

Comparison of prognostic value of epicardial blood flow and early ST-segment resolution after primary coronary angioplasty. ANIN – Myocardial Infarction Registry

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Abstract

Background: TIMI scale is commonly used for angiographic assessment of reperfusion effectiveness and early risk stratification in patients treated with primary angioplasty for ST-elevation myocardial infarction (STEMI). Since ST-resolution analysis allows a noninvasive insight into the reperfusion status at the myocardial tissue level, it may be a better predictor of outcome after primary angioplasty.

Aim: To compare the prognostic value of the reperfusion effectiveness evaluation based on either the epicardial blood flow assessment according to the TIMI scale, or ST-segment resolution analysis in patients treated with primary coronary angioplasty for STEMI.

Methods: 324 consecutive patients treated within 12 hours from the pain onset were studied. Based on the analysis of maximal ST-segment elevation/depression identified in a single ECG lead recorded after the procedure (maxSTE), patients were classified into groups of high versus medium/low risk. Independently, distinguished were groups with restored normal (TIMI 3) and abnormal (TIMI 0-2) final blood flow in infarct related artery.

Results: The 30-day and one-year mortality rates were higher in the high-risk maxSTE group (25% of all patients) than in the other patients (14.8% vs. 2.5%, $p < 0.001$ and 18.5% vs. 5.4%, $p < 0.001$ respectively). In subjects (82%) with restored TIMI grade 3 blood flow, mortality at one-month and one-year was lower than in the group with abnormal final blood flow (3.1% vs. 15.6%, $p = 0.001$ and 6.2% vs. 18.8%, $p = 0.005$). Comparison in multivariate analysis revealed that maxSTE stratification but not final TIMI grade assessment remained an independent predictor of both, 30-day and one-year mortality (high vs. medium/low-risk category; OR 5.3, 95% CI 1.6-16.7, $p = 0.005$, and OR 3.3, 95% CI 1.4-7.8, $p = 0.007$, respectively). Furthermore, maxSTE proved to stratify the risk of death even in subgroup of patients with restored normal blood flow (OR 6.2, 95% CI 1.4-27.8, $p = 0.016$, and OR 3.0, 95% CI 1.1-8.7, $p = 0.039$, respectively).

Conclusions: Analysis of extent of maximal ST-segment elevation or depression identified in a single ECG lead after primary coronary angioplasty allows better prognosis of subsequent 30-day and one-year mortality than the assessment of final epicardial blood flow, stratifying risk of death even in a subgroup of patients with restored normal blood flow.

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Introduction

Restoration of normal epicardial blood flow, and, first of all, achievement of effective myocardial tissue perfusion, determines favourable short and long-term outcome in patients with ST-elevation myocardial infarction (STEMI). Thus, it is an essential aim of primary coronary angioplasty [1, 2] and accordingly an appropriate (adequately sensitive and specific) as well as clinically useful method of early reperfusion evaluation is fundamental for further therapeutic decisions [3, 4]. In daily clinical practice, a four-grade TIMI (Thrombolysis In Myocardial Infarction) scale is used for angiographic assessment of reperfusion effectiveness [5]. This classification is based on semiquantitative blood flow evaluation and allows early identification of patients at high or low risk of adverse clinical events. It has been demonstrated that only restoration of normal epicardial blood flow (TIMI 3) in the infarct-related artery corresponds with effective reperfusion and thus predicts favourable short and long-term prognosis [6].

Analysis of ST-segment resolution is a noninvasive tool of early assessment of reperfusion effectiveness of evidence-based predictive value [7-9]. Several methods of ST-segment resolution analysis were applied, and their predictive values were widely compared in patients treated with thrombolysis [10]. Among them, a simple risk stratification based on the assessment of extent of maximal ST-elevation/depression in a single ECG lead recorded up to 3 hours after treatment initiation (maxSTE), proposed by Schröder et al., was characterised by good sensitivity and specificity [11].

The aim of the current study was to compare the predictive value of two methods of early assessment of reperfusion effectiveness: angiographic classification of final epicardial blood flow according to the TIMI scale with a noninvasive analysis of ST-segment resolution according to the maxSTE method, in prediction of 30-day and 1-year mortality after primary coronary angioplasty in STEMI.

