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Preliminary Evaluation of a Clinical-Laboratory Score for Predicting Severe Coronary Lesions in STEMI: A Pilot Study

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ST-elevation myocardial infarction (STEMI) is a critical condition requiring urgent diagnostic and therapeutic intervention. This study evaluated the clinical utility of the CORTA score, which integrates clinical and laboratory parameters, as a non-invasive predictor of severe coronary lesions in STEMI patients. A retrospective analysis was conducted on 30 patients who underwent primary percutaneous coronary intervention (PCI) on the day of hospital admission. The findings demonstrated that the CORTA score exhibited strong discriminatory ability (AUC = 0.767, p = 0.0044) in identifying patients with extensive coronary involvement. Comorbidities emerged as the most significant individual predictor, while the optimal cutoff value was determined to be ≥4, with a sensitivity of 73% and specificity of 80%. CORTA score, based on readily available clinical and laboratory data, has the potential to enhance early risk stratification in STEMI patients, facilitating timely therapeutic decisions and prioritizing those requiring urgent intervention. Further prospective research is needed to validate this score in larger populations and diverse clinical settings.

Keywords: STEMI, CORTA score, coronary lesions, comorbidities, angiography

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Preliminarna evaluacija kliničko-laboratorijskog skora za predikciju teških koronarnih lezija kod STEMI: Pilot studija

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ST-elevacioni infarkt miokarda (STEMI) predstavlja ozbiljno stanje koje zahteva hitnu dijagnostiku i terapijsku intervenciju. Ova studija procenjuje kliničku primenu CORTA skora, integrisanog skora koji uključuje kliničke i laboratorijske parametre, kao neinvazivnog prediktora izraženih koronarnih lezija kod pacijenata sa STEMI. Retrospektivna analiza obuhvatila je 30 pacijenata koji su podvrgnuti primarnoj perkutanoj koronarnoj intervenciji (PCI) na dan prijema u bolnicu. Dobijeni rezultati pokazuju da CORTA skor ima značajnu diskriminativnu moć u identifikaciji pacijenata sa naprednom koronarnom bolešću (AUC = 0.767, p = 0.0044). Komorbiditeti su se izdvojili kao najznačajniji pojedinačni prediktor, dok je optimalna granična vrednost skora bila ≥4, pri čemu je zabeležena senzitivnost od 73% i specifičnost od 80%. CORTA skor, zasnovan na lako dostupnim kliničkim i laboratorijskim parametrima, može unaprediti ranu stratifikaciju rizika kod STEMI pacijenata, omogućavajući pravovremene terapijske odluke i prioritizaciju onih kojima je hitna intervencija najneophodnija. Dalja prospektivna istraživanja su neophodna za validaciju ovog skora u većim populacijama i različitim kliničkim okruženjima.

Ključne reči: STEMI, CORTA skor, koronarne lezije, komorbiditeti, angiografija

Introduction

Cardiovascular diseases (CVD) remain the leading cause of mortality and morbidity worldwide, with acute coronary syndrome (ACS)—particularly ST-elevation myocardial infarction (STEMI)—often representing the first clinical manifestation of atherosclerotic heart disease. In 2019 alone, an estimated 5.8 million new cases of ischemic heart disease were reported among the member states of the European Society of Cardiology, with STEMI representing its most urgent and life-threatening form (1).

Pathophysiologically, STEMI results from acute occlusion of one or more coronary arteries, most commonly due to rupture or erosion of an atherosclerotic plaque followed by thrombus formation (2). In clinical practice, the diagnosis of STEMI is based on evidence of myocardial ischemia (clinical symptoms and electrocardiographic findings) accompanied by elevated cardiac biomarkers, primarily troponins (3).

A wide range of laboratory parameters is being investigated as potential coronary artery disease severity predictors. For example, Cardiac troponins, owing to their high sensitivity and specificity, are well-established as standard biomarkers for diagnosing acute coronary syndrome, and their levels correlate with the extent of myocardial injury (3). One study demonstrated that elevated RDW values are significantly associated with an increased risk of cardiovascular disease, with individuals in the highest quartile exhibiting up to a 49% greater risk compared to those in the lowest quartile (4).

Numerous risk factors contribute to the development of STEMI, including hypertension, dyslipidemia, advanced age, male sex, genetic predisposition, and smoking (2,5). The lifetime risk of developing coronary artery disease (CAD) after the age of 40 is approximately 49% for men and 32% for women (6). Chronic conditions such as chronic kidney disease (CKD) and various endocrine disorders have also been increasingly linked to endothelial dysfunction and the progression of atherosclerosis (7,8). In patients with diabetes, the risk of developing CVD is more than twice as high, and CVD represents the leading cause of death in this population (9).

