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The Relationship Between Selvester Qrs Score and Myocardial Performance İndex İn Patients With St Segment Elevation Myocardial İnfarctus Treated By Primary Percutaneous Coronary İntervention

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ABSTRACT

Electrocardiography (ECG) can be used to evaluate myocardial perfusion by using Selvester QRS score. The myocardial performance index (MPI), which is easily assessed by echocardiography (ECHO), is a technique that assesses both systolic and diastolic function regardless of ventricular shape. Our aim was to compare the association between MPI and Selvester QRS score in ST segment elevation myocardial infarctus (STEMI) patients.

Prospectively and sequentially, 101 patients with STEMI who came to our hospital between December 1, 2015, and September 31, 2017 were included in the research. The echocardiographies and ECGs performed between 24-48 hours of admission. Based on MPI value we separated the population into two groups. We considered patients with MPI≥ 0.4 as group 1, and patients with MPI <0.4 as group 2.

The mean age of the patients was 57,6 ± 11 years with 17% being female. The MPI and Selvester QRS score showed a positive correlation (coefficient: 0.501, p<0.001). A negative correlation was found between MPI and EF (coefficient: -0.353, p = 0.001) and GFR (coefficient: -0.219, p = 0.028).In multivariable logistic regression analysis Selvester QRS score was an independent predictor of MPI (%95 CI:0.599-0.981, p=0.035). In the ROC-curve analysis performed for MPI and Selvester QRS score, 69% sensitivity and 60% specificity were found for the Selvester QRS score cut-ff value of 3.5 (%95 CI:0.656-0.848, AUC:0.752, p <0.001).

Our study's findings indicate that we may predict left ventricular MPI in STEMI patients receiving primary PCI by using the Selvester QRS score.

Keywords: Myocardial performance index, Selvester QRS score, STEMI

Introducion

Acute myocardial infarction (AMI) is a common disease that progresses with serious morbidity and mortality and is mainly caused by atherosclerosis. Atherosclerotic heart disease can present with very different clinical spectrums, defined as stable coronary heart disease and acute coronary syndromes (ACS). The most common triggering event for AMI is the rupture of the sensitive plaque in the epicardial coronary arteries, followed by the activation of the intravascular coagulation cascade and total occlusion in the artery, which results in necrosis or death of myocardial cells.

The use of traditional echocardiographic parameters to estimate left ventricular (LV) diastolic and systolic functioning is fraught with limitations. The spherical form of the heart causes significant inaccuracies in the EF and LV volumes when the heart's ellipsoid shape changes. The most widely used technique for examining diastolic function, the Doppler signal of transmitral flow, is influenced by age, rhythm, conduction abnormalities, and variations in the preload and afterload of the heart. Tei Chuwa et al. initially created the global myocardial performance

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index (MPI)(1). It represents the myocardium's diastolic and systolic function. It has been linked to cardiovascular disease morbidity and death. It has a small range in healthy, typical people and is readily estimated. This index may be easily determined using doppler traces acquired from mitral and aortic flows, and it is unaffected by heart rate, age, ventricular anatomy, and afterload (2). Figure 1 depicts the Tei index's computation process.

Selvester QRS score; It is a set of electrocardiographic criteria designed to identify, localize and grade scar tissue in the left ventricle using QRS complex morphology (3). It was first described in 1972 (4). Many publications have demonstrated the clinical benefits of this scoring system (5, 6). The scoring was updated by Wagner et al. in 2009 to extend the Selvester criteria to patients with left ventricular hypertrophy (LVH) and conduction abnormalities such as left bundle branch block due to their interruption in patients with LBBB (3, 4). The modified Selvester QRS score is shown in figure 2.

A significant relationship between QRS score and left ventricular ejection fraction was found in the study by Palmeri et al. According to this study, there is an inversely proportional relationship between the QRS score and LV EF after acute myocardial infarction (7).

Our aim in this study was to compare the relationship between Selvester QRS score and myocardial performance index, which is used to evaluate left ventricular function in STEMI patients.

