with the SYNTAX score may be useful in judicious decision-making for patients with CTO requiring revascularization. In the present

study, we observed a strong relationship between high SYNTAX scores and the risk of procedural failure. There are 2 possible explanations for this observation in our opinion. First, the CART method was not possible because of the complexity of the disease in the coronary artery providing a collateral to the occluded lesion. Second, even if both antegrade and retrograde approaches were available, the complexity of the whole coronary arterial tree might cause hemodynamic instability and require a longer procedural time. Indeed, patients with high SYNTAX scores in our study required significantly longer radiation time and significantly more contrast media. These factors may subsequently cause procedural complications and thrombotic events. Moreover, the residual SYNTAX score of high SYNTAX group was significantly higher compared to those of low SYNTAX group. Therefore, this higher residual SYNTAX score may have an influence on long-term outcomes.

30-day MACE and SYNTAX score

As expected, CTO patients in the present study had high SYNTAX scores (median value 24). The SYNTAX trial demonstrated that, in multiple vessel disease the included left main artery disease, coronary artery bypass graft would be the preferred revascularization strategy in patients with intermediate (> 22) or high (> 33) SYNTAX scores.¹² Therefore, we set the cutoff point for the SYNTAX score at 22 when investigating the efficacy and safety of PCI in complex CTO. We found

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3 that additional stent implantation because of major collateral vessel injury was significantly higher in
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6 patients with high SYNTAX scores when compared with those with low SYNTAX scores. The
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9 30-day MACE was also significantly higher rate in patients with high SYNTAX scores; this was
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12 largely because of the difference in the myocardial infarction rate, which may had been because of
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15 either myocardial injury along the collateral vessel used for retrograde crossing or side branch
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18 occlusion. In the present study, most patients suffered non-Q wave myocardial infarction indicating
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21 limited myocardial injury that did not translate to 30-day mortality. However, a recent study reported
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24 that periprocedural myocardial injury after CTO-PCI was associated with worse subsequent clinical
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27 outcomes during mid-term follow-up.²² In that study, periprocedural myocardial injury and
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30 myocardial infarction were observed in 8.6% and 2.1%, respectively, whereas we identified
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33 myocardial infarction in 6.3% of patients with high SYNTAX scores. This might indirectly suggest
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36 that CTO-PCI in patients with high SYNTAX scores is related with poor prognosis regardless of
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39 CTO-PCI success. Therefore, the present findings together with the original SYNTAX trial may
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42 suggest that patients with high SYNTAX scores and adequate distal vessel beds are more appropriate
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45 candidates for coronary artery bypass grafting, except in those with a high surgical risk or PCI
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48 feasibility.
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54 The present study has several limitations. First, it was a single-center study with a small
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57 sample size. Therefore confounding factors might have influenced the results; for example, certain
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3 specialized CTO techniques might have differed among operators, and we know that the success rate
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6 of CTO-PCI is highly operator dependent. Also, specialized CTO-PCI equipment such as guidewires,
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9 and microcatheters changed over the course of the study, because patients with CTO were enrolled
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12 between January 2005 and April 2013. Improvements in the instruments themselves might have
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15 either improved the success rate of CTO-PCI or increased the risk of procedural complications such
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18 as myocardial injury and coronary perforation. Similarly, the first-generation DES (using sirolimus
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21 and paclitaxel) were used 67% of successfully implanted patients in this study. However, to our
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24 knowledge, there has been no other study evaluating the procedural success and MACE after
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27 CTO-PCI using the SYNTAX score and the J-CTO score.
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32 In conclusion, the SYNTAX score appeared predictive of procedural failure in patients
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35 undergoing CTO-PCI. Furthermore, we observed that high SYNTAX scores were strongly
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38 associated with increased risk of 30-day MACE. Although we did not provide insights with regard to
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41 the long-term outcomes in patients with high SYNTAX scores, it appears that the SYNTAX score
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44 was useful for clinical decision making in patients with complex CTO to minimize PCI-related
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47 procedural complications and thrombotic events. At present, careful consideration by a “heart team”
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50 would be warranted when revascularization strategies are needed in complex CTO patients,
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53 especially those with high SYNTAX scores.
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FIGURE LEGENDS

Figure 1: Kaplan–Meier curves depicting the survival from major adverse cardiac events according to the SYNTAX score. Patients were divided into 2 groups: low (≤ 22) and high (> 22) SYNTAX.

