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Original Article

SYNTAX Score 2020 Risk Estimates Between PCI and CABG in Coronary Artery Disease: A Descriptive Study

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Abstract

Background: The SYNTAX Score 2020 is a validated tool that combines anatomical and clinical parameters to estimate long-term outcomes in Coronary Artery Disease (CAD) and guide revascularization decisions between Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Grafting (CABG). Although its components are well-defined, further studies are needed to better describe how clinical variables are reflected in risk predictions across diverse populations, including those in Indonesia.

Methods: This descriptive observational, cross-sectional study included 115 patients with angiographically confirmed Three-vessel Disease (3VD) or Left Main Coronary Artery Disease (LMCAD) treated at dr. Doris Sylvanus Regional General Hospital, Palangka Raya, Indonesia, between January and June 2025. The anatomical SYNTAX Score I and SYNTAX Score 2020 were calculated using the official application. Predicted long-term risks for PCI and CABG were summarized descriptively and compared within individual patients.

Results: Predicted risks showed wide inter-individual variability and were generally higher under PCI than CABG. Predicted risks did not always align with anatomical risk assessment alone; differences became apparent when clinical variables were incorporated. Higher predicted risks and larger differences between PCI and CABG were more commonly observed in patients with older age, reduced Left Ventricular Ejection Fraction (LVEF), impaired renal function, greater anatomical complexity, insulin-treated Diabetes Mellitus (DM), and Peripheral Vascular Disease (PVD). Patients without DM or with non–insulin-treated DM were more frequently represented among those with lower predicted risk strata. When comparing PCI and CABG scenarios, most patients remained within the same predicted risk stratum, whereas shifts to higher predicted risk strata occurred more often under PCI.

Conclusions: SYNTAX Score 2020–predicted risks show marked inter-individual variability between PCI and CABG scenarios. Greater clinical and anatomical complexity tended to coincide with higher predicted risks and larger differences between revascularization strategies. Risk stratification based solely on anatomical assessment may be reclassified once patient-specific clinical variables are incorporated. These findings support the use of the SYNTAX Score 2020 to complement clinical judgment and multidisciplinary revascularization decision-making.

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Keywords: SYNTAX Score 2020, Coronary Artery Disease, Coronary Revascularization, Interventional Cardiology

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Introduction

Coronary Artery Disease (CAD) is a major global health issue and a leading cause of cardiovascular death. Cardiovascular diseases remain a leading cause of death worldwide, with a substantial burden in Southeast Asia, including Indonesia.[1] Patients with Three-Vessel Disease (3VD) or Left Main Coronary Artery Disease (LMCAD) involvement represent a clinically complex population in which revascularization decisions carry important long-term prognostic implications. In such patients, selecting an optimal revascularization strategy requires careful consideration of both coronary anatomy and individual clinical risk profiles.[2-3]

Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Grafting (CABG) are established revascularization strategies for complex CAD. Contemporary clinical practice guidelines emphasize that the choice between PCI and CABG should be guided by a multidisciplinary Heart Team approach that integrates anatomical complexity with clinical characteristics rather than relying on anatomical assessment alone.[2-3] This shift reflects the recognition that long-term outcomes following revascularization are influenced by a combination of lesion complexity and patient-specific clinical factors.

The SYNTAX Score was originally developed to quantify coronary anatomical complexity and support revascularization decision-making. Subsequent iterations, including the SYNTAX Score II and the updated SYNTAX Score 2020, expanded this concept by incorporating key clinical variables alongside anatomical features. SYNTAX Score 2020 provides individualized, strategy-specific estimates of 10-year mortality and 5-year major adverse cardiovascular events (MACE) for both PCI and CABG scenarios, offering a framework for contextualized long-term risk assessment at the patient level.[4-5]

Although the components of the SYNTAX Score 2020 are well defined and the model has undergone external validation, information on how clinical characteristics are reflected in its predicted risk estimates across diverse populations remains limited, particularly in Indonesia. In clinical practice, interpretation of revascularization risk often begins with anatomical assessment, as reflected by the SYNTAX Score I; however, incorporation of patient-specific clinical variables may lead to different risk perspectives when estimating long-term outcomes for PCI and CABG. Differences in predicted risks when moving beyond anatomical assessment alone to an integrated clinical framework; comparisons of predicted risks between PCI and CABG scenarios; distributions of absolute risk levels; and their alignment with anatomical complexity and accompanying clinical profiles are less frequently reported. Examining predicted risks across these complementary frameworks may therefore provide additional insights when weighing revascularization strategies within a multidisciplinary clinical context. Accordingly, the present study aimed to provide a descriptive evaluation of SYNTAX Score 2020–predicted risks in this population.

Methods

Study Design and Population

This descriptive observational cross-sectional study was conducted at dr. Doris Sylvanus General Hospital, Palangka Raya, Central Kalimantan, Indonesia. Patients with angiographically 3VD or LMCAD were enrolled between January and June 2025. A non-probability consecutive sampling approach was used, in which all patients who met the inclusion criteria and did not fulfill any exclusion criteria during the study period were included.

The inclusion criteria were the presence of obstructive 3VD or LMCAD on angiography, according to predefined criteria for significant stenosis, and the availability of sufficiently complete clinical and angiographic data to calculate the anatomical SYNTAX Score I and SYNTAX Score 2020. The exclusion criteria included missing key clinical or interview-based variables required for SYNTAX Score 2020 estimation, as well as patients who could not be interviewed.

During the study period, 115 patients fulfilled the eligibility criteria and were included in the descriptive analysis. Most patients presented with Acute Coronary Syndrome (ACS), including ST-segment Elevation Myocardial Infarction (STEMI), Non-ST-segment Elevation Myocardial Infarction (NSTEMI), and unstable angina, whereas a smaller proportion presented with stable angina.

Data Collection and Clinical Assessment

Clinical data were collected from hospital records and patient interviews during hospitalization and follow-up visits. The interviews verified the participants' demographic characteristics, smoking history, and comorbidities using standardized forms.

Diabetes Mellitus (DM) status was categorized as no diabetes; non-insulin-treated diabetes; or insulin-treated diabetes (defined according to standard diagnostic criteria when laboratory data were

available; HbA1c ≥6.5%, fasting plasma glucose ≥126 mg/dL, or random plasma glucose ≥200 mg/dL, and/or a documented physician diagnosis and/or current use of glucose-lowering medication).[6]

Peripheral Vascular Disease (PVD) (recorded primarily based on a history of physician-diagnosed PVD and/or typical symptoms of claudication or critical limb ischemia, and was cross-checked against medical records when available)[7] and Chronic Obstructive Pulmonary Disease (COPD) (defined as a physician-documented diagnosis when available and supplemented by a structured history of prior diagnosis and long-term inhaler use). Objective confirmatory testing (ankle–brachial index or vascular imaging for PVD and spirometry for COPD) was not routinely available for all patients. Therefore, misclassification and underdiagnosis, particularly for COPD and PVD, were considered possible. Renal function was assessed using serum creatinine levels measured with an automated chemistry analyzer (TMS 50i). Creatinine Clearance (CrCl) was calculated using the Cockcroft–Gault equation. Laboratory measurements were obtained primarily from baseline samples collected before coronary angiography as part of the routine clinical evaluation.

