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Percutaneous Coronary Intervention

Predictors of Impaired Reperfusion after Percutaneous Coronary Intervention in Patients with In-Hospital Acute Stent Thrombosis: A Retrospective Analyses of 5 Years of Data

Burak Açar, Orhan Maden, Kevser Gülcihan Balci, Sefa Ünal, Mustafa Mücahit Balci, Esra İpek Gücük, Meryem Kara, Hatice Selcuk and Mehmet Timur Selcuk

Background: Acute stent thrombosis (STh) is a rare complication of percutaneous coronary intervention (PCI) and is associated with a high-risk of reperfusion failure. However, data focusing on risk factors of reperfusion failure in patients undergoing repeat PCI for treatment of STh remains inadequate.

Methods: A total of 8815 patients who underwent PCI with stent implantation from January 2009 to December 2013 were retrospectively reviewed. Among those cases, patients that presented with acute STh and underwent a repeat PCI for acute STh were identified.

Results: There were 108 patients who underwent repeat PCI for the treatment of in-hospital acute STh that were retrospectively analyzed. Of these study subjects, 21 (25%) had thrombolysis in myocardial infarction (TIMI) flow < 3 after repeat PCI. The median value of pain-to-balloon time was 40 minutes in the TIMI < 3 group, 35 minutes in the TIMI = 3 group ($p < 0.001$), and the first PCI-to-stent thrombosis time was also longer in the TIMI < 3 group (10 hours vs. 2.5 hours, $p = 0.001$). When patients were evaluated according to PCI time, the percentage of patients with TIMI < 3 was significantly higher in the night period compared to the daytime period (46.4% vs. 17.5 %, $p = 0.002$). In the multivariable logistic regression analysis, stent length [odds ratio (OR) = 1.18, 95% confidence interval (CI) 1.008-1.38] and pain-to- balloon time (OR = 1.28, 95% CI, 1.06-1.54) were the only independent predictors of failed reperfusion.

Conclusions: Baseline stent length and pain-to-balloon time were associated with reperfusion failure in PCI for STh. Moreover, TIMI flow grade showed a circadian variation.

Key Words: Coronary angiography • Primary percutaneous coronary intervention • Thrombolysis in myocardial infarction

INTRODUCTION

Stent thrombosis (STh) is a catastrophic complication following percutaneous coronary intervention (PCI), that is particularly associated with myocardial infarction (MI) and mortality.[1] The incidence of STh in the first year following stent implantation is 1-3%, and the mortality rates range between 10-40%.[1]

Standard treatment of patients who develop STh consists of balloon angioplasty and, if necessary, implantation of a new stent.[2] In certain cases, no-reflow or reperfusion failure can occur even after angioplasty is performed. No-reflow, as the term implies, is defined as

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Turkiye Yuksek Ihtisas Research and Education Hospital, Ankara, Turkey.
Corresponding author: Dr. Kevser G. Balcı, Türkiye Yüksek Ihtisas Research and Education Hospital, Altındağ, Ankara, 06830 Turkey. Tel: +90 530 328 38 69 Fax: +90 312 306 10 00; E-mail: kevs84@gmail.com

the presence of inadequate microvascular perfusion despite reopening of the stenotic artery.[3] Such reperfusion failure in acute coronary syndromes (ACS) indicates poor prognosis and is associated with recurrent MI, low left ventricle ejection fraction, and death.[4,5] Although the underlying mechanism of reperfusion failure is unclear, it has been suggested that ischemia, endothelial injury, oxidative stress and microvascular inflammation all may play a role.[6,7]

While the role of many factors in predicting stent thrombosis and reperfusion failure in patients with stent implantation has been examined, studies on the predictors of successful reperfusion following primary percutaneous coronary intervention for the treatment of in-hospital acute stent thrombosis are limited.

The present study aimed to determine the factors that influence successful reperfusion after primary percutaneous coronary intervention in patients who develop acute stent thrombosis within the first 24 hours of either elective or emergency stent implantation during the hospital stay.

MATERIALS AND METHODS

Patient selection and study design

This retrospective study was conducted with the approval of the institutional review board and ethics committee of our hospital. From the case files available in the hospital archive for the period January 2009 to December 2013, records of a total of 9103 patients were reviewed who had undergone stent implantation at our hospital at least once, either as an emergency or an elective percutaneous intervention procedure. The operators were available for 24 hours a day in our hospital.