SYNTAX (SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery)

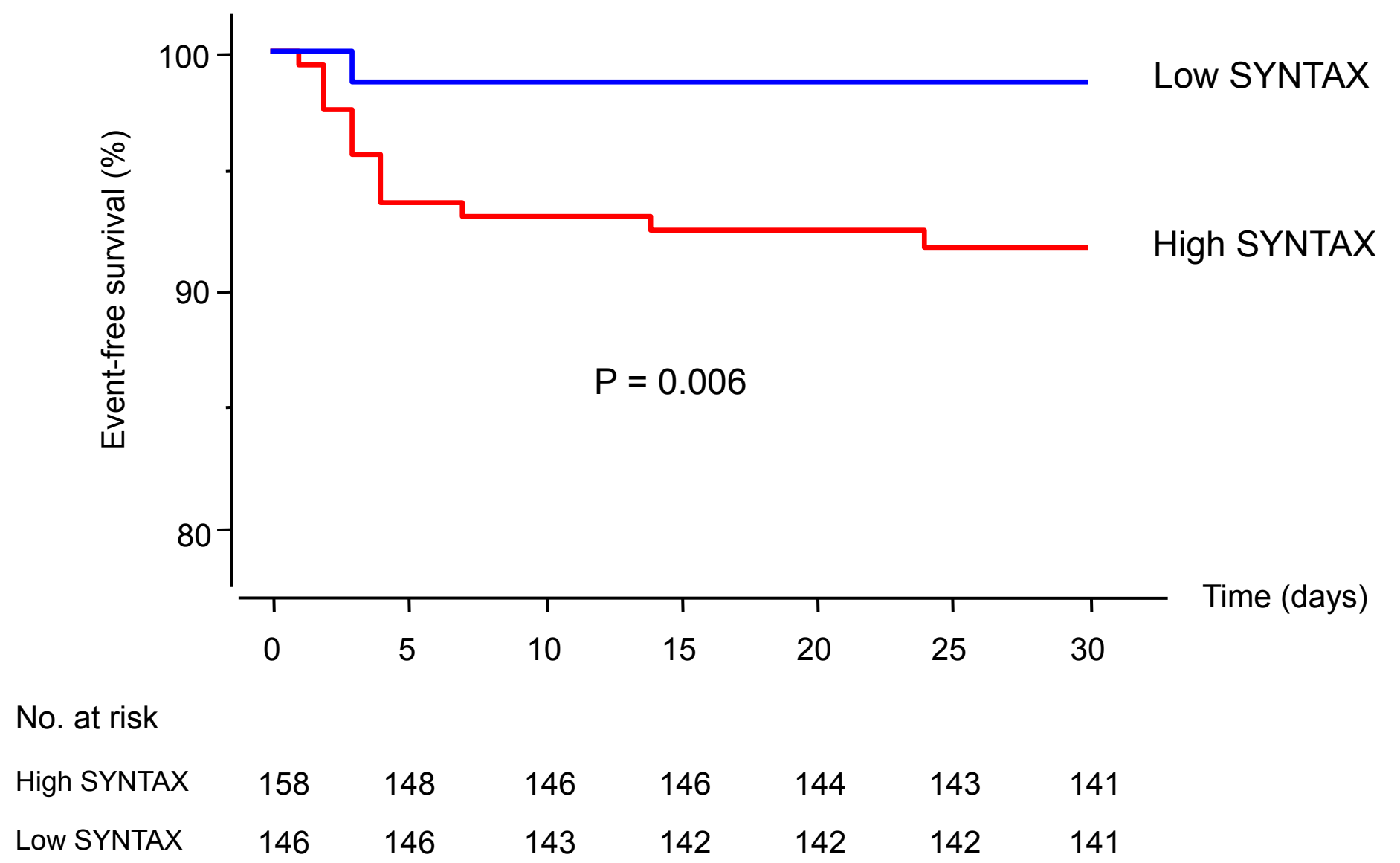
Figure 2: (A) Receiver-operating characteristic curve for predicting procedural failure by the SYNTAX and the J-CTO scores. (B) Receiver-operating characteristic curve for predicting the 30-day MACE by the SYNTAX and the J-CTO scores