Left Ventricular Ejection Fraction (LVEF) was assessed using transthoracic echocardiography performed during index hospitalization. Echocardiographic examinations were conducted using Philips EPIQ CVx 2D and Philips Sparq systems. LVEF measurements were obtained using the Teichholz method by two independent operators blinded to the SYNTAX Score 2020–predicted risk estimates and other study outputs. Echocardiography could be performed either before or after coronary angiography or revascularization, depending on the clinical workflow.

The anatomical SYNTAX Score I was calculated under cardiologist supervision using the official SYNTAX Score 2020 application[8], in accordance with quantitative coronary lesion measurements obtained through Quantitative Coronary Angiography (QCA) (Allura FC system) to ensure accuracy and consistency in evaluating lesion severity and anatomical complexity. Stenosis was classified as significant when there was a luminal narrowing of at least 70% in one angiographic projection, 50% or more in two projections, or 50% or more in the primary coronary arteries.[9] Anatomical coronary complexity was subsequently categorized using the SYNTAX Score I into low (≤22), intermediate (23–32), and high (≥33) anatomical risk groups, in accordance with the original SYNTAX trial classification and current guideline-based frameworks.[3]

The SYNTAX Score 2020 was calculated using the official application-based calculator (SYNTAX Score 2020, Version 1.3.3).[8] The calculator integrates anatomical SYNTAX Score I with predefined clinical variables, including age, smoking status, DM status, PVD, CrCl, COPD, and coronary anatomical category (3VD or LMCAD), to generate model-based predicted risks.

Study Variables

The study variables comprised clinical and anatomical parameters required of calculate the SYNTAX Score 2020, as well as the resulting model-based predicted risks. Clinical variables included age (years), current smoking status (yes/no), DM status (categorized as no diabetes, non–insulin-treated diabetes, and insulin-treated diabetes), PVD (yes/no), COPD (yes/no), CrCl (mL/min), and LVEF (%). Anatomical variables included the anatomical SYNTAX Score I (points), which was analyzed both as a continuous variable and as predefined anatomical risk categories, and the coronary disease category, defined as 3VD or LMCAD.

Outcome Definitions and Statistical Analysis

The primary outcomes were SYNTAX Score 2020–predicted risks, including predicted 10-year all-cause mortality (%) and 5-year MACE (%), generated separately for PCI and CABG scenarios using the SYNTAX Score 2020 calculator. These outcomes represent model-derived predicted risks and do not reflect the observed clinical events or actual patient outcomes.

To explore how the interpretation of revascularization risk may differ when assessment is based on anatomical disease burden alone versus when patient-specific clinical variables are incorporated, predicted risks derived from the SYNTAX Score 2020 were descriptively examined in relation to anatomical risk stratification defined by the SYNTAX Score I. This approach allowed characterization of scenarios in which anatomical assessment alone and integrated clinical assessment would yield different perspectives on the relative PCI and CABG risks.

To facilitate within-patient comparison between revascularization strategies, paired differences in predicted risks were calculated as Δ = PCI − CABG. This direction was intentionally selected to enhance clinical interpretability, whereby positive Δ values indicated a higher predicted risk under PCI than CABG, and negative values indicated a

lower predicted risk under PCI. Using CABG as the reference strategy aligns with contemporary guideline frameworks for complex CAD and with the comparative structure of the SYNTAX Score 2020 model[2-4], without implying the clinical superiority of either revascularization strategy. Based on the direction of Δ, the predicted revascularization profiles were descriptively classified as PCI-favored (Δ < 0), CABG-favored (Δ > 0), or equal (Δ = 0). Paired differences were categorized to indicate the direction and magnitude of predicted risk differences between PCI and CABG. Categories included differences indicating a lower predicted risk with PCI (PCI-favored; Δ < 0), minimal differences indicating similar predicted risks (equipoise; 0–<2%) and progressively larger differences indicating a lower predicted risk with CABG (CABG-favored), categorized as small (2–<5%), moderate (5–<10%), and large (≥10%). These categories were investigator-defined, applied solely for descriptive purposes, and not derived from guideline-recommended thresholds or outcome-based cutoffs.

In addition to paired differences, absolute predicted risks for 10-year mortality and 5-year MACE were further grouped into investigator-defined ordinal strata (<10%, 10–<20%, 20–<40%, and ≥40%), representing increasing levels of predicted risk, to facilitate descriptive visualization and comparison across clinical profiles. These ordinal strata were not provided by the SYNTAX Score 2020 calculator and were used exclusively for descriptive interpretation, including visualization of risk shifting between PCI and CABG scenarios.

Risk shifting was defined descriptively as stability (classification within the same predicted risk stratum under both PCI and CABG), upward shifting (classification into a higher predicted risk stratum under PCI), or downward shifting (classification into a lower predicted risk stratum under PCI). These classifications represent model-based reclassifications.

All analyses were performed on the full study population (n = 115) and were descriptive. Continuous variables were summarized as mean ± standard deviation or range, as appropriate, and categorical variables were presented as absolute frequencies and percentages. No inferential statistical testing, hypothesis testing, correlation analysis, or multivariable modeling was conducted.

Descriptive tables, cross-tabulations, box-and-whisker plots, and heatmap-style visualizations were generated using Microsoft Excel. Pivot tables were used to summarize the distributions of predicted risk differences and risk strata across clinical characteristics, and conditional formatting was applied to create heatmap-style displays for visualization. Statistical summaries were cross-checked using IBM SPSS Statistics version 31.

Table 1. Patient characteristics and SYNTAX Score 2020 input variables.