Although coronary angiography remains the gold standard for assessing the severity of coronary artery disease, it is an invasive procedure and may not be readily available in all settings. Therefore, identifying non-invasive clinical and laboratory parameters that can predict the extent of coronary lesions is of significant clinical relevance. There is a continuous need to discover additional simple predictors that can enhance early risk stratification and aid in

estimating disease severity at the initial point of care. Early identification of more extensive disease may guide timely therapeutic decisions and prioritization for percutaneous coronary intervention (PCI), especially when rapid reperfusion is critical for myocardial salvage ("time is muscle") (10).

In this context, composite scoring systems that combine multiple risk factors are increasingly being explored as useful tools for early patient stratification.

Aim

This pilot study aimed to assess whether a simple clinical-laboratory composite score could serve as an early predictor of severe coronary lesions in patients with ST-elevation myocardial infarction (STEMI), prior to coronary angiography.

Materials and Methods

This pilot study included patients with acute STEMI treated with primary percutaneous coronary intervention (PCI) on the same day of admission at the Cardiology Clinic of the University Clinical Center Niš. The study comprised 30 patients over 18 years old with a clearly defined STEMI diagnosis according to current ESC criteria, who underwent PCI with stent implantation on the day of admission. Exclusion criteria were age over 80 years, prior stenting, malignant diseases, chronic inflammatory conditions, active infections, and incomplete medical records.

Data were retrospectively collected from clinical documentation, including demographic data, laboratory results, admission ECG findings, presence of comorbidities, values of cardiac-specific biomarkers, and angiographic findings (stenosis percentage in LAD, LCX, RCA, LCA, Dg1, Dg2, and OM2).

Comorbidities were scored based on clinical relevance to form a comorbidity score as follows:

- 2 points: diabetes mellitus, cerebrovascular disease (CVI/TIA), chronic kidney disease, heart failure;
- 1 point: arterial hypertension, dyslipidemia/hypercholesterolemia, positive family history of cardiovascular disease;
- 0.5 points: alcoholism, hypothyroidism, atrial fibrillation, asthma/COPD.

Patients were classified into two groups according to the severity of coronary angiographic findings. Severe disease was defined as:

1. ≥70% stenosis of the LCA or proximal LAD;
2. ≥70% stenosis in two or more major coronary vessels (excluding smaller branches);

3. The presence of ≥50% narrowing in the LAD or LCA is accompanied by ≥70% narrowing in at least one additional major coronary artery.

Potential predictors of coronary disease severity were analyzed.

CORTA Score

Based on laboratory and clinical parameters, a novel predictive score—CORTA (Comorbidities, RDW, Troponin, Age)—was developed, incorporating a combination of significant variables. Each component was binarized according to clinically relevant cut-off values, and the total score was calculated as the sum of present risk factors.

Statistical Analysis

Continuous variables were described as mean ± standard deviation (SD). Correlations between the CORTA score and the severity of coronary lesions were assessed using Spearman's correlation coefficient. The discriminative ability of individual parameters and the CORTA score to predict severe angiographic findings was evaluated by receiver operating characteristic (ROC) curve analysis, with area under the curve (AUC) calculation. The optimal cut-off value was determined using the Youden index. Statistical significance was set at $p < 0.05$.

Results

The pilot study included 30 STEMI patients, of whom 73.33% were male, with a mean age of 62.43 ± 9.31 years. The most common comorbidities were hypertension (63.33%) and dyslipidemia (33.33%). Diabetes was present in 20% of patients. The average cumulative comorbidity score was 2.55 ± 1.36.

Coronary Angiography Findings

According to angiographic classification, 15 patients (50.00%) had mild disease, while 15 (50.00%) had severe disease. The LAD (66.67%) and RCA (63.33%) were the most commonly involved arteries, while notable lesions in the LCA were found in two patients.

Discriminative Ability of Individual Parameters

Three clinical parameters showed moderate discriminative ability for predicting severe coronary disease (Table 1).

Table 1. The discriminative ability of individual parameters in predicting severe coronary findings

Parameter	AUC	p-value
Age	0.658	0.0748
RDW	0.633	0.1078
Troponin I	0.627	0.1212

*AUC: area under the curve; RDW- red blood cell distribution width

Among the components, the comorbidity score demonstrated the highest individual discriminative power with an AUC of 0.756 (95% CI: 0.568–0.911, p = 0.0055). Other parameters had AUC values below 0.6 and were not further analyzed.