Methods

Patients

369 consecutive patients from the prospective ANIN Myocardial Infarction Registry, treated with primary coronary angioplasty between April and December 2002, were analysed. Design of ANIN registry was previously described [12]. Inclusion criteria were: ST-segment elevation ≥ 0.1 mV in >1 limb lead or ≥ 0.2 mV in >2 precordial leads, and chest pain lasting up to 12 hours. Patients with incomplete or illegible ECG tracings, with paced rhythm or with

intraventricular conduction disturbances interfering with ST-segment analysis, were excluded from the study. All patients were treated with a single loading dose of 300-500 mg aspirin and 300 mg of clopidogrel, followed by a typical daily dosing of 75-150 mg aspirin, 75 mg of clopidogrel or 500 mg of ticlopidine for at least 30 days. The use of GP IIb/IIIa inhibitors was left to the discretion of the operator; elective administration was instituted in patients with anterior STEMI, or diabetes. Emergency use of GP IIb/IIIa inhibitors was applied in the case of the "no reflow" phenomenon or massive thrombus in the patent artery. The study protocol was approved by the Local Bioethics Committee.

Coronary angiography

Blood flow in infarct related artery was assessed according to the TIMI scale independently by two interventional cardiologists. The following definitions were applied: TIMI 0 – no contrast flow below the site of occlusion; TIMI 1 – minimal, very slow contrast flow below the lesion; TIMI 2 – patent artery, but slow contrast flow in comparison with reference artery; TIMI 3 – normal coronary flow [5]. In the event of differences in individual assessment, an agreement had to be reached.

ECG analysis

Two independent observers, blinded for angiographic results of the procedure, analysed standard 12-lead ECG tracings, recorded before and 3 hours after the procedure. Measurement of maximal ST-segment elevation or depression was performed 20 ms after the J point with an accuracy of 0.05 mV. Leads I, aVL and V_1 - V_6 were analysed in anterior wall STEMI, whereas ST-segment elevation in II, III, aVF V_5 and V_6 and concomitant depression in V_1 - V_4 leads was evaluated in inferior wall STEMI.

Risk categories according to maxSTE

Based on the performed measurements, groups of low, medium and high-risk were distinguished according to the method proposed by Schröder et al. (Figure 1) [11]. In the case of large anterior wall STEMI, defined as a maximal ST-elevation of >4.5 mm before primary coronary angioplasty, the high-risk group consisted of patients with maximal ST-segment elevation >3 mm after angioplasty, and the group of low-risk included patients with residual elevation ≤ 2 mm. Conversely, in the case of anterior STEMI with maximal baseline ST-elevation ≤ 4.5 mm, patients were classified in the high-risk group when maximum

ST elevation exceeded 5-mm after the procedure, and to the low-risk group when ST-elevation was ≤ 1 mm. In the case of inferior STEMI, regardless of extent of baseline ST-elevation or depression, the high-risk group consisted of patients with maximal ST-segment elevation/depression >2 mm after the procedure, and the low-risk group included patients with ST-deviation of ≤ 1 mm. The remaining patients were classified in the medium-risk group.

Long-term follow-up

The 12-month mortality was evaluated based on medical records, prospective data obtained from outpatient clinic, written correspondence and telephone calls as well as PESEL register data.

Statistical analysis

Primary end-points of the study included 30-day and 1-year mortality. Continuous variables are presented as medians with interquartile intervals and compared by means of nonparametric Mann-Whitney and Kruskal-Wallis tests. Categorical variables are given as percentages and their distribution was compared using Fisher and χ^2 tests. One-year mortality was presented on the graphs as Kaplan-Meier curves. Prognostic value of analysed methods as predictors of primary end-points was evaluated by multivariate

logistic regression, including age, gender, diabetes history, previous myocardial infarction, hypertension, cigarette smoking, anterior wall STEMI, pain-to-balloon time, TIMI grade 3 in infarct related artery before coronary angioplasty, and additionally heart rate, systolic blood pressure and Killip class, all assessed on admission. High-risk and combined medium and low-risk groups according to maxSTE, as well as groups with normal (TIMI 3) and abnormal (TIMI 0-2) final blood flow, were compared in multivariate analysis. The relationship between two studied methods was assessed in cross-table analysis, determining the significance level of Spearman correlation and measure of agreement with ascertained Cohen's kappa coefficient (κ). Also, prognostic value of maxSTE stratification was studied separately in a subgroup of patients with normal blood flow after the procedure. A p value <0.05 was considered significant.