Materials and Methods

Study population: A prospective and sequential analysis was conducted on 120 cases; 98 men and 22 women, ages 25 to 80—who were admitted to Diyarbakır Gazi Yaşargil Training and Research Hospital between December 01, 2015, and September 31, 2017. These cases were evaluated as STEMI and did not have moderate-to-severe heart valve disease. 107 of these instances had acute STEMI diagnoses, and these individuals were studied. Six instances were eliminated from the research due to their inability to be contacted by phone or identification information query. There were 101 patients in the research. Every patient was made aware of the study's objectives and required to sign a permission form in order to take part. The patient and his first-degree relatives provided information on the patient. Clinical risk factors such smoking, diabetes, hyperlipidemia, hypertension, obesity, and family history were noted, along with the demographics of each patient included in the study.

In addition, the blood pressure, heart rate, and previous medications of all patients during hospitalization were recorded, serum creatinine, sodium, potassium, blood glucose, HbA1c, lipid values (total cholesterol, LDL, HDL, triglyceride) were studied, and the GFR values of all patients were calculated with the MDRD formula.

We divided the study population into 2 groups according to MPI value. We considered patients with MPI≥ 0.4 as group 1, and patients with MPI <0 .4 as group 2.

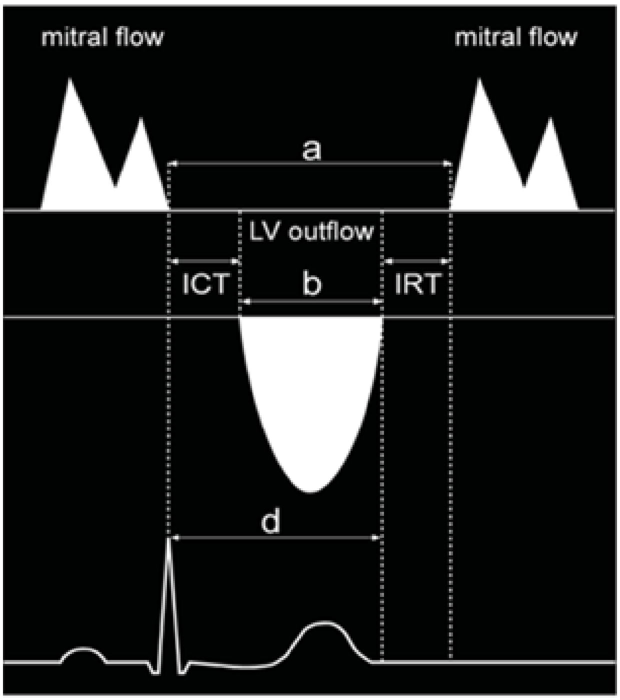
Definitions: Diabetes mellitus (DM): 126 mg/dL (7.0 mmol/L) or higher fasting blood sugar; an HbA1c of greater than 7; or use of antidiabetic drugs

Hypertension (HT): Arterial blood pressure more than 140 mmHg or the use of antihypertensive agents

Dyslipidemia: The use of antilipid medications or a reading of total cholesterol of fasting over 200 mg/dL

Coronary Anjiography: Coronary angiography and angioplasty of 101 patients were performed through the femoral approach using Philips Allura Xper FD10 (single-head) and Philips Allura Coronary angiographies were evaluated by at least two cardiologists. All angiographic measurements were made in diastole. Procedural succes was defined as residual stenosis <20%, Thrombolysis in Myocardial Infarction (TIMI) flow >3 and no death.

Caltulation Selvester QRS score and Myocardial performance index: Post-admission, a 12-lead continuous ECG was recorded at 24 hours after PCI. Selvester QRS score was calculated using the Selvester-Wagner QRS scoring system (8). Echocardiographic measurements of the patients were made with the Philips EPIQ 7G Release 1.5.6 device between 24-48 hours after the percutaneous coronary intervention. When measuring MPI with the conventional method, an apical five-chamber window was used. The PW doppler sampling marker was placed at the tip of the anterior mitral leaflet. Images in which both mitral filling and aortic discharge curves were clearly visible were taken and recorded. In the image taken, the period from the end of the diastolic mitral A wave to the beginning of the systolic aortic ejection (S) wave was determined as isovolumetric contraction time (ICT). The time from the end of the S wave to the beginning of the mitral diastolic E wave was determined as isovolumetric relactation time (IRT). The period between the beginning and the end of the S wave was accepted as ejection time (ET). MPI value was calculated by placing these three parameters in the determined formula. All echocardiographic measurements were measured according to the American Echocardiography Guidelines recommendations.