Parameter	N/Range	Percentage/ Mean ± SD
Gender		
Male	92	80.0
Female	23	20.0
Clinical presentation		
STEMI	51	44.0
NSTEMI	18	16.0
Unstable angina pectoris	43	37.0
Stable angina pectoris	3	3.0
Current smoking		
No	33	28.7
Yes	82	71.3
Peripheral Vascular Disease (PVD)		
No	83	72.2
Yes	32	27.8
Chronic Obstructive Pulmonary Disease (COPD)		
No	115	100.0
Yes	0	0.0

Diabetes mellitus (DM)		
No	77	67.0
Yes, Non-Insulin	14	12.2
Yes, Insulin	24	20.8
SYNTAX Score I		
Low risk (≤ 22)	45	39.1
Intermediate risk (23 – 32)	45	39.1
High risk (≥ 33)	25	21.8
Coronary anatomical category		
Three-vessel disease (3VD)	97	84.3
Left main coronary artery disease (LMCAD)	18	15.7
Age (years)	36 - 83	58.2 ± 9.5
Creatinine clearance (mL/min)	12.0 - 136.0	65.6 ± 23.5
Left ventricular ejection fraction (%)	21.0 - 78.8	47.0 ± 13.1
SYNTAX Score I (points)	8.0 - 47.5	25.3 ± 8.7
SYNTAX Score 2020-predicted risks (%)		
10 year mortality (CABG, %)	3.8 - 97.4	28.6 ± 22.1
10 year mortality (PCI, %)	4.4 - 99.9	34.8 ± 24.4
5 year MACE (CABG, %)	4.0 - 70.3	19.1 ± 13.3
5 year MACE (PCI, %)	4.7 - 92.8	25.5 ± 17.0

Note. Variables presented include clinical and anatomical factors incorporated into the SYNTAX Score 2020 risk prediction model. 3VD: Three-vessel disease ; CABG: Coronary Artery Bypass Grafting; COPD: Chronic Obstructive Pulmonary Disease; LMCAD: Left Main Coronary Artery Disease; NSTEMI: Non–ST-segment Elevation Myocardial Infarction; PCI: Percutaneous Coronary Intervention; PVD: Peripheral Vascular Disease; STEMI: ST-segment Elevation Myocardial Infarction.

Results

Patient Characteristics and SYNTAX Score 2020 Input Profiles

A total of 115 patients who fulfilled the predefined inclusion criteria were included in the study. Patient characteristics and variables incorporated into the SYNTAX Score 2020 calculator are summarized in Table 1. The study population was predominantly male, and ACS constituted the most common clinical presentation, with STEMI being the most frequent subtype.

The SYNTAX Score 2020 model integrates coronary anatomical features, including the presence of 3VD or LMCAD and anatomical complexity quantified by SYNTAX Score I, together with selected clinical variables, namely age, DM status, smoking status, PVD, and CrCl. These input variables demonstrated broad distributions in the present population, reflecting heterogeneity in both anatomical burden and clinical risk profiles.

Accordingly, the SYNTAX Score 2020–derived predicted risks showed substantial inter-individual variability. Predicted 10-year mortality and 5-year MACE varied widely across both CABG and PCI scenarios, with higher mean predicted risks observed under PCI.

Predicted Revascularization Risk Across Anatomical Risk Categories

Predicted revascularization risk derived from SYNTAX Score 2020 was evaluated across anatomical complexity strata defined by SYNTAX Score I (Table 2). Revascularization profiles were determined based on the direction of paired predicted risk differences between PCI and CABG, derived from both SYNTAX Score 2020–predicted risks 10-year mortality and 5-year MACE, with positive Δ values indicating a higher predicted risk under PCI (CABG-favored), negative Δ values indicating a lower predicted risk under PCI (PCI-favored), and Δ = 0 indicating an equal predicted risk.

Among patients categorized as low-risk by the SYNTAX Score I, all were CABG-favored. In the intermediate-risk group, the majority of patients were CABG-favored, and only a small proportion were either PCI-favored of had equal predicted risks for PCI and CABG. Similarly, among patients classified as high-risk by SYNTAX Score I, all demonstrated CABG-favored based on SYNTAX Score 2020–derived predicted risks.

Table 2. Revascularization classification based on SYNTAX Score 2020–predicted risks across anatomical SYNTAX Score I risk categories.

SYNTAX Score I category	SYNTAX Score 2020 revascularization classification		
	Equal	PCI-favored	CABG-favored
	n (%)	n (%)	n (%)
Low risk	0 (0.0)	0 (0.0)	45 (100.0)
Intermediate risk	1 (2.2)	1 (2.2)	43 (95.6)
High risk	0 (0.0)	0 (0.0)	25 (100.0)

Note. Anatomical risk was categorized using SYNTAX Score I as low (≤22), intermediate (23–32), or high (≥33). Classification was based on SYNTAX Score 2020 predicted risks. CABG-favored indicates higher predicted risk under PCI than CABG (Δ = PCI − CABG > 0), PCI-favored indicates lower predicted risk under PCI (Δ < 0), and equal indicates identical predicted risks under PCI and CABG (Δ = 0). Values represent number (percentage) of patients within each anatomical category. CABG: Coronary Artery Bypass Grafting; PCI: Percutaneous Coronary Intervention.

Table 3. SYNTAX Score 2020–predicted 10-year mortality and 5-year MACE under PCI and CABG scenarios and corresponding paired differences.

Outcome of SYNTAX Score 2020	Range	Mean ± SD
Predicted 10-year mortality (%)		
CABG	3.8 - 97.4	28.6 ± 22.1
PCI	4.4 - 99.9	34.8 ± 24.4
Δ (PCI – CABG)	-0.4 - 20.7	6.2 ± 4.2
Predicted 5-year MACE (%)		
CABG	4.0 - 70.3	19.1 ± 13.3
PCI	4.7 - 92.8	25.5 ± 17.0
Δ (PCI – CABG)	-0.3 - 22.5	6.5 ± 4.8

Note. Predicted risks were generated using the SYNTAX Score 2020 calculator and represent model-based estimates rather than observed clinical outcomes. Δ indicates within-patient paired differences between PCI and CABG predicted risks (Δ = PCI − CABG). CABG: Coronary Artery Bypass Grafting; PCI: Percutaneous Coronary Intervention.

Distribution of Paired Differences Between PCI and CABG Predicted Risks (Δ)

Within-patient paired differences in predicted risks between PCI and CABG scenarios were calculated as Δ (PCI − CABG), enabling a direct comparison of model-based predicted outcomes for the same individuals under alternative revascularization assumptions.

For the SYNTAX Score 2020–predicted 10-year mortality risk, the mean predicted risk was higher under the PCI scenario than under the CABG scenario, resulting in a positive mean Δ of 6.20%. A similar pattern was observed for the SYNTAX Score 2020–predicted 5-year MACE risk, with a mean Δ of 6.5%, again favoring CABG (Table 3).

Beyond these summary estimates, the Δ values exhibited marked inter-individual variability. As illustrated in Figure 1, most patients demonstrated positive Δ values, indicating higher predicted risks with PCI than CABG; however, the magnitude of this difference varied substantially across individuals. The distribution of Δ values at both endpoints was centered above zero, whereas the spread of values indicated considerable heterogeneity in the magnitude of predicted risk differences between revascularization strategies.