Results

Among 369 patients from ANIN registry, 324 met the study inclusion criteria (mean age: 60 years, from 36 to 90). Women constituted 28% of the study group, anterior STEMI was diagnosed in 145 patients (44.8% of cases), 12 (3.7%) patients presented with cardiogenic shock on admission, and 37 (11.4%) had symptoms of acute heart failure (Killip class >1). Median pain-to-balloon time was 4.2 hours (3.2-5.9). Forty-seven

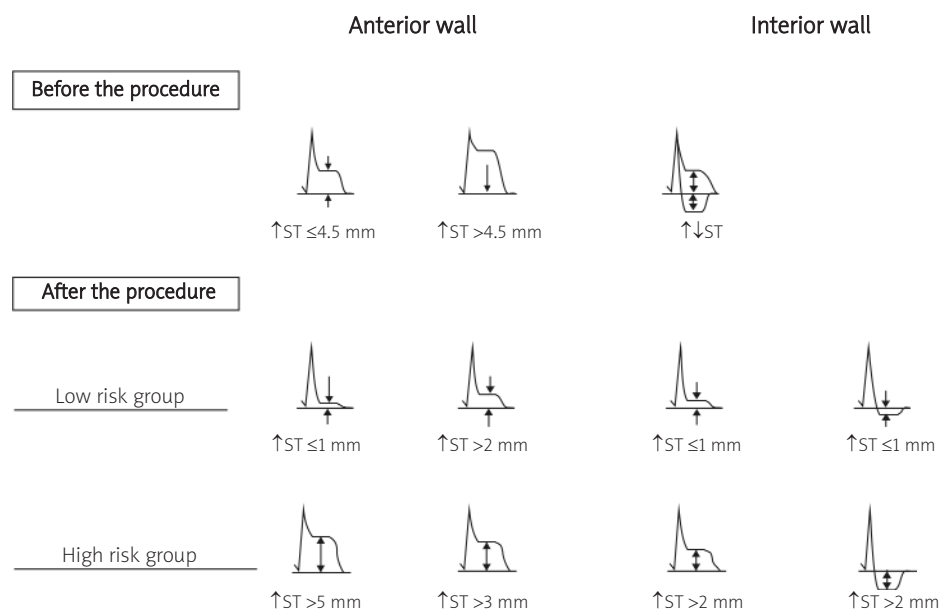


Figure 1. Diagram of ST-segment resolution analysis based on assessment of extent of maximal ST-segment *elevation* (anterior wall) or *elevation/depression* (inferior wall) identified in a single lead of ECG recorded upto 3 hours after primary angioplasty, according to the methodology proposed by Schröder et al. (maxSTE) [11]

Table I. Comparison of selected variables between groups with normal (TIMI 3) and abnormal (TIMI 0-2) blood flow after the procedure and between groups selected based on maxSTE

Parametr	Final blood flow in infarct-related artery TIMI score		Risk categories according to maxSTE		
	TIMI 3 (n=265; 81.7%)	TIMI 0-2 (n=59; 18.3%)	Low-risk group (n=139; 43.0%)	Medium-risk group (n=104; 31.9%)	High-risk group (n=81; 25.1%)
Age [years]	58.9 (51.0-68.0)	66.0 (53.8-72.7) ^b	57.7 (51.0-65.8)	59.4 (50.6-71.6)	64.0 (53.7-71.0)
Anterior STEMI [%]	45.1	40.7	33.1	57.3	46.9 ^b
Pre, Σ of ST-segment elevations and depressions [mm]	14.5 (8.0-21.5)	15.5 (7.0-23.0)	10.75 (5.5-18.0)	15.0 (8.8-19.5)	21.0 (14.3-32.5) ^c
Pre, maximal ST-segment elevation [mm]	4.0 (2.5-5.0)	4.0 (2.0-6.0)	3.0 (2.0-5.0)	4.0 (2.8-5.0)	5.0 (4.0-9.3) ^c
Post, Σ of ST-segment elevations and depressions [mm]	4.7 (2.0-9.5)	8.0 (5.0-12.0) ^c	2.0 (0.5-3.5)	7.0 (5.0-9.0)	13.0 (9.5-19.5) ^c
Post, maximal elevation/depression of ST [mm]	1.5 (1.0-3.0)	2.0 (1.5-3.5) ^c	1.0 (0.5-1.0)	2.0 (1.5-3.0)	4.0 (3.0-5.0) ^c
Degree of resolution of Σ of elevated ST segments [%]	63.0 (39.0-83.0)	39.0 (6.0-61.2) ^c	81.0 (65.0-92.0)	45.0 (25.0-63.0)	38.0 (8.8-57.8) ^c
Degree of resolution of Σ of elevated/depressed ST segments [%]	66.0 (44.0-85.0)	38.5 (14.0-61.8) ^c	82.0 (67.0-93.0)	48.0 (30.0-65.0)	40.5 (14.0-57.3) ^c
Diabetes [%]	15.2	25.4	14.4	19.4	18.5
History of smoking [%]	76.9	67.8	81.3	68.0	74.1
Previous myocardial infarction [%]	14.8	27.1 ^a	14.4	18.4	19.8
Heart rate on admission [#/min]	80.0 (68.0-90.0)	79.0 (69.5-92.3)	75.0 (66.0-90.0)	80.0 (69.0-90.0)	80.0 (68.0-92.0)
Systolic blood pressure on admission [mmHg]	132.0 (120.0-152.3)	142.0 (117.0-156.3)	130.0 (118.8-150.0)	144.0 (120.0-160.0)	130.0 (119.3-150.0) ^a
Patients admitted with Killip class >1 [%]	10.6	15.3	6.5	12.6	18.5 ^a
Patients admitted with cardiogenic shock [%]	2.3	10.2 ^a	1.4	4.9	6.2
Time from the pain-onset to first balloon inflation [h]	4.0 (3.1-5.8)	5.2 (3.6-6.7) ^a	3.9 (3.2-5.9)	4.4 (3.2-6.4)	4.0 (2.8-5.6)
Highest value of CKMB [U/L]	74.3 (22.6-176.7)	80.5 (14.2-210.1)	50.1 (8.3-108.4)	88.9 (16.8-206.7)	94.2 (50.5-190.6) ^a
Initially patent (TIMI 3) infarct-related artery [%]	17.1	1.7 ^c	21.6	10.7	6.3 ^b