$$MPI = \frac{(a - b)}{b} = \frac{(ICT + IRT)}{ET}$$

Fig. 1. Myocardial performance index calculation sheme

Lead	RBBB Criteria	Pts	LAFB Criteria	Pts	LAFB + RBBB Criteria	Pts	LVH Criteria	Pts	No Confounders Criteria	Pts	Max Pts
I	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	
	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	2
	R ≤ 0.2 mV		R ≤ 0.2 mV		R ≤ 0.2 mV		R ≤ 0.2 mV		R ≤ 0.2 mV		
II	Q ≥ 40 ms	2	Q ≥ 40 ms	2	Q ≥ 40 ms	2	Q ≥ 40 ms	2	Q ≥ 40 ms	2	2
	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	
aVL	Q ≥ 30 ms	1	Q ≥ 40 ms	1	Q ≥ 40 ms	1	Q ≥ 40 ms	1	Q ≥ 30 ms	1	2
	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	
aVF	Q ≥ 50 ms	3	Q ≥ 50 ms	3	Q ≥ 50 ms	3	Q ≥ 60 ms	3	Q ≥ 50 ms	3	
	Q ≥ 40 ms	2	Q ≥ 40 ms	2	Q ≥ 40 ms	2	Q ≥ 50 ms	2	Q ≥ 40 ms	2	
	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 40 ms	1	Q ≥ 30 ms	1	5
	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	
	R/Q ≤ 2	1	R/Q ≤ 2	1	R/Q ≤ 2	1	R/Q ≤ 2	1	R/Q ≤ 2	1	
V1	Q ≥ 50 ms	2			Q ≥ 50 ms	2	any QR				(2)
Ant.	any Q	1	any QR	1	any Q	1	(or QS if *)	1	any Q	1	1
	R ≤ 20 ms						.04S notch				
V1			R/S ≥ 1	1		1	R/S ≥ 1	1	R/S ≥ 1	1	
Post.	Init R ≥ 60 ms	2	Init R ≥ 50 ms	2	Init R ≥ 60 ms	2	Init R ≥ 50 ms	2	Init R ≥ 50 ms	2	
	Init R ≥ 1.5 mV		Init R ≥ 1 mV		Init R ≥ 1.5 mV		Init R ≥ 1 mV		Init R ≥ 1 mV		4
Exclude if	Init R ≥ 50 ms	1	Init R ≥ 40 ms	1	Init R ≥ 50 ms	1	Init R ≥ 40 ms	1	Init R ≥ 40 ms	1	
	Init R ≥ 1.0 mV		Init R ≥ 0.7 mV		Init R ≥ 1.0 mV		Init R ≥ 0.7 mV		Init R ≥ 0.7 mV		
↑			Q&S ≤ 0.2 mV	1			Q&S ≤ 0.2 mV	1	Q&S ≤ 0.2 mV	1	
V2	Q ≥ 50 ms	2			Q ≥ 50 ms	2					(2)
	any Q	1	any QR	1	any Q	1	any QR	1	any Q	1	1
Ant.	R ≤ 10 ms		R ≤ 10 ms		R ≤ 10 ms		(or QS if *)		R ≤ 10 ms		
	R ≤ 0.1 mV		R ≤ 0.1 mV		R ≤ 0.1 mV		.04S notch		R ≤ 0.1 mV		
V2			R/S ≥ 1.5	1			R/S ≥ 1.5	1	R/S ≥ 1.5	1	
Post.	Init R ≥ 70 ms	2	R ≥ 60 ms	2	Init R ≥ 70 ms	2	R ≥ 60 ms	2	R ≥ 60 ms	2	
