# Clinical Use of SYNTAX Score and Variants

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## Abstract:

SYNTAX score and its variants are used to determine the type of intervention, especially in stable coronary artery disease. The use of the SYNTAX score is recommended, especially in left main coronary lesions or in patients with multi-vessel disease. It is recommended by guidelines for determining anatomical complexity or determining long-term morbidity and mortality after percutaneous coronary intervention. We have presented this article titled the clinical use of SYNTAX score and its variants in order to shed light on the literature and provide scientific support to the health community.
**Keywords:** SYNTAX score; variant, main coronary; multi-vessel; morbidity; mortality; anatomical complexity.

## Introduction:

Cardiovascular diseases are the most important causes of mortality and morbidity in both developing and developed countries. Coronary artery disease is the most common cardiovascular disease and is associated with high mortality and morbidity. In 99% of these cases, the etiological cause is atherosclerosis. Presentations of coronary artery disease developing on the basis of atherosclerosis include silent ischemia, stable angina pectoris, unstable angina pectoris, acute myocardial infarction, heart failure or sudden death(1). The main diagnostic method of coronary artery disease is coronary angiography. While evaluating coronary artery disease in coronary angiography, expressions such as single vessel disease, two vessel disease, three vessel disease or left main coronary disease are used. In addition, an expression with the name of multi-vessel disease is also used. The presence of stenosis >70% in 2 or more vessels with a diameter greater than 2.5 mm is called multi-vessel disease(2). Interest in these diseases has increased due to the prevalence of cardiovascular events in the world. For this reason, important studies on diagnosis and treatment have come up.

Especially in the 1968s, while coronary artery bypass grafting was on the agenda in multi-vessel coronary artery patients, percutaneous coronary intervention was performed in single vessel patients(3). In the following years, thanks to the angiographic lesion scoring systems, which became increasingly widespread, percutaneous coronary intervention was started in patients with multiple vessels(4). In this article, we presented the clinical use of SYNTAX score and its variants, which are frequently used in patients with multivessel coronary artery or main coronary artery disease.

## SYNTAX score

Which revascularization strategy to choose in patients with multi-vessel disease has been a matter of debate for years. While balloon angioplasty and coronary artery bypass grafting were compared in clinical studies in these patients, in the following years, multi-vessel stenting and coronary bypass grafting were compared. Although there was no significant difference in mortality between these two revascularization strategies, restenosis and the need for repeated revascularization were higher in the percutaneous coronary intervention group. Although patients with 2 or 3 vessels were included in these studies, more complex cases were encountered that were not included in these studies in real life. For example, patients with chronic total occlusion of the right coronary artery and left coronary system trifurcation lesions were categorized in the same group as patients with 3 focal coronary artery disease. However, revascularization of patients with right coronary artery occlusion and left coronary trifurcation lesions is more difficult than the other group. This study had a negative reflection on the results in terms of percutaneous coronary intervention.

With the "The SYNTAX Score: An angiographic tool grading the complexity of coronary artery disease" study published in 2009, the anatomical severity and complexity of coronary artery disease can be quantified with an evidence-based method. In this study, in which 1800 patients were randomized 1: 1, patients with acute myocardial infarction, patients who had previously been revascularized, and patients requiring concurrent cardiac surgery were excluded(5).

If we look at the results of this study, the primary endpoint of death, stroke, recurrent revascularization, and myocardial infarction was higher in the group with percutaneous coronary intervention at 12 months compared to the coronary bypass group (17%; 12%, respectively)(5).

## SYNTAX Score and Variants

SYNTAX score 1 parameters, also known as the anatomical SYNTAX score, include coronary dominance, coronary lesion segment, total occlusion, trifurcation lesion, bifurcation lesion, aortaostial lesion, severe tortuosity, 20 mm <lesion length, dense calcification, thrombus and diffuse disease / small vessels. takes. In the anatomical evaluation of SYNTAX scores, in coronary vessels <1.5 mm, stenosis <50% is considered significant. This score estimates the risk of major adverse cardiac events (all-cause mortality, stroke, myocardial infarction, revascularization) for 1-5 years in left main coronary or 3-vessel disease based on the results of the SYNTAX study. In addition, this score helps to predict the 10-year mortality risk based on the results of the SYNTAXES study(6).

The logistic clinical SYNTAX score is in addition to the parameters of SYNTAX score 1, age, creatine clearance, left ventricular ejection fraction, chronic obstructive pulmonary disease, peripheral vascular disease, diabetes mellitus, smoking, body mass index, 3-vessel disease, left main coronary disease. It is calculated from parameters such as stroke, hemoglobin, and white blood cell count. This score helps to predict 1-3 years of all-cause mortality based on data from all percutaneous coronary intervention studies(7).