Correlation Between CORTA Score and Coronary Disease Severity

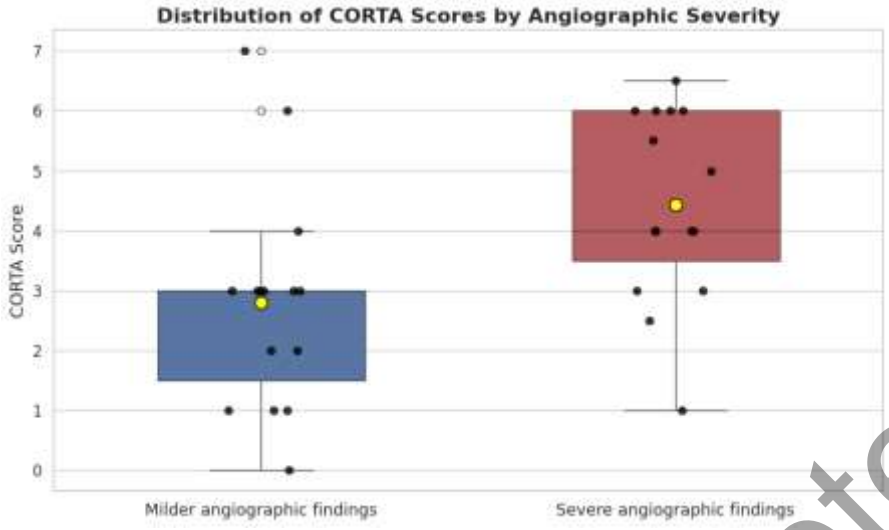
The mean CORTA score in the study sample was 3.62 ± 1.90, specifically 2.67 ± 2.11 in patients with milder findings and 4.53 ± 1.70 in patients with more severe findings. The difference in the distribution of CORTA scores between patients with milder and severe angiographic findings is shown in Figure 1.

A moderate positive and statistically significant correlation was found between the CORTA score and the severity of coronary lesions. The performance of the CORTA score about angiographic findings is presented in Table 2.

Table 2. Predictive characteristics of the CORTA score for identification of severe coronary findings

Parameter	Value
Optimal cut-off (Youden)	4.00
Sensitivity	0.73 (73%)
Specificity	0.80 (80%)
Youden index	0.53
Spearman's correlation (ρ)	0.469
p-value (correlation)	0.0089

ROC analysis demonstrated that the CORTA score has good discriminative ability in predicting severe coronary lesions, with an AUC of 0.767 (95% CI: 0.576–0.929, p = 0.0044) (Figure 2).



*The boxplots display the median, interquartile range, and the overall spread of the data for each group. The mean values are also highlighted on the boxplots (marked by yellow circles).

Figure 1. Distribution of CORTA Scores by Angiographic Severity

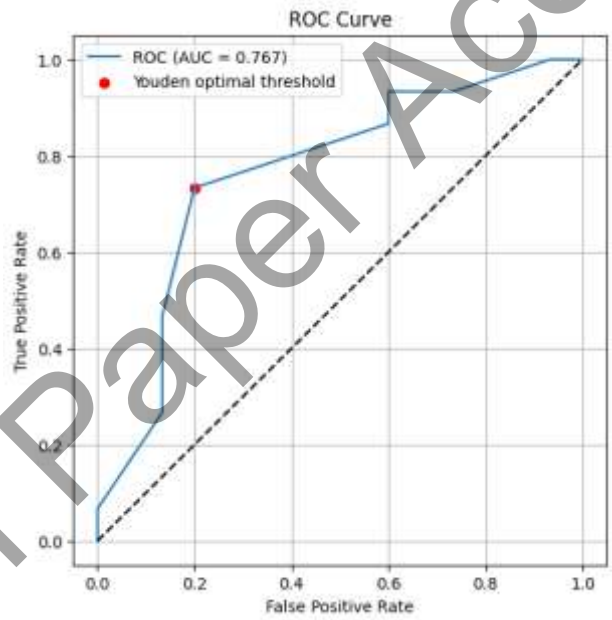


Figure 2. ROC curve of the CORTA score for prediction of severe coronary lesions.

Discussion

The results of this pilot study indicate that a simple clinical-laboratory score may serve as a useful tool for the initial risk assessment in patients presenting with ST-elevation myocardial infarction (STEMI). Specifically, the CORTA score—based on a combination of clinical and laboratory parameters (comorbidities, red cell distribution width [RDW], troponin I, and age)—effectively predicted severe coronary lesions in STEMI patients. The score demonstrated a significant discriminatory ability for identifying patients with more extensive coronary disease,

with an area under the curve (AUC) value of 0.767 (95% CI: 0.576–0.929, p = 0.0044), highlighting its potential as a simple, rapid, and non-invasive tool for early risk stratification. The CORTA score components were carefully selected based on previous evidence regarding predictors of advanced coronary disease and supported by individual statistical analysis of each parameter.

In our study, comorbidities emerged as the strongest individual predictor of severe coronary lesions (AUC = 0.756), aligning with contemporary studies emphasizing the critical role of chronic conditions—particularly type 2 diabetes mellitus (T2DM) and chronic kidney disease (CKD)—in the progression of coronary artery disease. The combination of T2DM and CKD has been associated with significantly increased mortality and major adverse cardiovascular events (MACE) in patients undergoing percutaneous coronary intervention (PCI). One study reported that this combination resulted in a 2.7-fold higher risk of cardiovascular events (11,12). These findings support the clinical value of comorbidity scoring in the early assessment of coronary disease severity.