Distribution of Δ Categories and the Equipoise Zone

To enhance clinical interpretability, paired differences in predicted risks were grouped to reflect both the direction and magnitude of the difference between PCI and CABG. Differences indicating a lower predicted risk with PCI were defined as PCI-favored (Δ < 0), minimal differences indicating similar predicted risks were defined as equipoise (0–<2%), and progressively larger differences indicating a lower predicted risk with CABG were categorized as CABG-favored across increasing difference ranges—small (2–<5%), moderate (5–<10%), and large (≥10%).

For the SYNTAX Score 2020–predicted 10-year mortality risk, most patients fell into categories indicating a lower predicted risk with CABG. The largest proportion was observed in the moderate-

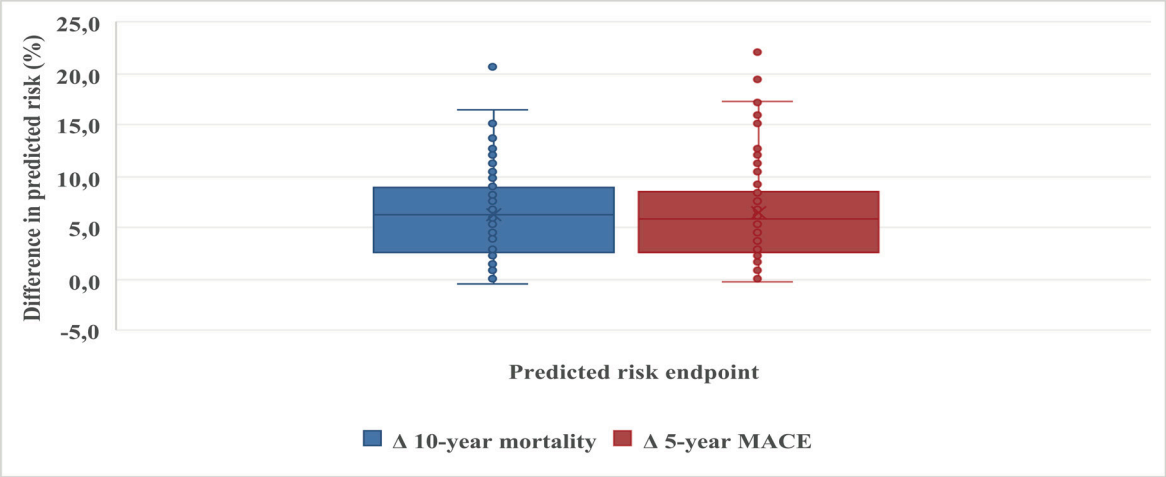

Figure 1. Distribution of within-patient differences in SYNTAX Score 2020-predicted risks between PCI and CABG.

Note. Δ was calculated as PCI minus CABG; positive values indicate higher predicted risk under PCI compared with CABG. The horizontal line within each box represents the median, the box denotes the interquartile range (IQR), whiskers indicate the range of non-outlier values, individual points represent patient-level data, and mean values are shown as × markers. MACE: Major Adverse Cardiovascular Events.

Table 4. Distribution of paired differences (Δ) between PCI and CABG predicted risks according to predefined magnitude categories.

Δ Category	Δ 10-year mortality	Δ 5-year MACE
	n (%)	n (%)
PCI-favored (Δ < 0)	1 (0.9)	1 (0.9)
Equipoise (0–<2%)	21 (18.3)	19 (16.5)
CABG-favored		
Small difference (2–<5%)	28 (24.3)	31 (27.0)
Moderate difference (5–<10%)	46 (40.0)	43 (37.4)
Large difference (≥10%)	19 (16.5)	21 (18.3)

Note. Δ represents within-patient paired differences in SYNTAX Score 2020–predicted risk between PCI and CABG scenarios (Δ = PCI − CABG). Although most patients were classified within CABG-favored categories, approximately 18% for 10-year mortality and 17% for 5-year MACE fell within the equipoise zone (Δ <2%). CABG: Coronary Artery Bypass Grafting; PCI: Percutaneous Coronary Intervention.

difference range (5–<10%), followed by the smaller (2–<5%) and larger (≥10%) difference categories. A subset of patients showed minimal differences between PCI and CABG, whereas differences indicating a lower predicted risk with PCI were uncommon (Table 4).

A similar pattern was observed for SYNTAX Score 2020–predicted risk 5-year MACE. Most patients were clustered within categories, indicating a lower predicted risk with CABG, while a subset exhibited minimal differences between PCI and CABG. Differences indicating a lower predicted risk with PCI remained infrequent across both endpoints.

Overall, these findings indicate that predicted risk differences favoring CABG predominated in this study. However, the magnitude of Δ varied across patients, with a proportion showing minimal differences consistent with an equipoise range

Risk Shifting Across SYNTAX Score 2020–Predicted Risk Strata

To further characterize how the predicted risk classifications differed between revascularization strategies, the SYNTAX Score 2020–predicted risks were examined across predefined absolute risk strata under both CABG and PCI scenarios. These strata (<10%, 10–<20%, 20–<40%, and ≥40%) were investigator-defined ranges of absolute predicted

(A) SYNTAX Score 2020-predicted 5-year MACE	PCI-predicted risk strata (%)			
CABG-predicted risk strata (%)	<10%	10–<20%	20–<40%	≥40%
<10%	17	11		
10–<20%		24	26	
20–<40%			18	8
≥40%				11
(B) SYNTAX Score 2020-predicted 10-year mortality	**PCI-predicted risk strata (%)**			
CABG-predicted risk strata (%)	<10%	10–<20%	20–<40%	≥40%
<10%	13	5		
10–<20%		20	18	
20–<40%			20	11
≥40%				28

Figure 2. Risk shifting between CABG and PCI scenarios based on SYNTAX Score 2020—predicted risk strata. (A) SYNTAX Score 2020-predicted 5-year MACE. (B) SYNTAX Score 2020-predicted 10-year mortality.

Note. Absolute predicted risks were generated by the SYNTAX Score 2020 calculator and were subsequently grouped into investigator-defined strata (<10%, 10–<20%, 20–<40%, ≥40%) for descriptive visualization. Rows represent CABG-based predictions and columns represent PCI-based predictions. Values indicate absolute numbers of patients. Cells along the main diagonal indicate unchanged predicted risk classification, whereas cells above the diagonal indicate upward shifts to higher predicted risk strata under the PCI scenario. CABG: Coronary Artery Bypass Grafting; PCI: Percutaneous Coronary Intervention.

risk (%) used to assess shifts in risk classification between PCI and CABG descriptively.