^ap <0.05, ^bp <0.01, ^cp <0.001

Abbreviations: TIMI – Thrombolysis in Myocardial Infarction, maxSTE – risk stratification based on analysis of maximal residual ST-segment elevation or depression in single ECG lead, Pre – preprocedural values, Post – postprocedural values, Σ – sum of ST-segment elevations/depressions across all 12 leads, CKMB – creatinine kinase myocardial band

patients (14.5%) had normal preprocedural blood flow in infarct related artery. Stents were implanted in 83% of cases, and GP IIb/IIIa inhibitors were used in 49% of patients. Normal blood flow (TIMI 3) in infarct related artery was restored in 265 (81.7%) of patients. Based on maxSTE, 81 (25.1%) patients were classified in the high-risk group, 104 (31.9%) in the medium-risk group and 139 (43.0%) in the low-risk group. There was a significant association between studied methods but with a low level of agreement ($\kappa=0.19\pm0.06$, $p<0.001$). Despite restoration of normal epicardial blood flow, 67 patients were classified in the high-risk group according to maxSTE (20.7% of subjects with final TIMI 3 grade), whereas among patients with final blood flow TIMI 0-2 only 39.3% met the high-risk criteria (Figure 2). Significant differences in analysed parameters between the studied groups are shown in Table I.

The 30-day and 1-year mortality rates were 5.6% and 8.6%, respectively. Both, 30-day and 1-year mortality rates were lower in patients with restored TIMI grade 3 blood flow than in patients with abnormal final blood flow (Figure 3). Thirty-day and one-year mortality rates were higher in the high-risk maxSTE group than in the other patients (Figure 4). Figures 5 and 6 show Kaplan-Meier survival curves plotted independently for both studied methods. Univariate predictors of death at 30-day and 1-year were age, Killip class >1 on admission, final TIMI grade 0-2, the high-risk maxSTE category, and systolic blood pressure on admission (only in prediction of 1-year mortality) (Table II). Multivariate analysis revealed that only the high-risk maxSTE category remained an independent predictor of both, 30-day and one-year mortality (Table II).

Furthermore, maxSTE proved to allow further and independent stratification of risk of death in a subgroup of patients with normal (TIMI 3) blood flow after the procedure (OR 6.2, 92% CI 1.4-27.8, $p=0.0016$ and OR 3.0, 95% CI 1.1-8.7, $p=0.039$, for 30-day and one-year mortality, respectively) (Figures 7 and 8). Patients from the medium and low-risk maxSTE groups did not differ significantly with regard to the mortality, either in the whole studied group or in the subgroup with restored TIMI grade 3.