During the study, 288 patients who had undergone stent implantation in the by-pass graft were excluded. Among the 8815 patients with stents implanted in their native arteries, 113 patients developed in-hospital acute thrombosis within 24 hours of stent implantation. These patients had been definitely diagnosed with stent thrombosis by coronary angiography according to the Academic Research Consortium (ARC) criteria, and had undergone a repeat PCI. Five patients with failed PCI after stent thrombosis were also excluded due to an inability of the wire to pass through the occluded stent. Thus, a total of 108 cases were used for the study and data analyses (Figure 1).

Clinical criteria for the diagnosis of STh were defined as the presence of acute-onset ischemic symptoms and/or new ischemic changes on electrocardiography after the first stent implantation. Angiographic criteria were defined as the presence of an obstructive or a non-obstructive thrombus either within the initially implanted stent, or within 5 mm proximal or distal to the stent. The patients were then divided into two groups based on reperfusion thrombolysis in myocardial infarction (TIMI) flow scores after PCI for stent thrombosis. TIMI3 flow was considered as successful reperfusion, while TIMI < 3 flow was considered as failed reperfusion or no-reflow, and the factors that could have potentially influenced successful reperfusion were investigated. In our study, all of the patients had TIMI III flow after initial PCI.

Definitions

Stent thrombosis was diagnosed by two interventional cardiologists according to ARC criteria, based on the coronary angiography recordings and clinical findings. PCI performed for STh was defined as the index event. Pain-to-balloon time was defined as the time from the first onset of chest pain after stent implantation until commencement of the PCI balloon procedure for STh. PCI-thrombosis time was defined as the time period between the first stent implantation to the onset of chest pain due to STh. Pain-to-balloon time and time elapsed after the first stent implantation were obtained from the medical records of the patients, nurse observation forms, and from the time stamp printed on the ECGs.

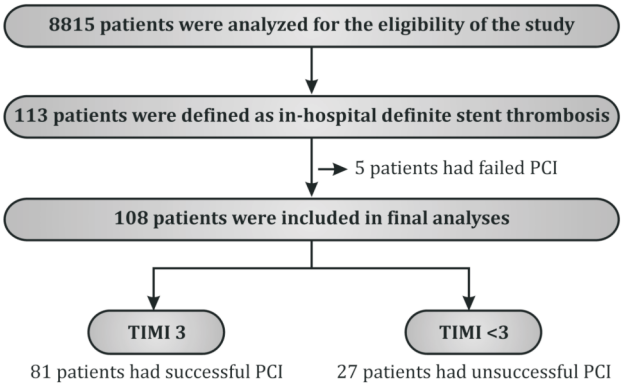

Figure 1. *Flow chart of the study.*

Dyslipidemia was defined as LDL cholesterol higher than 100 mg/dL, or if the patient was prescribed lipid-lowering drugs. Diabetes mellitus (DM) was defined as having a fasting plasma glucose greater than 126 mg/dL, or if the patient was being treated with insulin or oral antidiabetics. Peripheral artery disease (PAD) was defined as the presence of stenosis in arteries other than the coronary arteries, or if the patient had previously undergone a surgical procedure for this reason. Chronic kidney disease (CKD) was defined as glomerular filtration rate (GFR) lower than 60 mg/dL, or if the patient required routine hemodialysis.

PCIs were categorized as being applied during the daytime (8:00 am-20:00 pm) or nighttime (20:00 pm-8:00 am) to assess the circadian variation of TIMI flow grade.

Coronary angiography and disease scoring

All the patients received aspirin prior to or during the procedure and clopidogrel as adenosine diphosphate receptor inhibitor. Angiographic data were obtained from recordings of the procedure at the catheter laboratory. The femoral approach was used during primary PCI in all patients with STh. TIMI coronary flow classification and the myocardial blush grade (MBG) classification were used for evaluation of the infarct-related artery, both before and after the procedure. Thrombi were detected by the presence of a contrast defect compared to a non-infarcted coronary artery and by TIMI 0 or TIMI 1 flow in the occluded artery.

