Original Article

Comparison of Bleeding Complications Between Primary PCI and Rescue PCI Procedures

Ali-Asghar Farsavian[1], MD; Seifollah Abdi[2], MD; Mohsen Maadani*[2], MD; Hosein Farsavian[3], MD; Meisam Mojri[4], MD

ABSTRACT

Background: Bleeding during or after primary percutaneous coronary intervention (PCI) is the most common noncardiac complication in patients treated for cardiac ischemic events. The present study aimed to compare bleeding complications between primary and rescue PCI procedures.

Methods: In a prospective study, the recorded files of 95 consecutive patients who underwent one of the 2 procedures of primary PCI (n=90) or rescue PCI (n=5) were evaluated. The consequences of bleeding were assessed through the measurement of serum hemoglobin levels before, immediately after, and 24 hours after the procedures. Within the hospitalization period and before discharge, any occurrence of bleeding was recorded.

Results: Regarding postoperative events, hematoma was revealed in 3.3% in the primary PCI group and 20% in the rescue PCI group, with no significant difference (*P*=0.224). Additionally, gastrointestinal bleeding was reported in 2.2% of the patients who underwent primary PCI and none of those in the other group, without any difference (*P*=0.999). In total, postoperative morbidity was seen in 5.6% in the primary PCI group and in 20% in the rescue PCI group, with no difference (*P*=0.314). The mean of the decreased level of serum hemoglobin in the primary PCI group and the rescue PCI group was 1.22±1.31 and 1.33±0.90, respectively, with no difference (*P*=0.849). A multivariate linear regression model, after adjustments for the baseline parameters, showed no difference between the 2 procedures regarding the decreased level of serum hemoglobin. Advanced age was the only variable able to predict higher morbidity.

Conclusions: There were no significant differences in postprocedural complications regarding major bleeding between the 2 procedures of rescue PCI and primary PCI. The main predictor for bleeding after PCI was advanced age. ***(Iranian heart Journal 2018; 19(2): 6- 12)***

KEYWORDS: Primary PCI, Rescue PCI, Bleeding

[1] Department of Cardiology, Fatemeh Zahra Hospital, Mazandaran University of Medical Sciences, Sari, IR Iran.
[2] Cardiovascular Intervention Research Center, Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR Iran.
[3] Department of Vascular Surgery, Zahra Hospital, Mazandaran University of Medical Sciences, Sari, IR Iran.
[4] Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR Iran.

***Corresponding Author:** Mohsen Maadani, MD; Rajaie Cardiovascular, Medical, and Research Center, Iran University of Medical Sciences, Tehran, IR Iran.
Email: maadani@rhc.ac.ir **Tel:** 09123082153

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Coronary heart disease is still an important cause of death around the world. [1, 2] ST-elevation myocardial infarction (STEMI) is a dangerous manifestation of this disease and is mostly caused by an acute occlusion of a major coronary artery usually due to the disruption of an atherosclerotic plaque with subsequent formation of an occluding thrombus. [3] Effective and rapid restoration of the blood flow to the ischemic myocardial tissue is the most important initial goal in the treatment of patients with STEMI. Primary percutaneous coronary intervention (PCI) is the preferred strategy for reperfusion in the treatment of STEMI when feasible and when performed in a timely manner. [4, 5] Primary PCI has been shown to be superior to fibrinolytic therapy. [6-8] However, during or after primary PCI, unfavorable events such as bleeding may occur, which can influence the prognosis negatively. Although bleeding during or after primary PCI was long considered inherent to the modern therapeutic approach, it is currently seen as the most common noncardiac complication in patients treated for STEMI. Bleeding complications are associated with worse clinical outcomes and adverse events such as myocardial infarction, stroke, stent thrombosis, and death. [9-12] There are modifiable and non-modifiable risk factors for bleeding. The choice, dose, and combination of antit-hrombotic and antiplatelet drugs are probably the most readily modifiable risk factors. The complexity of these medical agents is increasing with regard to the number of agents, regimens used, potency, mechanism of action, and duration of therapy.