	Init R ≥ 2.5 mV		R ≥ 2 mV		Init R ≥ 2.5 mV		R ≥ 2 mV		R ≥ 2 mV		4
Exclude if	Init R ≥ 50 ms	1	R ≥ 50 ms	1	Init R ≥ 50 ms	1	R ≥ 50 ms	1	R ≥ 50 ms	1	
	Init R ≥ 2.0 mV		R ≥ 1.5 mV		Init R ≥ 2.0 mV		R ≥ 1.5 mV		R ≥ 1.5 mV		
↑			Q&S ≤ 0.3 mV	1		1	Q&S ≤ 0.3 mV	1	Q&S ≤ 0.3 mV	1	
V3	Q ≥ 30 ms	2	Q ≥ 30 ms	2	Q ≥ 30 ms	2	QR+Q ≥ 30 ms	2	Q ≥ 30 ms	2	
	R ≤ 10 ms		R ≤ 10 ms		R ≤ 10 ms		.04S notch		R ≤ 10 ms		2
	Q ≥ 20 ms	1	Q ≥ 20 ms	1	Q ≥ 20 ms	1	any QR	1	Q ≥ 20 ms	1	
	R ≤ 20 ms		R ≤ 20 ms		R ≤ 20 ms		(or QS if *)		R ≤ 20 ms		
V4	Q ≥ 20 ms	1	Q ≥ 20 ms	1	Q ≥ 20 ms	1	Q ≥ 20 ms	1	Q ≥ 20 ms	1	
	R/Q ≤ 0.5	2	R/Q ≤ 0.5	2	R/Q ≤ 0.5	2	R/Q ≤ 0.5	2	R/Q ≤ 0.5	2	
	R/S ≤ 0.5		R/S ≤ 0.5		R/S ≤ 0.5		R/S ≤ 0.5		R/S ≤ 0.5		
	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	R/Q ≤ 1	1	3
	R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		
	R ≤ 0.5 mV		R ≤ 0.5 mV		R ≤ 0.5 mV		R ≤ 0.5 mV		R ≤ 0.5 mV		
	.04R notch		.04R notch		.04R notch		.04R notch		.04R notch		
V5	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	
	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	
	R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		
	R/Q ≤ 2	1	R/Q ≤ 2	1	R/Q ≤ 2	1	R/Q ≤ 2	1	R/Q ≤ 2	1	3
	R/S ≤ 2		R/S ≤ 1.5		R/S ≤ 1.5		R/S ≤ 2		R/S ≤ 2		
	R ≤ 0.6 mV		R ≤ 0.6 mV		R ≤ 0.6 mV		R ≤ 0.6 mV		R ≤ 0.5 mV		
	.04R notch		.04R notch		.04R notch		.04R notch		.04R notch		
V6	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	Q ≥ 30 ms	1	
	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	R/Q ≤ 1	2	
	R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		R/S ≤ 1		
	R/Q ≤ 3	1	R/Q ≤ 3	1	R/Q ≤ 3	1	R/Q ≤ 3	1	R/Q ≤ 3	1	3
	R/S ≤ 3		R/S ≤ 2		R/S ≤ 2		R/S ≤ 3		R/S ≤ 3		
	R ≤ 0.6 mV		R ≤ 0.6 mV		R ≤ 0.6 mV		R ≤ 0.6 mV		R ≤ 0.6 mV		
	.04R notch		.04R notch		.04R notch		.04R notch		.04R notch		
Total	Points		Points		Points		Points		Points		32