Figure 2 depicts the cross-classification of the predicted risk strata, with rows representing CABG-based predictions and columns representing PCI-based predictions. Cells along the main diagonal indicate patients whose predicted risk strata remained unchanged across revascularization scenarios. In contrast, cells above the diagonal indicate upward shifts to higher predicted risk strata under the PCI scenario.

Across both 10-year mortality and 5-year MACE, a substantial proportion of patients remained in the same predicted risk stratum when moving from a CABG-based to a PCI-based prediction. However, a notable subset of patients experienced upward shifts to higher predicted-risk strata under the PCI scenario, reflecting reclassification to higher predicted-risk categories. Downward shifts to lower-predicted-risk strata were uncommon.

Taken together, these findings indicate that while predicted risk stratification remained stable for many patients across revascularization scenarios, changing the assumed strategy from CABG to PCI frequently resulted in an upward reclassification to higher predicted risk strata for a subset of individuals.

Paired Differences in Predicted Risks According to Clinical Characteristics

To explore how clinical characteristics were distributed across different magnitudes of paired differences, within-patient Δ values for SYNTAX Score 2020–predicted risks 10-year mortality and 5-year MACE were examined according to the predefined Δ categories (Table 5).

Across increasing Δ categories—corresponding to progressively larger CABG-favored predicted risk differences—patients demonstrated less favorable clinical and anatomical profiles. Larger Δ categories were associated with older age, lower LVEF, reduced CrCl, and higher SYNTAX Score I values. In contrast, patients within the equipoise range (Δ <2%) generally showed more preserved LVEF, higher CrCl, and lower anatomical complexity.

Categorical clinical characteristics also varied across Δ categories. Larger Δ categories were characterized by higher proportions of insulin-treated DM, PVD, and 3VD, whereas these features were less prevalent among patients in the equipoise and smaller-difference categories. The distribution of smoking status remained relatively high across all Δ categories without a consistent stepwise pattern.

Table 5. Distribution of paired differences in SYNTAX Score 2020–predicted 10-year mortality and 5-year MACE according to clinical characteristics.

10-year mortality predicted risk													
Δ Category (PCI − CABG)	**Age (mean ±SD)**	**CrCl (mean ±SD)**	**LVEF (mean ±SD)**	**SS I (mean ±SD)**	**DM (n%)**			**Current Smoking (n%)**		**PVD (n%)**		**Coronary Anatomical Category (n%)**	
					No	**Yes, Non-Insulin**	**Yes, Insulin**	**Yes**	**No**	**Yes**	**No**	**3VD**	**LMCAD**
PCI-favored (Δ <0)	63.0 ± NA	65.5 ± NA	65.0 ± NA	23.0 ± NA	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	100.0
Equipoise (0–<2%)	50.4 ± 10.1	81.1 ± 25.1	52.4 ± 12.4	17.6 ± 8.2	81.0	9.5	9.5	71.4	28.6	19.0	81.0	71.4	28.6
CABG-favored													
Small difference (2–<5%)	55.3 ± 9.8	69.8 ± 20.9	48.0 ± 12.9	23.8 ± 8.4	85.7	3.6	10.7	75.0	25.0	14.3	85.7	85.7	14.3
Moderate difference (5–<10%)	61.1 ± 7.1	62.3 ± 23.3	45.5 ± 13.1	26.7 ± 7.0	56.5	15.2	28.3	73.9	26.1	34.8	65.2	87.0	13.0
Large difference (≥10%)	63.6 ± 6.9	50.3 ± 13.8	42.3 ± 12.3	32.7 ± 6.3	47.4	21.1	31.6	57.9	42.1	42.1	57.9	94.7	5.3
5-year MACE predicted risk													
Δ Category (PCI − CABG)	**Age (mean ±SD)**	**CrCl (mean ±SD)**	**LVEF (mean ±SD)**	**SS I (mean ±SD)**	**DM (n%)**			**Current Smoking (n%)**		**PVD (n%)**		**Coronary Anatomical Category (n%)**	
					No	**Yes, Non-Insulin**	**Yes, Insulin**	**Yes**	**No**	**Yes**	**No**	**3VD**	**LMCAD**
PCI-favored (Δ <0)	63.0 ± NA	65.5 ± NA	65.0 ± NA	23.0 ± NA	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	100.0
Equipoise (0–<2%)	50.8 ± 10.0	81.6 ± 26.4	52.3 ± 12.5	16.3 ± 7.3	78.9	10.5	10.5	73.7	26.3	21.1	78.9	73.7	26.3
CABG-favored													
Small difference (2–<5%)	53.5 ± 8.0	71.3 ± 19.4	47.0 ± 12.5	22.8 ± 7.2	90.3	3.2	6.5	71.0	29.0	12.9	87.1	87.1	12.9
Moderate difference (5–<10%)	61.0 ± 7.6	64.9 ± 21.0	47.3 ± 12.2	27.6 ± 6.6	58.1	18.6	23.3	72.1	27.9	27.9	72.1	86.0	14.0
Large difference (≥10%)	65.8 ± 6.2	44.2 ± 15.6	40.5 ± 14.0	32.5 ± 7.7	38.1	14.3	47.6	66.7	33.3	57.1	42.9	90.5	9.5

Note. Δ represents within-patient paired differences in SYNTAX Score 2020–predicted risk between PCI and CABG scenarios (Δ = PCI − CABG). Continuous variables are presented as mean ± standard deviation, and categorical variables as number (percentage). NA denotes not applicable, reflecting categories with a single observation in which standard deviation cannot be calculated. Values summarize model-based predicted risks for the same patients under alternative revascularization assumptions and are presented for descriptive comparison only. Abbreviations: CABG, coronary artery bypass grafting; PCI, percutaneous coronary intervention; SS I, SYNTAX Score I; DM, diabetes mellitus; PVD, peripheral vascular disease; 3VD, three-vessel disease; LMCAD, left main coronary artery disease; CrCl, creatinine clearance; LVEF, left ventricular ejection fraction; MACE, major adverse cardiovascular events.

Table 6. Distribution of SYNTAX Score 2020–predicted risk strata for 10-year mortality and 5-year MACE according to clinical characteristics under PCI and CABG scenarios.