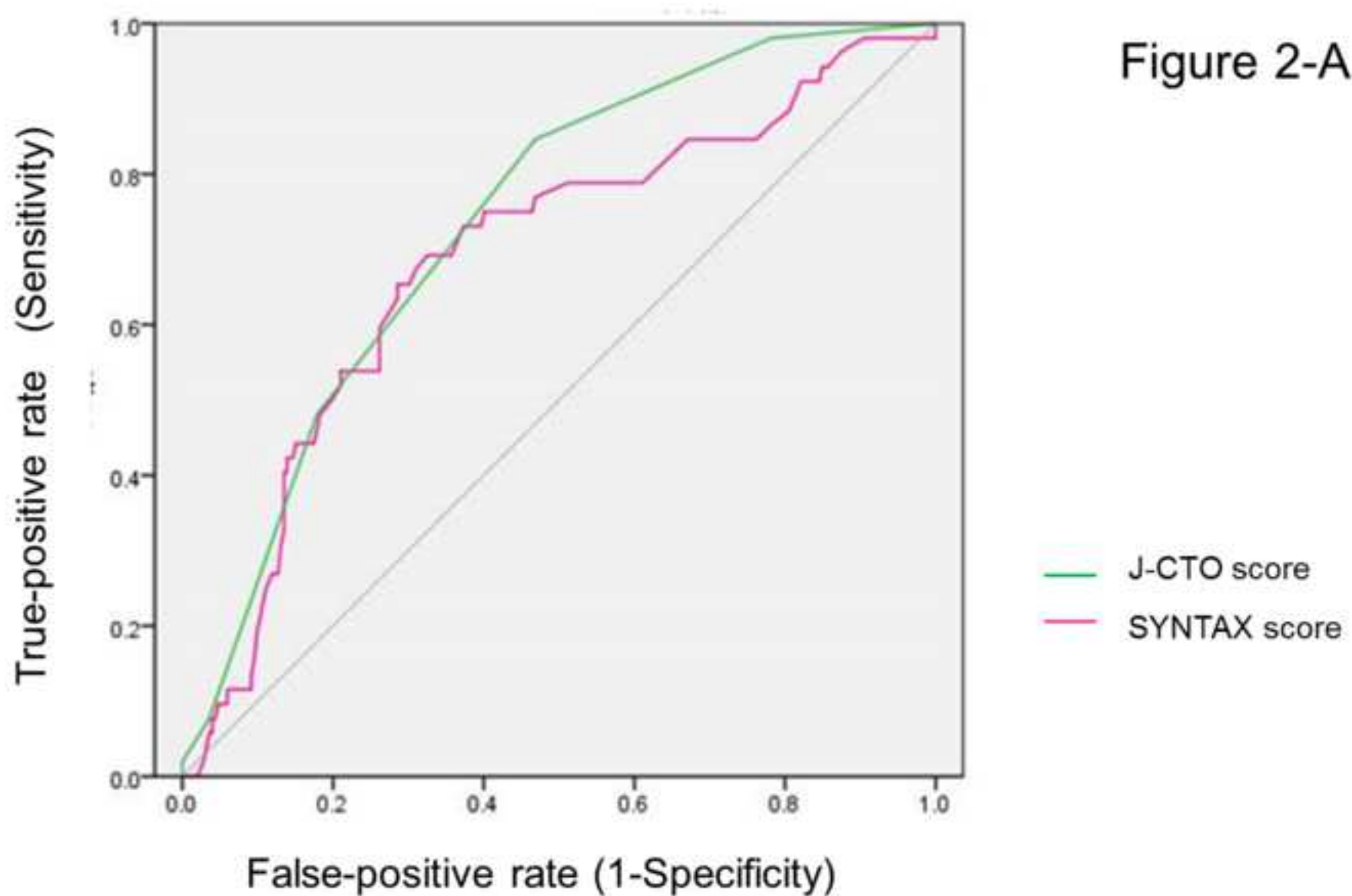
SYNTAX: (SYNergy between percutaneous coronary intervention with TAXus and cardiac surgery),