Percutaneous coronary intervention to relieve STh was appropriately performed only in the affected artery. All patients received low-molecular-weight heparin or unfractionated heparin either before or during the procedure, and additional heparin to maintain ACT (activated clotting time) levels at > 200s. The extent and severity of coronary artery disease were assessed and scored using the Gensini score[8] and the SYNTAX score. The SYNTAX score was determined in all coronary lesions with > 50% diameter stenosis in vessels with diameter > 1.5 mm using the SX score calculator 2.1 (www.syntaxscore.com).

Statistical methods

SPSS for Windows, version IBM 11.5 (SPSS Inc., Chicago, IL, USA) was used for data analysis. The Shapiro-Wilk test was used to assess distribution of the data. Continuous variables are presented as mean ± standard deviation or as median (interquartile distance), whereas categorical variables are presented as percentage (and number). Continuous variables were compared using the Student's t-test or Mann-Whitney U-test, whereas categorical variables were compared using the Chi-square or Fisher's test. The relationship between the variables and success of the procedure was determined by univariate regression analysis, and multivariate regression analysis was performed on variables that had a p value < 0.1 during univariate regression analysis. The results of regression analysis are presented as odds ratio (OR) and 95% confidence interval (CI). p values below 0.05 were considered statistically significant.

RESULTS

This retrospective study analyzed the records of 108 patients who had undergone an in-hospital repeat PCI for STh. Stents were initially implanted in 81 (75%) patients to treat ACS (emergent conditions) and for elective reasons in 27 cases (25%). The mean age of the patients was 59.2 ± 11.3 years, and male patients constituted 81.5% of the total patients.

Reperfusion failure (or no-reflow) occurred in 27 (25%) of the 108 patients who had undergone PCI for STh. PAD (18.5% vs. 3.7%, p = 0.02) and CKD (25.9% vs. 4.9%, p = 0.005) were significantly more prevalent in the failed reperfusion group. However, in multivariate analysis they were not found to be an independent predictor. When patients were evaluated according to the reason for first stent implantation, there were no significant differences with respect to reperfusion success. It was observed that LVEF upon admission was significantly lower in the no-reflow group compared to the successful reperfusion group (p < 0.001) (Table 1). Admission meant that white blood cell count (11.020 vs. 8.760, p < 0.001) and mean platelet count (288×10^3 vs. 249×10^3, p = 0.04) were higher in the no-reflow group (Table 2).

At the time of first stent implantation, the time and dose of clopidogrel administration were similar between the two groups. Unfractionated heparin was used in 105 (99.5%) patients and tirofiban was used in 23 (21.3%) patients; there was no significant difference between

Table 1. Distribution of demographic and clinical patient characteristics at the time of first stent implantation according to success of reperfusion

	TIMI < 3 (27)	TIMI-3 (81)	p-value
Age (year)	58.8 ± 11.8	59.3 ± 11.2	1.00
Male gender	22 (81.5%)	66 (81.5%)	0.53
BMI (kg/m^2)	26.5 (25-30.1)	27.9 (24.8-31.2)	0.73
DM	7 (25.9%)	23 (28.4%)	0.80
Current smoker	8 (29.6%)	35 (43.2%)	0.20
Dyslipidemia	19 (70.4%)	50 (61.7%)	0.42
Hypertension	17 (63%)	46 (56.8%)	0.57
Peripheral artery disease	5 (18.5%)	3 (3.7%)	0.02
CKD (GFR < 60)	7 (25.9%)	4 (4.9%)	0.005
History of PCI	8 (29.6%)	19 (23.5%)	0.52
History of CABG	3 (11.1%)	3 (3.7%)	0.16
Drugs (before the first procedure)			
Aspirin	13 (48.1%)	32 (39.5%)	0.43
Clopidogrel	1 (3.7%)	6 (7.4%)	1.00
Beta blocker	10 (38.5%)	31 (38.3%)	0.99
ACEI/ARB	11 (40.7%)	33 (40.7%)	1.00
Statin	8 (29.6%)	10 (12.3%)	0.07
Reason for first stent implantation			0.05
ACS	24 (88.9%)	57 (70.4%)	
Anterior MI	11 (40.7%)	24 (29.6%)	
Inferior MI	9 (33%)	20 (24.7%)	
Other STEMI	0 (0.0%)	2 (2.5%)	
NSTEMI	4 (14.8%)	11 (13.6%)	
Elective	3 (11.1%)	24 (29.6%)	
Admission LVEF (%)	40 (30-45)	46 (40.5-50)	< 0.001