10-year mortality predicted risk PCI													
Predicted Risk Strata (%)	Age (mean ±SD)	CrCl (mean ±SD)	LVEF (mean ±SD)	SS I (mean ±SD)	DM (n%)			Current Smoking (n%)		PVD (n%)		Coronary Anatomical Category (n%)	
					No	Yes, Non-Insulin	Yes, Insulin	Yes	No	Yes	No	3VD	LMCAD
<10%	42.8 ± 5.5	92.9 ± 19.0	47.6 ± 12.3	19.8 ± 7.0	100.0	0.0	0.0	92.3	7.7	7.7	92.3	92.3	7.7
10–<20%	53.3 ± 6.0	77.3 ± 18.0	51.4 ± 12.8	21.4 ± 8.8	80.0	8.0	12.0	64.0	36.0	12.0	88.0	84.0	16.0
20–<40%	58.2 ± 4.4	63.3 ± 21.9	47.5 ± 12.7	27.1 ± 7.8	60.5	18.4	21.1	63.2	36.8	18.4	81.6	89.5	10.5
≥40%	66.4 ± 7.2	51.3 ± 27.5	43.4 ± 13.4	27.9 ± 8.5	53.8	12.8	33.3	76.9	23.1	53.8	46.2	76.9	23.1
10-year mortality predicted risk CABG													
Predicted Risk Strata (%)	Age (mean ±SD)	CrCl (mean ±SD)	LVEF (mean ±SD)	SS I (mean ±SD)	DM (n%)			Current Smoking (n%)		PVD (n%)		Coronary Anatomical Category (n%)	
					No	Yes, Non-Insulin	Yes, Insulin	Yes	No	Yes	No	3VD	LMCAD
<10%	45.2 ± 7.0	94.2 ± 17.2	49.4 ± 13.9	21.0 ± 8.2	94.4	5.6	0.0	83.3	16.7	5.6	94.4	88.9	11.1
10–<20%	55.5 ± 5.3	67.7 ± 20.0	49.9 ± 11.8	24.4 ± 8.7	71.1	13.2	15.8	63.2	36.8	13.2	86.8	92.1	7.9
20–<40%	60.1 ± 5.5	61.4 ± 18.7	45.4 ± 12.4	26.4 ± 7.5	48.4	19.4	32.3	64.5	35.5	22.6	77.4	83.9	16.1
≥40%	68.0 ± 6.9	49.2 ± 18.7	43.3 ± 14.3	28.0 ± 9.4	64.3	7.1	28.6	82.1	17.9	67.9	32.1	71.4	28.6
5-year MACE predicted risk PCI													
Predicted Risk Strata (%)	Age (mean ±SD)	CrCl (mean ±SD)	LVEF (mean ±SD)	SS I (mean ±SD)	DM (n%)			Current Smoking (n%)		PVD (n%)		Coronary Anatomical Category (n%)	
					No	Yes, Non-Insulin	Yes, Insulin	Yes	No	Yes	No	3VD	LMCAD
<10%	44.7 ± 6.5	94.1 ± 17.4	50.6 ± 13.7	18.7 ± 6.9	88.2	5.9	5.9	82.4	17.6	11.8	88.2	94.1	5.9
10–<20%	55.4 ± 5.7	68.1 ± 18.4	50.2 ± 11.7	23.3 ± 8.1	74.3	8.6	17.1	62.9	37.1	8.6	91.4	85.7	14.3
20–<40%	60.5 ± 6.2	62.6 ± 20.4	44.9 ± 12.5	27.0 ± 8.2	59.1	18.2	22.7	70.5	29.5	34.1	65.9	84.1	15.9
≥40%	70.0 ± 5.5	42.5 ± 14.7	42.7 ± 14.8	30.8 ± 8.1	52.6	10.5	36.8	78.9	21.1	63.2	36.8	73.7	26.3
5-year MACE predicted risk CABG													
Predicted Risk Strata (%)	Age (mean ±SD)	CrCl (mean ±SD)	LVEF (mean ±SD)	SS I (mean ±SD)	DM (n%)			Current Smoking (n%)		PVD (n%)		Coronary Anatomical Category (n%)	
					No	Yes, Non-Insulin	Yes, Insulin	Yes	No	Yes	No	3VD	LMCAD
<10%	48.8 ± 8.4	86.6 ± 20.2	50.9 ± 12.1	20.4 ± 8.3	92.9	3.6	3.6	67.9	32.1	14.3	85.7	92.9	7.1
10–<20%	56.8 ± 4.8	64.3 ± 20.5	46.3 ± 12.5	26.3 ± 8.0	56.0	18.0	26.0	66.0	34.0	16.0	84.0	90.0	10.0
20–<40%	65.8 ± 6.1	56.9 ± 15.0	45.7 ± 12.5	25.8 ± 8.1	73.1	7.7	19.2	80.8	19.2	46.2	53.8	73.1	26.9
≥40%	70.5 ± 6.7	38.8 ± 17.3	43.0 ± 18.1	31.8 ± 8.7	36.4	18.2	45.5	81.8	18.2	72.7	27.3	63.6	36.4

Note. Predicted risk strata are based on SYNTAX Score 2020 estimates under PCI and CABG scenarios. Continuous variables are presented as mean ± standard deviation, and categorical variables as number (percentage). Values represent model-based predicted risks for descriptive comparison across strata. Abbreviations: CABG, coronary artery bypass grafting; PCI, percutaneous coronary intervention; SS I, SYNTAX Score I; DM, diabetes mellitus; PVD, peripheral vascular disease; 3VD, three-vessel disease; LMCAD, left main coronary artery disease; CrCl, creatinine clearance; LVEF, left ventricular ejection fraction; MACE, major adverse cardiovascular events.

Comparable patterns were observed for both SYNTAX Score 2020–predicted risks 10-year mortality and 5-year MACE, indicating that greater clinical and anatomical complexities clustered among patients with larger CABG-favored predicted risk differences.

Distribution of SYNTAX Score 2020–Predicted Risk Strata According to Clinical Characteristics

The clinical characteristics were further examined across investigator-defined SYNTAX Score 2020–predicted absolute risk strata (<10%, 10–<20%, 20–<40%, and ≥40%), representing increasing levels of predicted risk, under both PCI and CABG scenarios (Table 6).

Across increasing predicted risk strata, patients demonstrated a stepwise gradient of clinical risk. Higher risk strata were characterized by older age, lower LVEF, reduced CrCl, and higher SYNTAX Score I values. These trends were consistently observed under both PCI and CABG scenarios and for both 10-year mortality and 5-year MACE predictions.

The categorical clinical variables also showed stratified distributions. Insulin-treated DM, PVD, and 3VD were more frequent in the higher-predicted-risk strata, whereas the lower strata were enriched for patients without DM, with preserved LVEF, and with lower anatomical complexity. Smoking prevalence tended to be higher in the higher strata, particularly for 5-year MACE. Notably, although the absolute predicted risks differed between PCI and CABG scenarios, the overall clinical profiles within the corresponding risk strata were broadly similar, indicating that SYNTAX Score 2020 stratification captures coherent clinical risk patterns regardless of the assumed revascularization strategy

Discussion

This study provides a descriptive examination of SYNTAX Score 2020–predicted risks for PCI and CABG, highlighting how predicted long-term risk profiles vary across patients when clinical factors are considered alongside anatomical assessment. The findings are interpreted strictly as model-based predictions and are not intended to represent observed clinical outcomes or imply causal treatment effects. Contemporary revascularization guidelines emphasize that decisions should integrate both anatomical complexity and clinical comorbidity within a multidisciplinary Heart Team framework, and the patterns observed in this study are consistent with that principle.[2,10]

Reclassification of Anatomical Risk Profiles Under SYNTAX Score 2020

Risk evaluation frequently begins with anatomical assessment; however, the integration of patient-specific clinical characteristics may prompt a reappraisal of the predicted risk profile and subsequent treatment considerations.