Fig. 2. Selvester QRS score calculation sheme

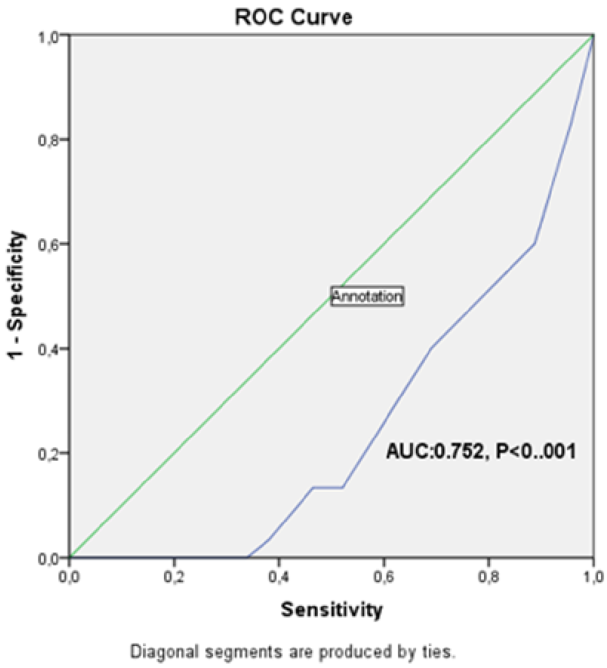


Fig. 3. ROC analysis of Selvester QRS score and MPI

Statistical Analysis: The statistical software program SPSS v24 was used to analyze the data statistically Power analysis and sample size were made with G*power 3.1.9.4 program. We calculated that a minimum of 94 patients were sufficient for the study at 0.05 of the alpha (α) error value and at 95% of the research power. Kolmogorov-Smirnov tests and histograms were employed to evaluate the data's homogeneous distribution. The mean ± standard deviation was used to display normally distributed continuous data, the median and 25.-75. percentiles were used to display non-normally distributed continuous data, and number and percentage were used to display categorical data. The Student T test was used to compare regularly distributed continuous data between groups, while the Mann Whitney U test was used to analyze non-normally distributed continuous data. To compare categorical data, the Chi-square test was employed. The Pearson correlation tests were used to conduct correlation analysis. Parameters with $p<0.1$ in univariate logistic regression analysis were taken into account in multivariate logistic regression analysis. The data was evaluated using the "p" value to determine the statistical significance threshold; a value of $p < 0.05$ was considered statistically significant.

Results

Our study comprised 17 female and 84 male participants. The mean age was 57.6±11.1 years, mean body mass index (BMI) was 27.66±4.65, mean MPI value was 0.47±0.12, mean Selvester QRS score was

Table 1: Baseline Characteristics of the Study Population

Variable	Total population mean±SD, n (%) or median (25-75. percentiles) (n=101)	MPI ≥0.4 mean±SD, n (%) or median (25-75. percentiles) (n=71)	MPI<0.4 mean±SD, n (%) or median (25-75. percentiles) (n=30)	p value
Age (year)	57.64±11,1	57.58±12.14	57,80±8.35	0.637
Female gender	17 (%16.8)	14 (%19.7)	3 (%10)	0.076
MPI value	0.47±0.12	0.505±0.08	0.32±0.05	0.001
Selvester QRS score	4.69 (1-6)	5.71 (2-9)	2.27 (1-3)	0.001
HT	37 (%36.6)	28 (%39.4)	9 (%30)	0.375
DM	29 (%28.7)	20 (%28.1)	9 (%30)	0.853
Hyperlipidemia	67 (%66.3)	45 (%63.4)	22 (%73.3)	0.329
CAD History	45 (%45.5)	29 (%40.8)	16 (%53.3)	0.268
Smoking	74 (%73.3)	51 (%71.8)	23 (%76.6)	0.616
BMI (kg/m2)	27.66±4.65	27.62±4.79	27.77±4.36	0.121
HR (beat/minute)	72.97±12.92	75±12.46	68.17±2.36	0.248
EF (%)	55(48-60)	50 (43-58)	55 (55-60)	0.001
GFR (ml/1.73m2)	84 (71-90)	87 (72-90)	90 (81-90)	0.028
Fasting glucose (mg/dl)	122 (107-148)	135 (113-168)	128 (109-150)	0.613
Total cholesterol (mg/dl)	187.8±44.43	185.7±45.3	192.8±42.7	0.204
Triglyceride (mg/dl)	151.9±81.8	155.7±86.2	142.9±71.4	0.585
LDL (mg/dl)	118.7±36	116.8±36.6	123.1±35.1	0.178
HDL (mg/dl)	38.64±8.76	38.57±8.37	38.82±9.8	0.773
HbA1c	5.5 (5.1-5.9)	5.6 (5.1-6.5)	5.75 (5.5-6.4)	0.934

MPI: Myocardial performance index (Tei index), HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery disease, BMI: Body mass index, HR: Heart rate, EF: Ejection fraction, GFR: Glomerulary filtration rate, LDL: Low density lipoprotein, HDL: High density lipoprotein

Student t test, Mann whitney U test and Chi-sqare test was used in this table

Table 2: Pearson Correlation Analysis of MPI and Other Continious Variables

Variable	MPI (correlation coefficient=r)	p value
Age (year)	-0.048	0.637
Selvester QRS score	0.501	0.001
BMI (kg/m^2)	-0.156	0.121
HR (beat/minute)	0.116	0.248
EF (%)	-0.353	0.001
GFR (ml/1.73m^2)	-0.219	0.028
Total cholesterol (md/dl)	-0.131	0.204
Triglyceride (mg/dl)	0.056	0.585
LDL (mg/dl)	-0.139	0.178
HDL (mg/dl)	-0.030	0.773
HbA1c	-0.008	0.934