ACEI, angiotensin-converting-enzyme inhibitor; ACS, acute coronary syndrome; ARB, angiotensin receptor blocker; BMI, body mass index; CABG, coronary artery by-pass grafting; CAD, coronary artery disease; CKD, chronic kidney disease; DM, diabetes mellitus; LVEF, left ventricle ejection fraction; MI, myocardial infarction; NSTEMI, non-ST-elevation myocardial infarction; PCI, percutaneous coronary intervention; STEMI, ST-elevation myocardial infarction; TIMI, thrombolysis in myocardial infarction.

Table 2. Relation between baseline laboratory values and success of coronary intervention performed for stent thrombosis

	TIMI < 3 (27)	TIMI 3 (81)	p-value
Glucose (mg/dL)	125 (97-152)	114 (99-147.5)	0.91
Urea (mg/dL)	33 (24-60)	34 (26.5-39)	0.59
Creatinine (mg/dL)	0.9 (0.77-1)	0.85 (0.73-0.97)	0.15
Hemoglobin (g/dL)	14.4 (12.5-15.6)	14 (12.6-14.9)	0.46
RDW (%)	13.7 (13.3-14.1)	13.5 (13-14.1)	0.07
Platelet ($\times 10^3/\mu L$)	288 (242-301)	249 (204-295)	0.04
MPV (fL)	8.9 ± 0.88	8.8 ± 0.92	0.48
White blood cell (counts/μL)	11020 (9590-12800)	8760 (7600-10653)	< 0.001
Fibrinogen (g/L)	3.3 (2.9-4.4)	3.2 (2.4-3.7)	0.18
LDL (mg/dL)	130.6 ± 27	118.9 ± 38.2	0.14
HDL (mg/dL)	42 (33-47)	37 (30.5-45)	0.12
Total cholesterol (mg/dL)	203 ± 35.9	186.2 ± 46.8	0.09
Triglyceride (mg/dL)	132 (108-155)	150 (104-192)	0.35
Uric acid (mg/dL)	5.5 ± 1.3	5.2 ± 1.2	0.22
GFR (mL/min)	78.2 (59.7-106)	87.9 (75.8-104.6)	0.34

GFR, glomerular filtration rate; HDL, high-density lipoprotein; LDL, low-density lipoprotein; MPV, mean platelet volume; NLO, neutrophil/lymphocyte ratio; RDW, red blood cell distribution width;TIMI, thrombolysis in myocardial infarction.

the two groups with respect to the total heparin dose or heparin dose per kilogram (Table 3). Interestingly, it was observed that post-procedure anticoagulant use was significantly higher in the group with reperfusion failure compared to the group with successful reperfusion (88.4% vs. 60.5%, p = 0.006). Drug eluting stents were used in 13 (12%) cases and bare metal stents were used in 95 (88%) cases, and the stent type did not affect reperfusion success. Stent length was significantly longer in the no-reflow group compared to the successful reperfusion group (median 20 mm vs. 16 mm, p = 0.005) (Table 3).

During the STh intervention, a comparison between the type of PCI procedures used for testing of the groups is shown in Table 4. After stent thrombosis, 65 patients (60.2%) underwent only balloon dilatation, 10 patients (9.3%) underwent only new stent implantation, while 32 patients (29.6%) underwent balloon dilatation with new stent implantation. Only one patient required aspiration of the thrombus. Groups were also similar in terms of the type of the PCI procedures performed for the treatment of STh (p = 0.17). While the median value of pain-to-balloon time was 40 minutes in the no-reflow group, it was 35 minutes in the successful reperfusion group (p < 0.001); also, the first PCI-to-stent thrombosis time was longer in the no-reflow group (10 h vs. 2.5 h, p = 0.001). When patients were evaluated according to the PCI time, the percentage of the patients with TIMI < 3 was significantly higher in the night period when compared to the daytime period (46.4% vs. 17.5%, p = 0.002) (Figure 2).