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Figure 1

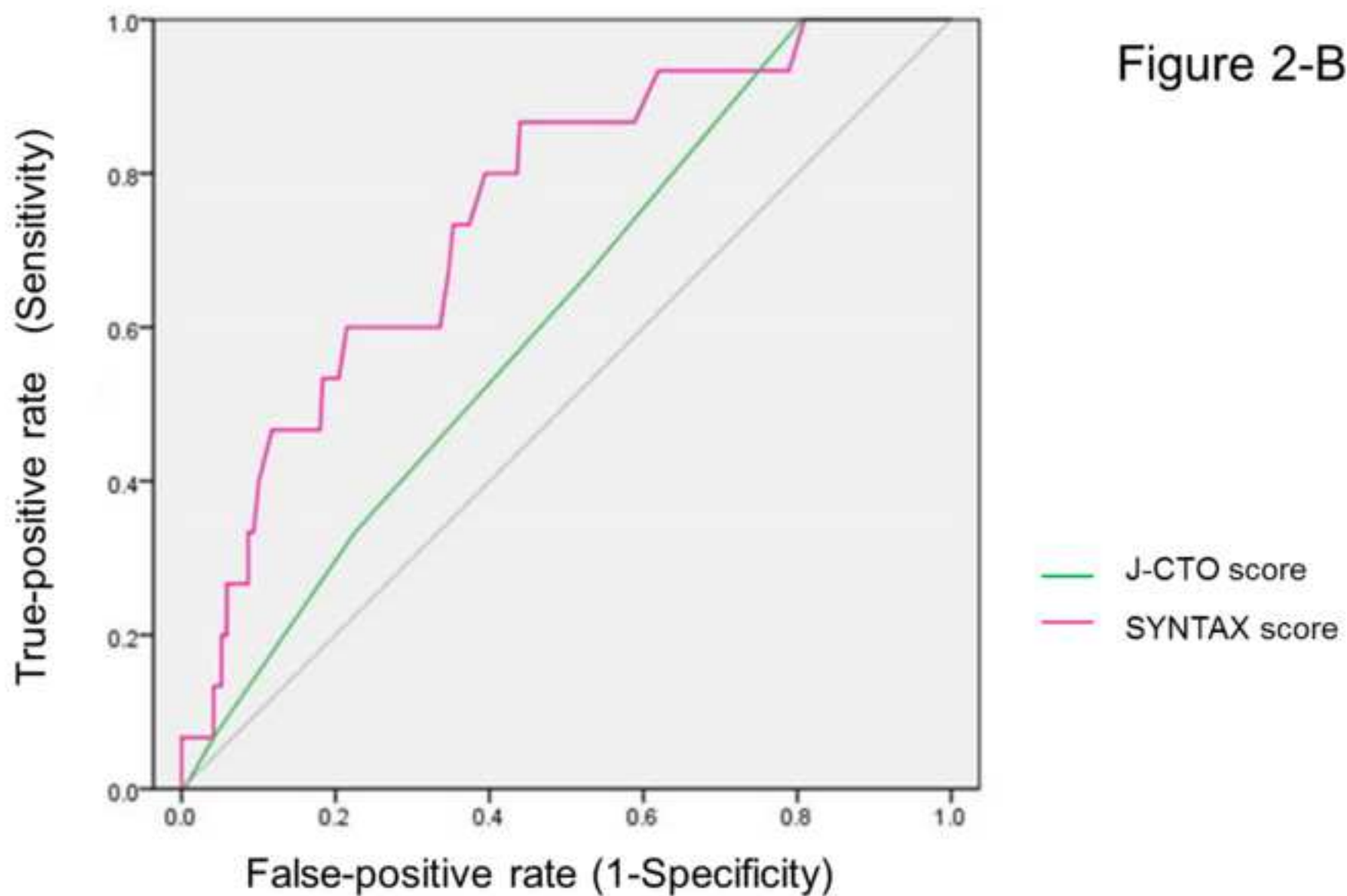
Figure 1 Major adverse cardiac events during 30 days