In the present study, comparison between anatomical risk stratification using the SYNTAX Score I and integrated risk assessment using the SYNTAX Score 2020 demonstrated substantial reclassification of revascularization strategy. Among 45 patients categorized as low anatomical risk by the SYNTAX Score I, all (100%) were reclassified to a CABG-favored strategy when clinical variables were incorporated into risk estimation. Similarly, among patients with intermediate anatomical risk, the majority were reclassified to a CABG-favored strategy. These findings provide descriptive evidence that incorporation of clinical factors may meaningfully alter the interpretation of revascularization risk beyond anatomical assessment alone.

These findings are consistent with contemporary guideline recommendations emphasizing that revascularization decisions should integrate both anatomical and clinical characteristics within a multidisciplinary Heart Team framework, rather than relying on anatomical complexity in isolation.[2-3,10] Further discussion of these findings is provided in the subsequent sections

Interpretation of Δ distributions and the equipoise zone

A key observation is the broad inter-individual variability in paired predicted risk differences between PCI and CABG. Because SYNTAX Score 2020 integrates anatomical disease features with clinical variables (age, renal function, ventricular function, diabetes status, PVD, and smoking), heterogeneity in Δ is expected and clinically meaningful: it reflects differences in baseline vulnerability and anatomical complexity, rather than random variation. The redevelopment of SYNTAX Score 2020 was explicitly designed to individualize decision-making between PCI and CABG by predicting 10-year mortality and 5-year MACE using both clinical and anatomical inputs, supporting this interpretive framework.[4-5]

Notably, a clinically relevant proportion of patients fell within the predefined equipoise range (Δ <2%), indicating minimal predicted differences between PCI and CABG for both endpoints (as summarized in Table 4). In practice, this subgroup

is important because guidelines and expert consensus highlight that when predicted risks are similar, and anatomy is suitable for either strategy, final decisions should weigh patient preference, procedural feasibility, local expertise, and additional comorbidities not fully captured by any single tool—again reinforcing the role of multidisciplinary evaluation rather than score-only decisions.[2-3]

Risk shifting and "stability" across predicted strata

The risk shifting analysis (Figure 2) adds an important interpretive layer. The presence of a substantial diagonal (patients remaining in the same stratum under both strategies) can be described as risk classification stability, meaning that for many individuals, their overall risk profile is sufficiently dominated by baseline clinical/anatomical burden such that the predicted stratum does not materially change between PCI and CABG scenarios. Conversely, off-diagonal movement—particularly upward shifting to higher strata under the PCI scenario—identifies a subset in whom predicted risk is more sensitive to the assumed revascularization strategy. Importantly, this should not be interpreted as evidence of observed differences in outcomes, but rather as a descriptive illustration that the model predicts meaningful, strategy-dependent risk changes in a clinically higher-risk subset.

The parallel inclusion of Table 6 (risk strata by clinical characteristics) strengthens interpretability: when upward shifts cluster among older patients, those with worse renal function, lower LVEF, more severe diabetes (insulin-treated), and greater anatomical complexity, the pattern of shifts becomes biologically coherent and clinically readable. This framing also aligns with guideline recommendations that emphasize integrated assessment (clinical and anatomical) and multidisciplinary discussion for decisions regarding complex coronary disease.[2-3,10]

Why larger CABG-favored Δ and higher predicted risk strata clusters in clinically higher-risk phenotypes

Across Tables 5 and 6, patients in categories with greater predicted risk differences favoring CABG and higher predicted risk strata exhibited a more adverse clinical profile. Several pathophysiological mechanisms can plausibly contextualize these descriptive patterns:

1. Ventricular dysfunction (lower LVEF): limited myocardial reserve.

   Lower LVEF implies reduced tolerance to residual ischemia and recurrent ischemic burden. Even modest incomplete revascularization or recurrent ischemia can translate into disproportionate clinical impact in patients with reduced myocardial reserve (e.g., Heart Failure [HF] progression and malignant arrhythmia susceptibility). Thus, it is biologically plausible that patients with lower LVEF cluster in higher predicted risk strata and larger CABG-favored Δ categories, because comprehensive revascularization and durable flow restoration become more consequential as ventricular reserve declines.[2,10]

2. Renal dysfunction (lower CrCl): inflammation, endothelial dysfunction, and prothrombotic milieu.

   Chronic Kidney Disease (CKD) is associated with endothelial dysfunction, chronic inflammation, altered platelet activation, and accelerated atherosclerosis. These processes can increase vulnerability to ischemic events and contribute to poorer long-term outcomes after focal coronary interventions, particularly when the disease is diffuse. Consistent with this, contemporary analyses comparing PCI and CABG in CKD populations highlight that completeness of revascularization and systemic risk burden are important modifiers of long-term prognosis. In Table 6, lower renal function tracking with higher predicted strata supports the interpretation that renal dysfunction acts as a "risk amplifier" within the SYNTAX Score 2020 framework.[11-12]

3. DM severity gradient (no DM → non-insulin → insulin-treated): diffuse disease and microvascular dysfunction.

   The dataset distinguishes diabetes status by treatment (no DM, non-insulin-treated DM, insulin-treated DM), which is clinically important because insulin-treated diabetes often reflects longer duration and more advanced metabolic and vascular disease. Advanced diabetic vasculopathy is characterized by diffuse coronary atherosclerosis, microvascular dysfunction, impaired endothelial nitric oxide signaling, and heightened inflammatory/thrombotic risk factors that may limit the durability of focal lesion treatment and favor strategies that provide more global myocardial perfusion in diffuse disease. Contemporary observational evidence and reviews in

diabetic multivessel disease continue to report better long-term outcomes with CABG compared with PCI in many higher-risk diabetic phenotypes, providing biological plausibility for the clustering of insulin-treated diabetes among higher predicted risk and larger CABG-favored Δ categories observed in Tables 5 and 6.[13-14]