Use of multivariate analysis identified an increased stent length (OR 1.18, 95% CI, 1.008-1.38, p = 0.04) and prolonged pain-to-balloon time (OR 1.28, 95% CI 1.06-

Table 3. Baseline clinical and angiographic characteristics of the study population in the first event according to success of reperfusion

	TIMI < 3 (27)	TIMI-3 (81)	p-value
Gensini score	68.5 (36-93.3)	38.5 (21-62.3)	0.05
Syntax score	26.78 (±10.0)	24.12 (±10.7)	0.26
Clopidogrel time			0.70
Receiving since before the first procedure	1 (3.7%)	6 (7.4%)	
Given during first procedure	16 (59.3%)	42 (51.9%)	
Given prior to the first procedure	10 (37%)	33 (40.7%)	
Clopidogrel dose (mg)			0.71
75	0 (0%)	1 (1.2%)	
300	5 (18.5%)	11 (13.6%)	
600	22 (81.5%)	69 (85.2%)	
Heparin usage	100 (100%)	78 (96.3%)	0.57
Total heparin dose (IU)	8000 (6000-10000)	8000 (7000-8000)	0.95
Heparin dose (IU/kg)	99 (84.2-114.9)	100 (84.7-109.9)	0.75
Post-procedure anticoagulant	24 (88.9%)	49 (60.5%)	0.006
Culprit lesion			0.12
Proximal LAD	9 (33.3%)	22 (27.2%)	
Mid LAD	5 (18.5%)	17 (21.0%)	
Proximal Cx	3 (11.1%)	6 (7.4%)	
Distal Cx	0 (0.0%)	3 (3.7%)	
Proximal RCA	4 (14.8%)	27 (33.3%)	
Distal RCA	3 (11.1%)	5 (6.2%)	
OM	3 (11.1%)	1 (1.2%)	
Tirofiban usage	8 (29.6%)	15 (18.5%)	0.22
Predilatation	19 (70.4%)	48 (59.3%)	0.30
DES	2 (7.4%)	11 (13.6%)	0.51
Stent diameter (mm)	3 (2.5-3)	3 (2.75-3)	0.79
Stent length (mm)	20 (18-23)	16 (13-20)	0.005

Cx, circumflex artery; DES, drug eluting stent; LAD, left anterior descending coronary artery; OM, obtuse marginal artery; RCA, right coronary artery; TIMI, thrombolysis in myocardial infarction.

Table 4. Comparison of the groups in terms of the characteristics of percutaneous coronary intervention performed after stent thrombosis

	TIMI < 3 (27)	TIMI-3 (81)	p-value
The time between first PCI and STh	10 (4-12)	2.5 (1.2-7)	0.001
Pain-balloon time for STh (min)	40 (35-50)	35 (30-37.5)	< 0.001
Baseline TIMI flow = 0 after STh	22 (81%)	42 (51.9%)	0.02
Baseline MBG = 0 after STh	25 (92.6%)	57 (70.4%)	0.007
Post-thrombosis procedure			0.17
Balloon	20 (74.1%)	45 (55.6%)	
Stent	0	10 (12.3%)	
Balloon + Stent	7 (25.9%)	25 (30.9%)	
Thrombus aspiration	0	1 (1.2%)	

MBG, myocardial blush grading; PCI, percutaneous coronary intervention; STh, stent thrombosis; TIMI, thrombolysis in myocardial infarction.

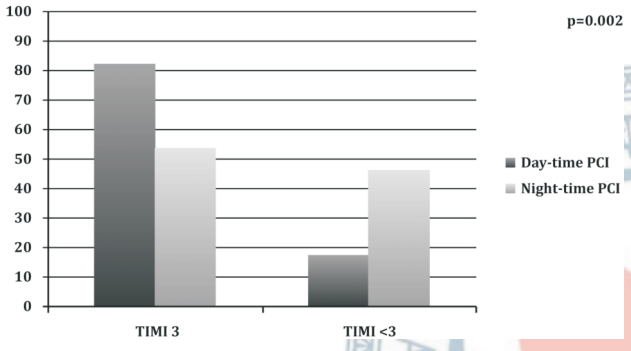

Figure 2. *Circadian variation of TIMI flow grade between the study groups.*

1.54, p = 0.009) as independent predictors of failed reperfusion when PCI was performed for the treatment of acute stent thrombosis (Table 5).