J-CTO score: C-statistic (AUC), 0.736 (95%CI 0.669 - 0.804), $P < 0.0001$

SYNTAX score: C-statistic (AUC), 0.687 (95%CI 0.606 - 0.769), $P < 0.0001$



J-CTO score: C-statistic (AUC), 0.616 (95%CI 0.489 - 0.743), $P=0.130$

SYNTAX score: C-statistic (AUC), 0.750 (95%CI 0.632 - 0.868), $P=0.001$

Table 1. Baseline patient characteristics according to high or low SYNTAX score

	High SYNTAX (>22) n=158	Low SYNTAX (≤ 22) n=146	p value
Age, years	70 ± 10	66 ± 10	0.003
Men	131 (83%)	126 (86%)	0.43
BMI, kg/m ²	23.6 ± 3.2	24.5 ± 4.1	0.05
BMI > 25 kg/m ²	49 (31%)	54 (37%)	0.28
Hypertension	145 (92%)	126 (86%)	0.14
Diabetes mellitus	100 (63%)	65 (45%)	0.001
Insulin user	19 (12%)	9 (6%)	0.11
Dyslipidemia	123 (78%)	123 (84%)	0.19
Killip classification ≥ 2	8 (5%)	6 (4%)	0.79
e-GFR, ml/min	74 ± 32	80 ± 31	0.08
Chronic kidney disease	45 (28%)	30 (21%)	0.11
Previous myocardial infarction	94 (59%)	94 (64%)	0.41
Stable angina pectoris	140 (89%)	129 (88%)	0.95
Acute coronary syndrome	18 (11%)	17 (12%)	0.95
LVEF, %	54 ± 16	56 ± 14	0.24
LVEF < 40%	34 (22%)	22 (15%)	0.18
Medications			
Dual antiplatelet drugs	157 (99%)	145 (99%)	0.96
Statins	133 (84%)	126 (86%)	0.63

ACE-I/ARB	115 (73%)	108 (74%)	0.90
β-blockers	58 (37%)	46 (32%)	0.40
Oral diabetic drugs	45 (28%)	29 (20%)	0.08

Data are presented as number of patients (%) or mean ± SD. SYNTAX: The SYNergy between

percutaneous intervention with TAXus drug-eluting stents and cardiac surgery,

BMI: body mass index,

e-GFR: estimated glomerular filtration rate, LVEF: left ventricular ejection fraction

ACE-I: angiotensin converting enzyme inhibitors,

ARB: angiotensin receptor blockers

Table 2. Angiographic and procedural characteristics according to high or low SYNTAX score

	High SYNTAX	Low SYNTAX	p value
	(>22)	(≤ 22)	
	n=158	n=146	
Target lesion			
Left main	13 (8%)	3 (2%)	0.02
Left anterior descending	66 (42%)	31 (21%)	0.0002
Left circumflex	16 (10%)	29 (20%)	0.03
Right	63 (40%)	83 (57%)	0.004
Number of disease coronary arteries			
One vessel	33 (21%)	73 (50%)	<0.0001
Two vessels	64 (40%)	54 (37%)	0.56
Three vessels	61 (39%)	19 (13%)	<0.0001
SYNTAX score	35.6 ± 9.8	15.7 ± 5.3	<0.0001
Refernce diameter > 3.0 mm	76 (48%)	103 (71%)	<0.0001
Bifurcated lesion	54 (34%)	44 (30%)	0.53
Previous attmpt	10 (6%)	17 (12%)	0.11
Blunt stump type	35 (22%)	32 (22%)	0.96
Severe calcified lesion	69 (44%)	39 (27%)	0.003
Bending > 45 degree lesion	53 (34%)	59 (40%)	0.24
Lesion length > 20mm	94 (59%)	84 (58%)	0.64
J-CTO score	1.7 ± 1.1	1.5 ± 1.2	0.52
Retrograde collateral grade ≥2	131 (83%)	123 (84%)	0.76
Bridge collateral	81 (51%)	56 (38%)	0.03

Used route			
Antegrade approach	142 (90%)	132 (90%)	0.88
Retrograde approach	26 (16%)	16 (11%)	0.22
Final TIMI flow grade 3	119 (75%)	134 (92%)	0.0001
Drug-eluting stent	114 (72%)	122 (84%)	0.02
Bare-metal stent	5 (3%)	4 (3%)	0.91
Balloon angioplasty	1 (0.6%)	8 (5%)	0.03
Number of stents	1.8 ± 1.2	1.8 ± 1.0	0.98
Stent diameter, mm	3.0 ± 0.3	3.1 ± 0.3	0.06
Total stent length, mm	54 ± 28	50 ± 26	0.27