MPI: Myocardial performance index (Tei index), HT: Hypertension, DM: Diabetes mellitus, BMI: Body mass index, HR: Heart rate, EF: Ejection fraction, GFR: Glomerulary filtration rate, LDL: Low density lipoprotein, HDL: High density lipoprotein

Pearson correlation analysis was used in this table

Table 3: Predictors of MPI in Univariable and Multivariable Logistic Regression Analysis Model

Variables	Univariate Model		Multivariate Model	
	OR (CI 95%)	p value	OR (CI 95%)	p value
Age	0.985(0.947-1.024)	0.443		
Female gender	3.750 (0.801-17.555)	0.093	32.903 (2.599-416.548)	0.007
BMI	1.035(0.924-1.159)	0.554		
QRS score	0.701(0.573-0.856)	0.001	0.761(0.596-0.972)	0.029
EF	1.149(1.057-1.248)	0.001	1.175(1.034-1.336)	0.014
LAD	0.398(0.105-1.512)	0.176		
GFR	1.051(1.000-1.104)	0.048	1.044(0.994-1.097)	0.087
Albumin	2.46280.194-31.213) 31,213	0.487		
Total cholesterol	1.000(0.991-1.008)	0.917		
Hemoglobine	1.116(0.836-1.490)	0.455		
HbA1c	1.163(0.974-1.389)	0.095	1.466(1.068-2.014)	0.018
DM	1.093(0.428-2.788)	0.853		
HT	0.658(0.264-1.642)	0.37		
HL	0.629(0.245-1.615)	0.335		
CAD History	1.655(0.701-3.909)	0.25		
Smoking	1.289(0.478-3.473)	0.616		

MPI: Myocardial performance index (Tei index), HT: Hypertension, DM: Diabetes mellitus, CAD: Coronary artery disease, BMI: Body mass index, HR: Heart rate, EF: Ejection fraction, GFR: Glomerulary filtration rate, LDL: Low density lipoprotein, HDL: High density lipoprotein
Logistic regression models used in this table

4.63±4.15. mean cardiac beat was 72.97±12.92 bpm, mean ejection fraction was 50.59±8.89, mean GFR was 83±12.19 ml/min, mean LDL cholesterol value was 118.7±36.06 mg/dl, mean Hba1c value was 6.48±2.28. The baseline characteristics of the study population are shown in table 1.

There were no notable variations in the groups' comorbidities, such as as HT, DM, BMI, CAD, HL, and smoking (p>0.05). In Group 1, Selvester QRS score was 5.71 ±4.29 vs 2.27±2.53 and was statistically significantly higher (p<0.001). Group 1's EF was lower (group 1: 49.2±9.35, group 2: 54.15±6.53 [p<0.001]). Lastly, group 1's GFR value was lower (group 1: 82±13.83, group 2: 85.3±6.62 [p=0.028]). The levels of total cholesterol, triglycerides, HDL, LDL, TSH, HB, and HbA1c did not significantly differ across the groups.

Pearson correlation analysis was performed to investigate the relationship between MPI value and Selvester QRS score, EF and GFR. A positive correlation was found between MPI and Selvester QRS score (coefficient: 0.501, p<0.001). A negative correlation was detected between MPI and EF (coefficient: -0.353, p = 0.001) and GFR (coefficient: -0.219, p = 0.028).

Univariate logistic regression analysis was utilized to investigate the impact of the covariates on the MPI value. The variables with p<0.1 in the univariable logistic regression analysis were incorporated in the multivariable logistic regression. There was a noteworthy correlation found between gender (%95 CI:2.181-323.609, OR:26.566, p=0.010), Selvester QRS score (%95 CI:0.599-0.981, OR:0.766, p=0.035), EF (%95 CI:1.009-1.328, OR:1.157, p=0.037) and HbA1c (%95 CI:1.057-1.980, OR:1.447, p=0.021) values and MPI. Selvester QRS score was evaluated as an independent predictor of MPI. Logistic regression analyse results were shown in table 3.

In the ROC-curve analysis performed for MPI and Selvester QRS score, 69% sensitivity and 60% specificity were found for the Selvester QRS score cut-ff value of 2.5 (figure 3, %95 CI:0.656-0.848, AUC:0.752, p <0.001).