DISCUSSION

This retrospective study involved a special patient population that experienced in-hospital acute stent thrombosis. We determined that reperfusion failure (or no-reflow) occurred in 25% of study patients, and that the presence of PAD, CKD, high platelet count, high white blood cell count, low baseline TIMI flow and low MBG values were associated with no-reflow. Furthermore, prolonged pain-to-balloon time and increased stent length were identified as independent risk factors that predicted reperfusion failure following primary coronary intervention for acute stent thrombosis, and TIMI flow grade showed a circadian variation that reperfusion failure was more prevalent in the night-time rather than daytime PCIs.

A majority of stent thrombosis occurs within the first month, and according to the data from the "Dutch Stent Thrombosis Registry" comprising 21,009 patients, STh developed in only 2.1% of the patients, and 32% of these patients developed acute STh.[9] However, in another series, the incidence of STh during a two-year follow-up period was determined to be approximately 4%, but with more than one-third of the events occurring during the hospital stay.[10,11] Additionally, the Gauging coronary Healing with biOresorbable Scaffolding plaTforms in EUrope (GHOST-EU) recording study found that a majority of the STh occurred within the first 30 days.[12] In the series we reported here, the incidence of acute stent thrombosis was 1.2%. In this context, the incidence of acute STh derived from our-single center experience is comparable to previous studies. The underlying mechanism of STh is believed to be a multifactorial one, wherein the resistance to clopidogrel or acetylsalicylic acid, stent choice, and duration of antiplatelet therapy are the main influencing factors.[9]

It has also been reported that ST-elevation myocardial infarction (STEMI) patients experience higher rates of stent thrombosis compared to patients presenting with other forms of ACS.[13] Similarly, the occurrence of no-reflow is higher in STEMI compared to the non-ST-elevation myocardial infarction.[14] When we analyzed whether the success rate differed according to the reason for stent implantation, no such significant difference was observed in TIMI flow grades according to the forms of ACSs. However, in our study the patients who presented with STEMI were significantly younger than the

Table 5. Multivariate analysis of the factors associated with reperfusion success of primary coronary intervention performed for the treatment of acute stent thrombosis

	Univariate			Multivariate		
	OR	CI 95%	p-value	OR	CI 95%	p-value
Peripheral artery disease	5.91	1.31-26.68	0.02			
Statin use before first PCI	2.99	1.04-8.62	0.04			
Admission creatinine	6.74	0.82-55.2	0.08			
Admission platelet count	1.006	1.000-1.012	0.05			
Admission white blood cell	1	1.000-1.001	< 0.001			
Admission total cholesterol level	1.009	0.99-1.02	0.09			
The time between first PCI and STh	1.15	1.06-1.24	0.001			
Stent length in first PCI	1.09	1.005-1.19	0.04	1.18	1.008-1.38	0.04
Baseline TIMI flow after STh	0.26	0.098-0.71	0.008			
Baseline MBG after STh	0.19	0.45-0.88	0.03			
Pain-balloon time for STh	1.16	1.08-1.25	< 0.001	1.28	1.06-1.54	0.009
Gensini score	1.03	1.003-1.05	0.03			
Anticoagulation after first PCI	5.22	1.45-18.79	0.01			
ACS	3.37	0.93-12.26	0.07			
CKD (GFR < 60)	6.74	1.79-25.31	0.005			
LVEF	0.9	0.85-0.95	< 0.001			

ACS, acute coronary syndrome; CI, confidence interval; CKD, chronic kidney disease; GFR, glomerular filtration rate; LVEF, left ventricle ejection fraction; MBG, myocardial blush grading; OR, odds ratio; PCI, percutaneous coronary intervention; STh, stent thrombosis; TIMI, thrombolysis in myocardial infarction.

patients who presented with ACS or non-ST-elevation myocardial infarction (NSTEMI) (56.6 + 11.1 vs. 63.6 + 8.1, p = 0.17) that may influence the results.