SYNTAX score 2 is calculated from parameters such as age, creatinine clearance, left ventricular ejection fraction, left main coronary, gender, chronic obstructive pulmonary disease and peripheral vascular disease in addition to SYNTAX score 1(1). This score helps to predict 4-year all-cause mortality based on the SYNTAX study. In addition, this score can be used as a criterion for inclusion in percutaneous coronary intervention, as it predicts balanced all-cause mortality based on the results of the SYNTAX 2 study.

SYNTAX score 2 2020 calculated in the SYNTAXES study(6). 8 clinical parameters (age, diabetes, insulin use, creatine clearance, left ventricular ejection fraction, chronic obstructive pulmonary disease, peripheral vascular disease, smoking) and 2 anatomical parameters (left main coronary-3 vascular disease, anatomical syntax score) used in calculation(1). Based on the relevant study results, this score should be used together with the decision of the heart team, the patient and the patient's family in the decision of coronary by-pass grafting or percutaneous coronary intervention. Based on external validation in PRECOMBAT(8), BEST(9), FREEDOM(10) and cross validation in SYNTAX study(6), this score is helpful in predicting the 5-year risk of major adverse cardiac events and the 10-year risk of death.

Functional SYNTAX score(11), on the other hand, was created by adding functional evaluation to the anatomical evaluation by invasive coronary angiography or angiographic computed tomography. Functional evaluation is done with ffr, ifr, ffr $_{CT}$. It contributes to the treatment decision with both anatomical and functional evaluation.

The SNTAX 3 score(12) is calculated by anatomical evaluation with angiographic computed tomography, comorbidities, and functional evaluation of the CT scan with ffr $_{CT}$. Based on the SYNTAX 3 REVOLUTION study, multislice CT scanning with ffr $_{CT}$ helps to make the decision of percutaneous coronary intervention or coronary bypass grafting in patients with left main coronary or 3 vessels. In addition, the SYNTAX 3 score was also used in the FASTTRACK CABG study. In this study, SYNTAX score 3 calculated with the same method helped to make the coronary by-pass graft decision.

The residual SYNTAX score (13) is the calculation of the SYNTAX score based on lesions in other coronary vessels after opening the total occluded coronary lesion. In addition, the SYNTAX score collected in patients who underwent complete revascularization, namely coronaries with TIMI 3 flow or residual residuals of more than 20%, or coronaries that cannot be revascularized due to different reasons (ostial, calcific, ectasic, bifurcation, thrombus, chronic total lesion, 20 mm < lesion length) By calculating the residual SYNTAX score can be calculated. Existing studies are not sufficient to evaluate the effectiveness of this score. An increase in the 5-year risk of death was determined in those with a residual SYNTAX score above 8 calculated after percutaneous coronary intervention. In addition, an increase in the combined outcome of death, myocardial infarction and stroke was observed in this patient group. In addition, if any residual SYNTAX score is above 0, it has been shown that there is an increase in recurrent revascularization rates.

## Clinical Use of SYNTAX Score and Variants

The SYNTAX score is particularly used to determine the interventional treatment of stable coronary artery disease. In the 5-year follow-up of the SYNTAX trial, there was no difference in the combined outcome of death, myocardial infarction, and stroke between percutaneous coronary intervention and coronary artery bypass. However, the rate of recurrent revascularization was higher in the percutaneous coronary intervention group. Especially in the diabetic patient group, the rate of recurrent revascularization was found to be higher.

In the 2018 European myocardial revascularization guideline(14), calculation of the SYNTAX score is recommended with a class 1 indication to evaluate the anatomical complexity of coronary artery disease in left main coronary lesions or multivessel disease. However, in the same guideline, it is recommended to calculate the SYNTAX score with a class 1 indication to determine long-term morbidity and mortality after percutaneous coronary intervention in left main coronary lesions and multivessel disease. In this guideline, coronary artery by-pass graft with class 1 indication is recommended in severe left main coronary lesions regardless of the SYNTAX score value. However, the value of SYNTAX is important for percutaneous coronary intervention in severe left main coronary lesions.

Percutaneous coronary intervention is recommended with a class 1 indication for those with a SYNTAX score below 22, while for

those with a SYNTAX score above 32, percutaneous coronary intervention is class 3. However, for those with SYNTAX score between 23-32, percutaneous coronary intervention is recommended with class 2a indication.

Coronary artery b-pass grafting is recommended regardless of the SYNTAX score in patients with 3-vessel disease with or without diabetes. However, the value of SYNTAX score is important in 3-vessel patients in whom percutaneous coronary intervention is planned. Percutaneous coronary intervention with a SYNTAX score below 23 is recommended with a class 1 indication in 3-vessel disease not accompanied by diabetes. However, the application of percutaneous coronary intervention in patients with a SYNTAX score above 22, independent of diabetes, is class 3. However, percutaneous coronary intervention is recommended with a class 2b indication in 3-vessel patients with a SYNTAX score below 23 accompanied by diabetes.

In non-ST-elevation or ST-elevation myocardial infarction, responsible non-lesional lesions should be evaluated as stable coronary artery disease. The SYNTAX score is important in determining the type of intervention in these patients(15,16).

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