Discussion

The results of the present study of 324 patients with STEMI from the prospective registry of subjects treated with primary angioplasty in a specialised centre with 24-hour emergency cath lab availability, confirms the prognostic value of a simple single ECG lead ST-segment resolution analysis in prediction of subsequent 30-day and one-year mortality. Furthermore, they suggest that evaluation of

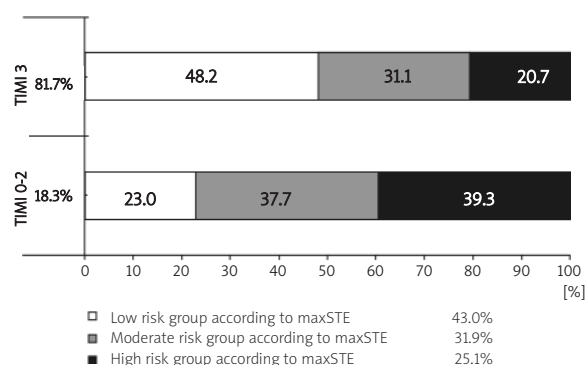


Figure 2. Distribution of risk categories according to maxSTE in groups with normal (TIMI 3) and abnormal (TIMI 0-2) blood flow in infarct related artery after the procedure

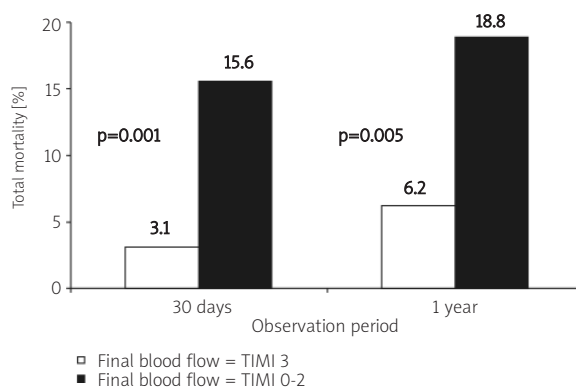


Figure 3. Mortality in groups with normal (TIMI 3) and abnormal (TIMI 0-2) final blood flow in infarct related artery in two time point: 30-days and 1-year of observation

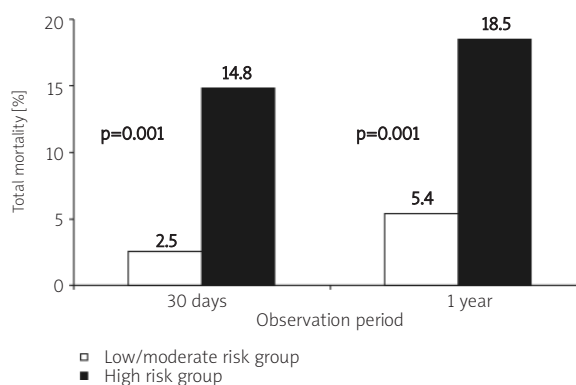


Figure 4. Mortality in groups classified according to maxSTE for two time points: 30 days and 1 year of observation

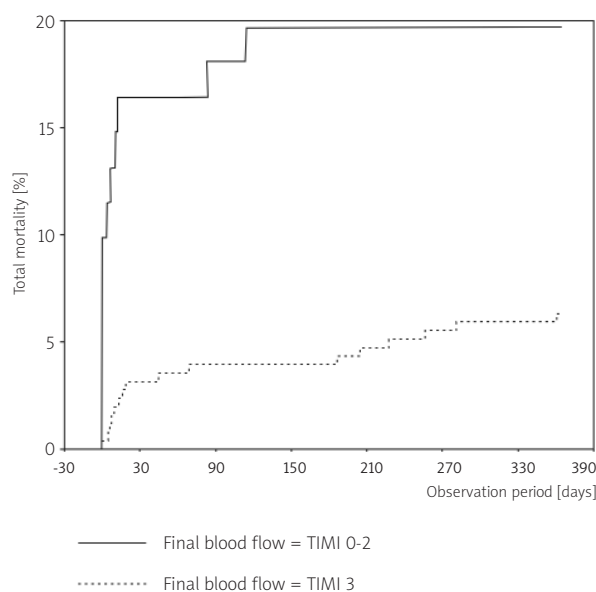


Figure 5. Kaplan-Meier curves displaying total mortality during 365 days of observation period for two groups with final normal (TIMI 3) and abnormal (TIMI 0-2) blood flow in infarct related artery