4. Systemic atherosclerosis markers (PVD): diffuse burden beyond the coronaries.

   PVD is a marker of systemic atherosclerotic burden and is associated with diffuse vascular involvement, endothelial dysfunction, and heightened thrombogenicity. Within a descriptive framework, the higher representation of PVD in larger Δ and higher strata groups supports the notion that systemic disease burden meaningfully informs predicted long-term risk—consistent with how SYNTAX Score 2020 weights clinical comorbidity in addition to coronary anatomy.[2,4]

5. Anatomical complexity and completeness of revascularization as a mechanistic bridge

   Anatomical complexity (reflected in SYNTAX Score I and the presence of 3VD or LMCAD) provides a direct mechanistic bridge to larger predicted differences between PCI and CABG. In complex, diffuse, heavily calcified, or bifurcation-rich disease, PCI is more likely to result in incomplete revascularization or higher residual ischemic burden. Over longer time horizons, residual ischemia and incomplete revascularization have been associated with worse cardiovascular outcomes and increased repeat revascularization risk. This is consistent with modern studies and meta-analytic evidence supporting the clinical relevance of achieving complete revascularization, particularly in surgically treated patients and complex disease subsets.[15-16]

   Accordingly, the descriptive association in Tables 5 and 6—higher anatomical complexity tracking with higher predicted strata and more CABG-favored Δ—can be interpreted as the model expressing a clinically intuitive principle: as coronary disease becomes more complex and systemic vulnerability increases, long-term risk predictions diverge more strongly between strategies that treat focal lesions versus those that bypass diseased segments

Smoking Status and COPD in the Context of Predicted Risk

In this study, smoking prevalence remained high across predicted risk strata and across categories of predicted differences between PCI and CABG, although no consistent stepwise pattern was observed with increasing magnitude of predicted differences. This finding suggests that smoking contributes primarily to overall cardiovascular risk captured by SYNTAX Score 2020 rather than clearly differentiating predicted risk between revascularization strategies. Cigarette smoking contributes to cardiovascular risk through mechanisms including endothelial dysfunction, oxidative stress, and vascular inflammation, which accelerate atherosclerosis and increase the likelihood of adverse cardiovascular events. Smoking-induced endothelial impairment alters nitric oxide bioavailability and promotes pro-inflammatory and pro-atherogenic vascular changes, which are reflected in higher absolute predicted cardiac risk.[17-18]

COPD is recognized to be associated with increased cardiovascular morbidity and mortality, largely through shared mechanisms of systemic inflammation, hypoxemia, and overlapping risk factors such as smoking. COPD and cardiovascular disease frequently coexist, and their interaction is linked to elevated risk of ischemic events, HF, and other cardiovascular outcomes in affected populations.[19-20] In the present study, no patients were classified as having COPD. This likely reflects under-recognition or underdocumentation in an acute-care setting, where routine spirometry was not consistently performed, and comorbidity assessment relied on medical records and structured clinical history. As a result, COPD-related patterns in predicted risk could not be examined.

Clinical Implications

Taken together, the results support a practical interpretation of SYNTAX Score 2020 outputs:

1. Predicted risk differences favoring CABG were common, but their magnitude varied widely across patients, underscoring the importance of individualized risk estimation.[4]
2. A distinct subgroup with minimal predicted differences between PCI and CABG was identified, supporting individualized treatment selection in situations where long-term predicted risks are similar and shared decision-making is central.[2-3]
3. Clinical severity gradients (age, LVEF, renal function, diabetes severity, PVD), together

with anatomical complexity, provide a plausible biological explanation for the observed clustering of predicted risks and Δ values.

4. Collectively, these findings indicate that incorporation of clinical factors beyond anatomical assessment can meaningfully influence predicted revascularization risk profiles and treatment selection, reinforcing the importance of integrated evaluation within a multidisciplinary Heart Team framework.[2-3,10]

Study Limitations

This study was descriptive and based on SYNTAX Score 2020–predicted risks rather than observed clinical events or real-world outcomes. The single-center design and predominance of ACS presentations may limit the generalizability of these findings to other populations. The timing of key calculator inputs reflected routine acute care workflows, which may have introduced variability in predicted risk estimates. For conditions in which objective confirmation was not routinely available, including PVD and COPD, structured history-taking and medical record review were used, raising the possibility of under-recognition or misclassification. Notably, the absence of COPD in this study may have led to an underestimation of SYNTAX Score 2020–predicted risks. Evaluation of SYNTAX Score 2020 performance ultimately requires prospective follow-up with observed clinical outcomes, representing an important direction for future studies.

Conclusion

In this study, SYNTAX Score 2020–predicted risks demonstrated marked inter-individual variability between PCI and CABG scenarios. Greater clinical and anatomical complexity—including older age, reduced LVEF, impaired renal function, DM (particularly insulin-treated), PVD, and higher anatomical disease burden—tended to coincide with higher predicted risks and larger differences between revascularization strategies. Risk stratification based on anatomical assessment alone may be reclassified following the incorporation of patient-specific clinical variables. Overall, these descriptive findings support the use of SYNTAX Score 2020 as an integrated decision-support tool to complement clinical judgment within multidisciplinary Heart Team decision-making for complex CAD.

List of Abbreviations

3VD	Three-vessel Disease
ACS	Acute Coronary Syndrome
CABG	Coronary Artery Bypass Grafting
CAD	Coronary Artery Disease
CKD	Chronic Kidney Disease
COPD	Chronic Obstructive Pulmonary Disease
CrCl	Creatinine Clearance
DM	Diabetes Mellitus
HF	Heart Failure
IQR	Interquartile Range
LMCAD	Left Main Coronary Artery Disease
LVEF	Left Ventricular Ejection Fraction
MACE	Major Adverse Cardiovascular Events
NSTEMI	Non–ST-segment Elevation Myocardial Infarction
PCI	Percutaneous Coronary Intervention
PVD	Peripheral Vascular Disease
QCA	Quantitative Coronary Angiography
STEMI	ST-segment Elevation Myocardial Infarction
SYNTAX	Synergy between percutaneous coronary intervention with taxus and cardiac surge

Ethical Clearance

All methods were carried out according to relevant guidelines and regulations after obtaining approval and recommendations from the Ethics Committee Review Board of dr. Doris Sylvanus General Hospital (reference number 2384/UMPEG/RSUD/03-2025). Patient confidentiality and anonymity were maintained throughout the study.

Publication Approval

All authors consent to the publication of this manuscript.

Authors Contributions

Conceptualization: S.I.S. and A.M.M.; methodology: S.I.S. and A.M.M.; sample collection: A.M.M., K. Y., and R.T.A.; formal analysis: A.M.M. and S.I.S.; writing—original draft preparation: A.M.M.; review and editing: A.M.M., S.I.S., and Y.G.; supervision: S.I.S. and Y.G.

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Conflict of Interest

None.

Availability of Data and Materials

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