RDW, incorporated in the CORTA score, has recently emerged as an independent marker for predicting cardiovascular events and the extent of coronary artery disease. For instance, the large SCAPIS cohort study demonstrated that elevated RDW correlates with higher coronary calcium scores and greater plaque infiltration (13). Furthermore, studies such as Sun et al. (2023) reported that RDW predicts the no-reflow phenomenon in diabetic STEMI cases, suggesting oxidative injury as an underlying mechanism (14). The pathophysiological basis likely includes inflammation, impaired erythropoiesis regulation, and oxidative stress.

While troponin I is primarily used as a diagnostic marker for STEMI, recent research has demonstrated its correlation with coronary disease burden. Samman Tahhan et al. analyzed 3,087 patients and found that elevated hs-cTnI levels were significantly associated with more severe coronary stenosis and disease progression ($\beta=0.31$; $p<0.001$) (15). However, in our study population—composed exclusively of STEMI patients—troponin I alone did not exhibit significant individual discriminatory power, possibly due to the homogeneity of the clinical presentation.

Age, a component of widely used risk stratification tools such as the GRACE and TIMI scores, also demonstrated a trend toward association with more advanced angiographic disease in our cohort. This finding aligns with well-established evidence that older individuals typically exhibit

a greater atherosclerotic burden and accumulate multiple cardiovascular risk factors over time. Nonetheless, age alone was not a sufficient standalone predictor in our analysis.

The CORTA score demonstrated superior risk stratification capabilities compared to individual parameters. Unlike existing risk scores such as GRACE, TIMI, and PURSUIT—which were primarily developed to predict mortality, reinfarction, or bleeding in acute coronary syndrome (ACS)—the CORTA score was designed to estimate the anatomical severity of coronary disease. This differentiation significantly influences treatment planning, especially concerning the timing and prioritization of invasive procedures.

Previous studies have evaluated the predictive value of scores such as $CHADS_2$ and CHA_2DS_2-VASc in assessing the severity of coronary artery disease in STEMI patients. Although a certain correlation with lesion severity was noted, these scores demonstrated restricted capacity in forecasting the number of involved vessels (16,17).

Additionally, one study examined the visual coronary artery calcium (CAC) scoring method as a predictor of significant coronary stenosis in patients with cardiac arrest but without STEMI, demonstrating that this visual CAC score could have a high predictive value (AUC = 0.95) for identifying patients who may benefit from emergent coronary angiography (18). These data reinforce the concept that non-invasive parameters may play a significant role in the early assessment of coronary disease severity.

Our results also revealed a moderate but statistically significant correlation between the CORTA score and angiographic severity ($\rho = 0.469$, $p = 0.0089$), supporting the hypothesis that higher CORTA scores may reflect more advanced coronary involvement. This is in line with previous findings linking comorbidities, inflammatory markers, and the progression of atherosclerosis.

The strength of our findings lies in the fact that the CORTA score is based on readily available parameters from standard medical history and laboratory testing and can be implemented early in the emergency department setting. An optimal cutoff value of CORTA ≥4 provided a favorable balance between sensitivity (73%) and specificity (80%), further supporting its clinical applicability in the initial assessment of STEMI patients.

In time-sensitive scenarios—particularly in resource-limited centers or when coronary angiography is not immediately available—such a simple tool can facilitate early risk stratification before invasive procedures. Accurate and timely risk stratification is essential in clinical settings, as it guides key decisions on patient transport, treatment pathways, and

triage. The CORTA score was designed as a bedside tool that utilizes information available within the first hour—without requiring additional testing—and may assist in determining the urgency of further diagnostic and therapeutic steps.

The primary limitations of this study are the small sample size and its retrospective nature, both of which may limit the external validity of the findings. Consequently, further validation in larger, prospective studies is essential to determine the clinical utility of the CORTA score. In addition, comparison with established anatomical scoring systems—such as the SYNTAX score—would offer valuable context regarding its relative predictive strength. Future refinements may include recalibration of the score or incorporation of additional clinical and biomarker variables to improve its prognostic precision.

Conclusion

The results of this study suggest that the CORTA score, a combination of clinical and laboratory parameters, may serve as a useful tool for assessing the severity of coronary artery disease in STEMI patients before coronary angiography. Identifying patients with a CORTA score ≥4 enables early risk stratification and directs them toward invasive diagnostics. This simple and easily applicable model has potential clinical value, particularly in emergency medical services and centers with limited diagnostic resources. However, given the small sample size and retrospective study design, further prospective research is needed to validate this score in larger populations and diverse clinical settings.

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