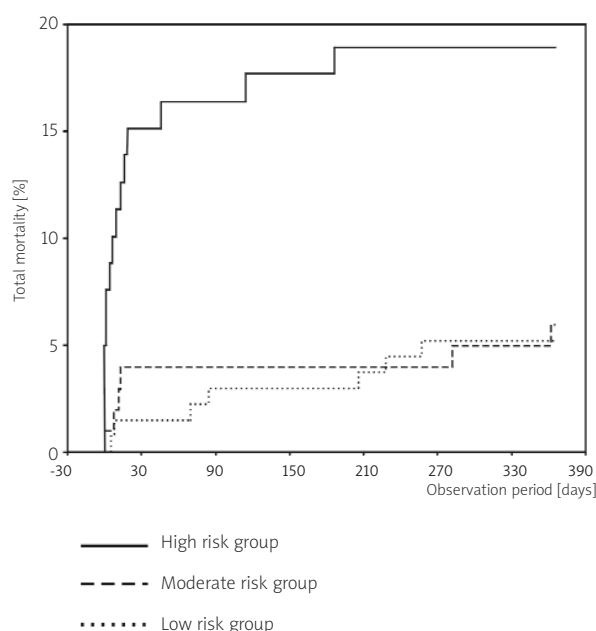


Figure 6. Kaplan-Meier curves displaying total mortality during 365 days of observation period in 3 groups of patients classified according to maxSTE

ST-segment resolution enables independent risk stratification even in the group of patients with restored normal blood flow (TIMI 3).

The present results confirm the superiority of the assessment of ST-segment resolution over the analysis of restored epicardial blood flow (TIMI scale) in early stratification of risk of mortality after primary coronary angioplasty, which is consistent with previous reports [13-14]. Moreover, since the restoration of adequate myocardial tissue perfusion is crucial for favourable short and long-term outcome in STEMI, therefore our results seems to confirm the significance of ST-segment resolution analysis as a noninvasive and practical tool of early assessment of reperfusion status at the microvascular level [7-9, 15]. In the present study the 30-day and one-year mortality rates are consistent with the results from other centers where patients with STEMI are also being transferred to a specialised cath lab [16].

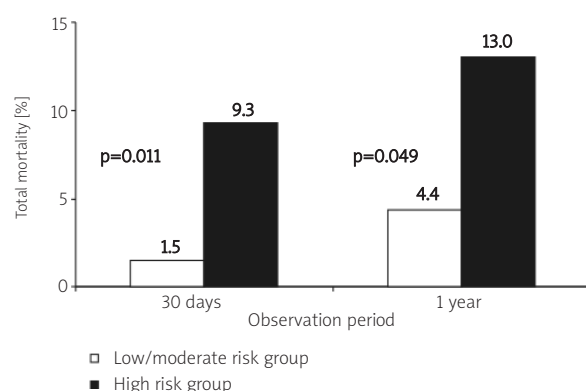
When thrombolysis was treatment of choice in patients with STEMI, the main purpose of early ST-segment resolution assessment was, apart from predicting the prognosis, to evaluate indications for rescue angioplasty. Accordingly, different methods of ST-segment resolution analysis have been widely examined in order to find the most correct and at the same time clinically practical tool [17]. Finally analysis of extent of maximal ST-segment elevation or depression identified in a single ECG lead at 3 hours after administration of thrombolytic therapy, according to the Schröder methodology (maxSTE), proved to be of good specificity and sensitivity in estimation of short- and long-term prognosis [11]. Nowadays, when the superiority of primary coronary intervention over fibrinolytic therapy has been established, and, consequently, mechanical reperfusion has been widely used as the treatment of choice in patients with STEMI, it has been proved that early assessment of ST-segment resolution remains an useful tool in estimation of patient prognosis [18, 19]. Current study confirms the prognostic value of ST-segment resolution evaluation after primary angioplasty as well, being at the same time the first comparison of the clinical utility of maxSTE analysis with a standard method of mechanical reperfusion effectiveness assessment – final blood flow judgment according to the TIMI scale.

In the present study, normal blood flow (TIMI 3) in the infarct related artery was restored in 81.7% of patients and this is consistent with results achieved in comparable groups of patients in other centers, [20-23]. Our results indicate that both, assessment of final blood flow according to the TIMI scale as well as analysis of ST-segment resolution allow early