The incidence of major bleeding in patients with acute coronary syndrome as reported in randomized trials varies between 0.6% and more than 15%, depending on the definition, clinical presentation, and treatment of the bleeding. [13-16] Bleeding is an important independent predictor of prognosis in patients with STEMI following primary PCI. Major bleeding is associated with increased 1-year's mortality. [17] Several potential mechanisms may underlie the association between bleeding and deterioration of prognosis. Bleeding may lead to early cessation of dual antiplatelet therapy, which might result in ischemia, hemodynamic decompensation, stent thrombosis, recurrent myocardial infarction, or death. [18, 19] Further, bleeding with hypovolemia and impaired oxygen-carrying capacity might precipitate hyperadrenergic state, hypotension, and heart failure. Moreover, bleeding leads to a prolonged and complex hospital stay and may require invasive monitoring. The impact of bleeding on the outcome varies with the initial severity insofar as a more severe bleeding indicates a greater the impact on the outcome. [20] Rescue PCI for STEMI is defined as mechanical reperfusion for failed fibrinolysis. The efficacy of rescue PCI has always been debated. Despite a high level of immediate technical success and the positive impact on the ventricular function, conflicting data on mortality have been reported. [21] Several historical explanations may be given. Initially, rescue PCI was associated with a high re-occlusion rate and increased mortality if unsuccessful. Contrary to fibrinolysis, the rare randomized trials on rescue PCI are characterized by small study populations and major differences in methodology [22]. Also, there are a few studies that compared complications and outcome of the two procedures including primary PCI and rescue PCI especially in terms of intraoperative or postoperative bleeding. The present study aimed to compare the bleeding complications between primary PCI and rescue PCI in the patients with coronary artery disease and candidate for PCI.

METHODS

In the current prospective study, the recorded files of all consecutive patients with STEMI who were referred to Rajaie Cardiovascular, Medical, and Research Center within 1 year to

undergo one of the 2 procedures of primary PCI or rescue PCI were evaluated. In this regard, those with left main involvement, candidacy for open heart surgery, different types of coagulopathies, or a previous history of hemorrhagic disorders were not assessed. The patients' baseline characteristics and clinical data—including demographic characteristics, risk factors for coronary artery disease, oral medication, severity of coronary artery involvement assessed by coronary angiography, and a previous history of any cardiac interventions—were collected by reviewing the recorded files. The consequences of bleeding were assessed through the measurement of serum hemoglobin levels before, immediately after, and 24 hours after the procedures. In addition, history of using antiplatelet and anticoagulant drugs was also recorded. Within the hospitalization period and before discharge, any occurrence of bleeding such as cerebral hemorrhagic and gastrointestinal bleeding as well as bleeding from the saphenous vein source was recorded and its severity was determined. Any early mortality or complication was recorded, and the length of hospital stay was assessed.

The results were presented as means ± standard deviations (SDs) for the quantitative variables and were summarized by absolute frequencies and percentages for the categorical variables. The continuous variables were compared using the *t*-test or the nonparametric Mann–Whitney *U* test whenever the data did not appear to have normal distributions or when the assumption of equal variances was violated across the groups. The categorical variables were, on the other hand, compared using the χ^2 or Fisher exact test when more than 20% of cells with expected counts of fewer than 5 were observed. The Pearson correlation test was applied to examine the association between the study measures. The main predictors for the occurrence of bleeding were assessed by multivariable logistic regression modeling. For the statistical analyses, the statistical software SPSS version 20.0 for Windows (SPSS Inc, Chicago, IL) was used. A *P* value of 0.05 or less was considered statistically significant.

RESULTS

In the present study, 95 patients were categorized into 2 groups of Primary PCI (n=90) and Rescue PCI (n=5). The mean age of the patients was 58.18±12.65 years in the primary PCI group and 57.60±8.35 years in the rescue PCI group, and 88.9% and 80% of the patients in the 2 groups were male, respectively. As is shown in Table 1, there were no significant differences in terms of the demographic characteristics, previous history of cardiovascular disorders or cardiac interventions, risk factors for coronary disease, number of diseased coronary arteries, biochemical laboratory parameters, and left ventricular ejection fraction between the 2 groups. All the subjects in both groups used aspirin and also Plavix within the study period. However, receiving IIb/IIIa inhibitors was seen in 40% of the cases in the primary PCI group and use of streptokinase was reported in 4 out of 5 patients in the rescue PCI group. Regarding the postoperative events, hematoma was revealed in 3.3% in the primary PCI group and 20% in the rescue PCI group, without significant differences (*P*=0.224). Further, gastrointestinal bleeding was reported in 2.2% of the patients who underwent primary PCI and none of the patients in the other group, with the difference not constituting statistical significance (*P*=0.999). In total, postoperative morbidity (defined as the presence of at least one of the hematoma or gastrointestinal bleeding) was seen in 5.6% in the primary PCI group and in 20% in the rescue PCI group; there was no statistically significant difference between the 2 groups (*P*=0.314). The mean of the decreased level of serum hemoglobin in the primary PCI group and rescue PCI group was 1.22±1.31 and 1.33±0.90, respectively, with no statistically significant difference (*P*=0.849).

Considering 3 subgroups of decreased levels of hemoglobin (ie, ≥2.0 mg/dL, 0.1 to 1.9 mg/dL, and without decrease) showed that the frequency of the patients in the 3 categories was 13.3%, 38.9%, and 47.8% in the primary PCI group and 20%, 40%, and 40% in the rescue PCI group (*P*=0.898).