The incidence of no-reflow following primary PCI ranges from 5 to 25%.[15,16] Such differences in rates can be attributed to differences in definitions of re-flow, patient characteristics, adjuvant therapies, and catheter techniques used in these studies.[17] In the present series, the rate of failed reperfusion was relatively high at 25%, which could be attributed to the fact that the majority of the patients were being treated for ACS (75%). Given that ACS is a thrombotic event, STh might occur more commonly in these patients after stent implantation.[18] Furthermore, the presence of large amounts of circulating activated platelets and platelet-monocyte aggregates makes such patients more prone to thrombosis[19,20] and no-reflow.[14]

In our cohort, PCI had been performed for STh within the first 2 hours from the onset of pain, but the median time was 40 minutes in TIMI < 3 group, which was significantly longer than the median time in the TIMI-3 group. We found that prolonged pain-to-balloon time is an independent predictor of reperfusion failure following PCI for stent thrombosis. Late reperfusion involves a delay from the onset of symptoms to reperfusion, and is associated with the phenomenon no-reflow.[14] This is attributed to higher amounts of prothrombotic substances being released into the affected area and a subsequent hardening of the lesion due to higher numbers of infiltrating erythrocytes.[17] Conversely, Abdi et al. reported a higher incidence of no-reflow at shorter pain durations in patients undergoing PCI for acute myocardial infarction. They concluded that fresh clot and shorter pain durations contributed to no-reflow.[21] However, it is reasonable that shorter pain-balloon time provides less damage to the myocardium.[22] Moreover, organized thrombus that is a result of delayed reperfusion less likely responds to antithrombotic regimens when compared to fresh thrombus and older thrombus, and tends to fragment after balloon dilatation and causes distal embolization.[17] In the present study, 60.2% of the patients had undergone balloon angioplasty, 9.3% had undergone stent implantation, and 29.6% had undergone balloon angioplasty together with stent implantation. However, the post-thrombosis procedure did not differ according to the presence of no-reflow. Interestingly, the

patients who underwent PCIs during the night-time period had a significantly higher percent of failed reperfusion rates compared to the patients who had PCIs at the day-time period. After a long working day operators may experience fatigue that may impair their performance[23] and judgment[24] and, therefore, resultant worse outcomes. Also, medication administered during the day-time may have attenuated cardioprotective effects during the night and owing to this the incidence of ischemic complications may increase when the procedure is done during the night period.[24] Furthermore, the body circadian rhythm and nervous system of the patients might be responsible for even worse intervention results.[25]

We also demonstrated that increased stent length is another independent predictor of reperfusion failure. It is apparent that the need for longer stent length means more extended target lesions containing a larger burden of atherosclerotic plaque.[26] Similar to our results, Choo et al. showed that stent length was also an independent predictor of reperfusion failure, in addition to advanced age, baseline TIMI flow and high CRP levels in patients undergoing primary percutaneous coronary intervention.[16] Besides, plaques with a high thrombus load and a massive lipid load are more likely to exist in long lesions, and these factors also negatively influence microcirculation.[17] Also, we observed relatively higher Gensini scores in the TIMI < 3 group than in the TIMI-3 group (68.5 vs. 38.5); however, this difference did not reach statistical significance (p = 0.05). Previously, Akturk et al. reported that high Gensini and Syntax scores were related to no-reflow in patients with STEMI.[27] Therefore, it can be concluded that high Gensini scores may indicate high plaque burden of the coronary artery tree, and somehow a tendency to no-reflow. Therefore, in such patients no-reflow can be expected. The patients with failed reperfusion after the intervention for STh had lower ejection fraction compared to the patients with TIMI flow 3. The possible explanation for this finding might be that the patients who were included in the study were mostly presented with acute coronary syndrome at the first event (75%).

The results presented herein are from a single center study and, therefore, cannot be generalized and applied to the entire patient population as they are not sufficiently representative. The retrospective design is also a major limitation as patients with stent thrombosis were not evaluated by imaging methods such as IVUS or OCT. The number of failure events was relatively low, and this is an important factor that limits the predictive power of the multivariate analysis. The factors, such as differences in equipment used during the first and second PCI procedures and experience of the operators, can influence the procedure's success; however, these aspects were neither considered nor evaluated during the analyses.

CONCLUSIONS

The level of PCI failure is high in patients with acute stent thrombosis and stent length and pain-to-balloon time are independent predictors of reperfusion failure. Furthermore, the time of the intervention (day time or night time) might affect the reperfusion success.

DECLARATION OF INTEREST

None declared.

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