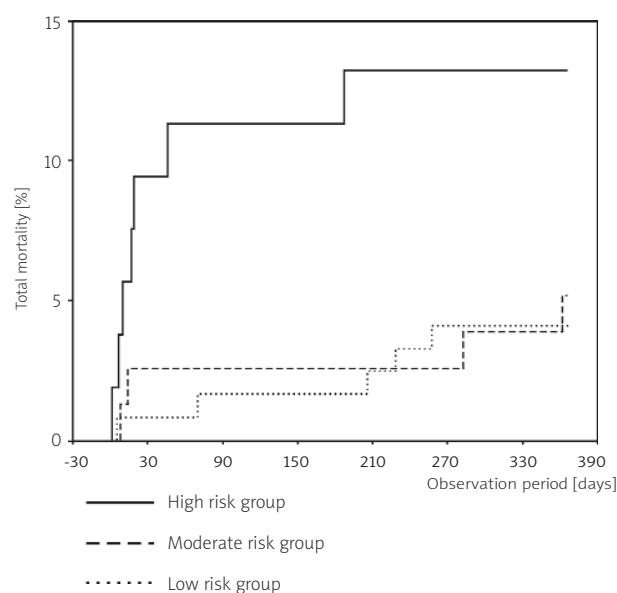
Table II. Parameters for predicting 30-day and one-year cardiac mortality

	Univariate analysis			Multivariate analysis		
	Odds ratio	95% confidence interval	p	Odds ratio	95% confidence interval	p
30 days						
Age [years]	1.06	1.01-1.11	0.010	—	—	—
Killip class >1 on admission	7.60	2.80-20.80	<0.001	3.60	1.04-12.30	0.043
TIMI grade 0-2 blood flow, after procedure	5.80	2.10-15.40	<0.001	—	—	—
High-risk maxSTE category	6.80	2.50-18.90	<0.001	5.30	1.60-16.70	0.005
1 year						
Age [years]	1.06	1.02-1.10	0.001	1.06	1.01-1.10	0.008
Systolic blood pressure on admission [mmHg]	0.98	0.97-0.99	0.043	—	—	—
Killip class >1 on admission	4.50	1.90-10.90	<0.001	—	—	—
TIMI grade 0-2 blood flow, after procedure	3.50	1.60-7.80	0.002	—	—	—
High-risk maxSTE category	4.00	1.80-8.80	<0.001	3.30	1.40-7.80	0.007

evaluation of prognosis. However, comparison of studied methods in multivariate analysis showed that only risk stratification according to maxSTE remained an independent predictor of both, short- and long-term prognosis. Interestingly, 21% of patients with restored normal epicardial blood flow were classified in the high-risk maxSTE group. Knowing that there is a negative correlation between extent of ST-segment resolution and effectiveness of myocardial tissue reperfusion, confirmed recently by a similar relationship between maxSTE and positron emission tomography assessed reperfusion status [24], it should be admitted that in a substantial proportion of studied patients despite restored normal epicardial vessel patency, adequate tissue myocardial reperfusion was not achieved [25-27]. Furthermore, both 30-day and one-year mortality were considerably higher in the high-risk maxSTE group than in other groups, despite

**Figure 7.** Mortality in risk groups classified according to maxSTE, only in patients with restored normal (TIMI 3) blood flow. Mortality indices are displayed for two time points: 30-days and 1-year of observation period

restored normal epicardial blood flow (Figures 7 and 8). On the other hand, among patients with abnormal epicardial blood flow after the procedure, only 40% met the criteria for high-risk according to maxSTE. Interestingly, the degree of restored epicardial flow, contrary to degree of ST-segment resolution, correlated significantly with patients age, history of previous myocardial infarction, diabetes, and also with pain-to-balloon time – parameters which were all included in the multivariate analysis. It is also important to note that risk categories according to maxSTE corresponded with both, myocardium at risk (sum of initial

**Figure 8.** Kaplan-Meier curves displaying total mortality during 365 days of observation period in 3 groups of patients classified according to maxSTE only in patients with restored normal (TIMI 3) blood flow

ST-segment elevations and depressions) and myocardial damage (peak creatinine phosphokinase myocardial band). These differences may explain the result of comparison of studied methods and determine the superiority of ST-segment resolution analysis over angiographic epicardial flow classification in accurate assessment of prognosis after primary angioplasty [14, 28]. They may also clarify the potential pathomechanism explaining the significance of ST-segment resolution evaluation even in patients with restored normal epicardial blood flow.

Kaplan-Meier curves and other current results indicate that there are significant differences in early and late mortality only between combined: low and medium, versus high-risk maxSTE groups. This is consistent with previous observations in which maxSTE stratified patients into two distinct groups: those with very good and good prognosis – *low and moderate-risk group*, and those with poor prognosis – *high-risk group* [11].