Discussion

In this study, we discovered that EF and the Selvester QRS score were independent predictors of MPI in STEMI patients who had PCI. Numerous studies have examined the relationship between Selvester

QRS score and MPI and heart failure and death in cardiovascular diseases. (9-14).

MPI value increases in STEMI patients compared to normal(9, 15). This increase continues to decrease for about a year (16). Research has demonstrated a correlation between elevated MPI values during the acute phase and the onset of heart failure and death in individuals with STEMI. (10). In a study supporting this result, a significant relationship was shown between the MPI value higher than 0.60 obtained at the 24th hour of STEMI and the occurrence of left ventricular dilatation and mortality (9). Similar to this study, our study also found a relationship between high MPI values and the development of heart failure. However, since patient follow-up was not performed for mortality in our study, the relationship between MPI and mortality was not investigated.

A remarkable result was obtained in a study by Poulsen et al (16). They reported that the MPI value determined in the late period of MI is more sensitive than EF in predicting the development of adverse cardiovascular events. There are also many studies supporting the superiority of MPI over EF in evaluating systolic and diastolic functions.

An increase in MPI has been shown in patients with hypertension (17). IRT is prolonged due to diastolic dysfunction secondary to hypertension, in which case an increase in MPI value is the expected result. In our study, no significant relationship was found between hypertension and MPI. This may be because patients were evaluated only in the acute period.

In a study conducted by Bounous E.P et al. including 1915 patients, the relationship between QRS score and life expectancy was investigated, and as a result of this study, 1, 3, and 5-year life expectancy was found to be significantly lower in patients with high QRS scores than in patients with low QRS scores (12).

In patients with acute STEMI undergoing primary PCI, Uyarel H et al. examined the predictive efficacy of the QRS score with respect to the ST segment and 30-day clinical outcomes. In this investigation, patients who had elevated QRS scores (≥4) were more likely to exhibit the no-reflow phenomena than patients with low QRS values (34.4% and 6.3%, $p<0.001$). Once more, in this investigation, the high QRS score group saw a greater risk of 30-day composite major cardiac events (14% vs. 0%, $p=0.007$) compared to the low QRS score group. The findings of this study led to the hypothesis that in patients with acute STEMI who had PCI, the QRS score, noreflow, and 30-day composite may be predictive of significant cardiac events. (14).

Heart failure patients undergoing cardiac resynchronization treatment (CRT) were studied by Bani R et al. in order to determine the predictive value of the LBBB Selvester QRS scoring system and the simplified QRS scoring system in terms of anticipated CRT response. The reaction to CRT was inversely correlated with the LBBB Selvester QRS score and the simplified QRS score. It was discovered that non-response to CRT was independently correlated with both scores. Regarding the other endpoints, neither scoring technique showed any connection. In heart failure patients with real LBBB, the simplified QRS score can predict responsiveness to CRT, according to this study. (18).

As a result, looking at the correlation of these two parameters used to evaluate left ventricular functions, there is a significant relationship between them and Selvester QRS score is an independent predictor of MPI.

Limitations: Our studys major limitation is that revascularized patients were evaluated. There are significant changes in MPI value after revascularization. One of the limiting factors of our study is imaging methods other than echocardiography were not used when evaluating left ventricular functions. Apart from echocardiography, left heart functions can also be evaluated by cardiac catheterization and nuclear imaging methods. However, these methods have limited superiority over echocardiography in routine evaluation because they are risky, have high costs, and cannot be used at the bedside. Another limitation of our study is the small number of patients. Patients were not followed up after hospitalization. The MPI values of the patients before revascularization were not examined. Another limitation of our study is that only conventional MPI value measurement was made, tissue doppler MPI measurement was not performed.

Based on the correlation we discovered between the MPI and QRS score, superficial ECG becomes more significant in the overall assessment of patients who arrive at the emergency room with STEMI. Because this study suggests that we may be able to predict MPI using the QRS score obtained from superficial ECG. A superficial ECG can save time in this patient group that is brought to the emergency room with a diagnosis of STEMI, when time is of the essence.

Because the Selvester QRS score obtains and uses prognostic information from the conventional ECG in a straightforward quantitative way, it is a valuable test for physicians monitoring patients with coronary artery disease. Measuring the observed variations in QRS can yield superior prognostic results. Similarly, researchers looking into individuals with coronary artery disease can benefit from QRS scoring due to its ease of use, cheap cost, and minimal risk.

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