Data are presented as number of patients (%) or mean ± SD. SYNTAX: The SYNergy between percutaneous intervention with TAXus drug-eluting stents and cardiac surgery, TIMI: the Thrombolysis in Myocardial Infarction

Table 3

Table 3. Overall procedural success rate and detailed clinical outcomes within 30 days

	Overall	High SYNTAX	Low SYNTAX	p value*
	n = 304	(>22) n=158 (%)	(≤ 22) n=146 (%)	
Procedural success	252 (82.9%)	118 (74.7%)	134 (91.8%)	<0.0001
Residual SYNTAX score	4.6 ± 7.5	6.0 ± 8.9	2.2 ± 4.3	0.001
Radiation time, min	68 ± 39	78 ± 37	58 ± 38	<0.0001
Contrast media, ml	198 ± 77	219 ± 81	172 ± 64	<0.0001
Any complications related procedure	33 (10.9%)	23 (14.6%)	10 (6.8%)	0.04
Major collateral vessel injury *	11 (3.6%)	9 (5.7%)	2 (1.4%)	0.06
Coronary perforation	24 (7.9%)	16 (10.1%)	8 (5.5%)	0.14
Tamponade	7 (2.3%)	4 (2.5%)	3 (2.1%)	0.78
30-day outcomes				

MACE	15 (4.9%)	13 (8.2%)	2 (1.4%)	0.007
Cardiac death	1 (0.3%)	1 (0.6%)	0 (0%)	0.36
Myocardial infarction	12 (3.9%)	10 (6.3%)	2 (1.4%)	0.04
Q-wave myocardial infarction	2 (0.7%)	2 (1.3%)	0 (0%)	0.50
Target vessel revascularization	4 (1.3%)	4 (2.5%)	0 (0%)	0.12

P value *: High SYNTAX vs. Low SYNTAX,

SYNTAX: The SYNergy between percutaneous intervention with TAXus drug-eluting stents and cardiac surgery,

Major collateral vessel injury *: additional stent implantation due to major collateral vessel injury

MACE; major adverse cardiac events

Table 4

Table 4. predictors of procedural failure on multivariate analysis

variables	univariate	p value	multivariate	p value
	Odd ratio (95%CI)		Odd ratio (95%CI)	
SYNTAX score > 22	3.79 (1.90-7.55)	0.0002	3.33 (1.44-7.74)	0.005
J CTO score (per 1-unit increase)	2.24 (1.65-3.04)	<0.0001	3.64 (1.24-10.66)	0.019
Reference vessel diameter > 3mm	0.49 (0.27-0.89)	0.02	0.50 (0.25-0.99)	0.047
Diabetes mellitus	2.15 (1.13-4.06)	0.02		
Severe calcification	3.71 (1.99-6.89)	<0.0001		
Left main disease	3.16 (1.09-9.11)	0.03		
3 vessel coronary disease	2.26 (1.11-4.60)	0.03		
Blunt stump type	1.96 (1.02-3.79)	0.04		
bending > 45 degree	2.33 (1.27-4.27)	0.006		
Lesion length > 20mm	2.67 (1.34-5.32)	0.005		

CI=confidence interval

SYNTAX: The SYNergy between percutaneous intervention with TAXus drug-eluting stents and cardiac surgery,

Table 5

Table 5. predictors of major adverse cardiac events on multivariate analysis

variables	Univariate	p value	Multivariate	p value
	Odd ratio (95%CI)		Odd ratio (95%CI)	
SYNTAX score > 22	6.46 (1.43-29.12)	0.015	4.80 (1.03-22.42)	0.046
Left ventricular ejection fraction <40%	4.29 (1.49-12.37)	0.007	3.86 (1.28-11.67)	0.017
Insulin user	4.00 (1.18-13.53)	0.03		
Severe calcification	2.88 (1.00-8.32)	0.05		

CI=confidence interval

SYNTAX: The SYNergy between percutaneous intervention with TAXus drug-eluting stents and cardiac surgery,