Limitations of the study

Applied methodology of the assessment of two consecutive ECG tracings (diagnostic and recorded after primary coronary angioplasty) may appear to be imperfect, as the process of reperfusion is extended in time. However, there is no clear evidence of the advantages of ST change assessment from continuous ECG tracings in comparison with analysis of consecutive ECG recordings performed at selected time points [17]. Exclusion of patients with intraventricular conduction disturbances and those with temporary pacing may lead to unintentional omission of patients with the worst prognosis [29, 30]. In the present study the following angiographic methods of assessment of reperfusion effectiveness were not considered: corrected TIMI frame count (CTFC) and myocardial blush grade (MBG). However, one must remember that clinical superiority of the epicardial flow assessment according to CTFC over TIMI scale has not been proved [31, 32], and that MBG evaluation is highly subjective and its correct realisation requires much experience, limiting its use in practice. Additionally, it was shown, that ST-segment resolution analysis is better than MBG assessment in early risk stratification in patients treated with primary angioplasty [33].

Conclusions

Simple risk stratification based on the analysis of maximal ST-segment elevation or depression identified in a single ECG lead recorded after primary coronary angioplasty allows better prognosis of 30-day and

one-year mortality than the assessment of postprocedural epicardial blood flow according to the TIMI scale. Restoration of normal blood flow in the epicardial artery is not necessarily associated with improved prognosis unless it is accompanied by ST-segment resolution.

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Porównanie wartości rokowniczej przepływu nasierdziejowego i normalizacji uniesionego odcinka ST po pierwotnej angioplastyce wieńcowej. Rejestr Zawałów Serca – ANIN

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Streszczenie

Wstęp: Przywrócenie prawidłowego przepływu krwi w tętnicy dozawałowej jest głównym celem pierwotnej angioplastyki wieńcowej i jest rutynowo określane za pomocą skali TIMI. Mimo że ten parametr ma uznane znaczenie prognostyczne, trwają poszukiwania innych, prostszych i nieinwazyjnych wskaźników prognostycznych.

Cel: Porównanie wartości rokowniczej oceny skuteczności reperfuzji na podstawie klasyfikacji przepływu nasierdziejowego wg skali TIMI z analizą normalizacji uniesionego odcinka ST u pacjentów leczonych pierwotną angioplastyką wieńcową w ostrym zespole wieńcowym z przetrwałym uniesieniem odcinka ST (STEMI).

Metodyka: Zbadano 324 kolejnych pacjentów leczonych do 12 godz. od początku bólu. Na podstawie analizy wielkości maksymalnego uniesienia/obniżenia odcinka ST rejestrowanego po zabiegu w pojedynczym odprowadzeniu EKG (maxSTE), pacjentów przypisano do grup wysokiego i niskiego/średniego ryzyka. Niezależnie wyodrębniono grupy z prawidłowym (TIMI 3) i nieprawidłowym (TIMI 0–2) przepływem końcowym.

Wyniki: Śmiertelność 30-dniowa i roczna w grupie wysokiego ryzyka wg maxSTE (25% pacjentów) była wyższa niż u pozostałych pacjentów (14,8% vs 2,5%, $p < 0,001$ i 18,5% vs 5,4%, $p < 0,001$). W grupie pacjentów z przywróconym przepływem TIMI 3 (82%) śmiertelność po miesiącu i roku była niższa niż w grupie z nieprawidłowym przepływem końcowym (3,1% vs 15,6%, $p = 0,001$ i 6,2% vs 18,8%, $p = 0,005$). Porównując badane metody w modelu analizy wieloczynnikowej, wykazano, że niezależnym predyktorem zarówno 30-dniowej, jak i rocznej śmiertelności jest tylko kategoria wysokiego ryzyka wg maxSTE (OR 5,3; 95% CI 1,6–16,7; $p = 0,005$ i OR 3,3; 95% CI 1,4–7,8; $p = 0,007$). MaxSTE określa ryzyko także w grupie pacjentów z prawidłowym przepływem po zabiegu (OR 6,2; 95% CI 1,4–27,8; $p = 0,016$ i OR 3,0; 95% CI 1,1–8,7; $p = 0,039$).

Wnioski: Analiza wielkości maksymalnego uniesienia bądź obniżenia odcinka ST identyfikowanego po pierwotnej angioplastyce wieńcowej w pojedynczym odprowadzeniu EKG jest lepsza w przewidywaniu 30-dniowej i rocznej śmiertelności od oceny przywróconego przepływu nasierdziejowego, określającego ryzyko nawet wśród chorych z prawidłowym przepływem po zabiegu.

Słowa kluczowe: TIMI, normalizacja uniesionego odcinka ST

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