Table 1. Baseline characteristics and clinical data

Characteristic	Primary PCI (n=90)	Rescue PCI (n=5)	*P* value
Male gender	80 (88.9)	4 (80.0)	0.467
Age, y	58.18 ± 12.65	57.60 ± 8.35	0.890
Previous PCI	12 (13.3)	0	
Previous CABG	3 (3.3)	0	
Previous CSA	8 (8.9)	1 (20.0)	
Previous UA	1 (1.1)	0	
History of HTN	35 (38.9)	1 (20.0)	0.647
History of DM	27 (30.0)	1 (20.0)	0.999
History of HLP	29 (32.2)	1 (20.0)	0.999
Family history of CAD	15 (16.7)	0	0.999
Number of involved vessels			0.158
One	44 (48.9)	2 (40.0)	
Two	22 (24.4)	3 (60.0)	
Three	24 (26.7)	0	
Use of IIb/IIIa inhibitor	36 (40.0)	0	0.153
Use of streptokinase	0	4 (80.0)	< 0.001
Serum level of FBS	136.98 ± 58.91	119.60 ± 31.41	
Serum level of LDL	112.10 ± 37.53	91.00 ± 47.76	0.445
Serum level of HDL	46.00 ± 17.05	39.00 ± 4.83	0.053
Serum level of TG	144.59 ± 56.13	119.25 ± 65.12	0.497
LVEF, %	38.18 ± 9.53	36.00 ± 14.32	0.753

PCI, Percutaneous coronary intervention; CABG, Coronary artery bypass grafting; HTN, Hypertension; DM, Diabetes mellitus; HLP, Hyperlipoproteinemia; CAD, Coronary artery disease; FBS, Fasting blood sugar; LDL, Low-density lipoprotein; HDL, High-density lipoprotein; TG, Triglyceride; LVEF, Left ventricular ejection fraction

The multivariable logistic regression model illustrated a slight higher prevalence rate of morbidity following rescue PCI compared with primary PCI (Table 2). Moreover, using a multivariate linear regression model showed no difference between the 2 procedures regarding the decreased level of serum hemoglobin when adjusted for the baseline parameters (Table 3). Advanced age was the only variable capable of predicting higher morbidity in the patients undergoing PCI.

Table 2. Multivariate logistic regression model

Item	*P* value	Odds Ratio	95% CI
Primary PCI	0.049	0.033	0.001 – 0.979
Age	0.058	0.905	0.817 – 1.003
Previous PCI	0.202	5.764	0.390 – 85.127
History of HTN	0.311	3.519	0.309 – 40.081
History of DM	0.664	1.685	0.160 – 17.717
History of HLP	0.377	0.276	0.016 – 4.780
Family history of CAD	0.471	2.897	0.161 – 52.175
Number of involved vessels	0.551	0.970	0.878 – 1.072
LVEF	0.246	0.452	0.118 – 1.728

PCI, Percutaneous coronary intervention; HTN, Hypertension; DM, Diabetes mellitus; HLP, Hyperlipoproteinemia; CAD, Coronary artery disease; LVEF, Left ventricular ejection fraction

Table 3. Multivariate linear regression model

Item	Beta	*P* value
Primary PCI	0.007	0.971
Male gender	-0.029	0.867
Age	0.086	0.581
Previous PCI	0.110	0.512
History of HTN	-0.254	0.153
History of DM	-0.017	0.923
History of HLP	-0.099	0.575
Family history of CAD	0.001	0.997
Number of involved vessels	-0.271	0.080
LVEF	0.113	0.484

PCI, Percutaneous coronary intervention; HTN, Hypertension; DM, Diabetes mellitus; HLP, Hyperlipoproteinemia; CAD, Coronary artery disease; LVEF, Left ventricular ejection fraction

DISCUSSION

The present study aimed to assess and compare the outcome of the 2 procedures of primary PCI and rescue PCI, especially regarding hemorrhagic events. Because the bleeding complication is common following PCI procedures, we considered 2 indices of hematoma and gastrointestinal bleeding as the main study point. We first showed that only 5% of the patients underwent rescue PCI. In fact, because this procedure is routinely considered for patients with failed fibrinolysis, the presence of failed fibrinolysis was indicated to be low in our study population and thus most patients were candidated for primary PCI. We also showed no difference in the occurrence of hematoma and gastrointestinal bleeding between the 2 procedures. However, our multivariable regression model illustrated a slightly higher rate of morbidity in rescue PCI than in primary PCI, which is not a high-power finding because of the small sample size of the study population. Furthermore, a decreased level of hemoglobin was a rare event following both procedures, without a statistically significant difference between the 2 study groups. In fact, rescue PCI is as safe as primary PCI to provide arterial blood supply to ischemic tissues.

Comparisons of our results with those of other studies show conflicting results. In a study by Ellis et al, [26] it was observed that the incidence of major bleeding was 8% in the patients undergoing rescue PCI and 6% in those undergoing primary PCI (*P*=0.35). The authors reported no significant differences in bleeding associated with the use of the GP IIb/IIIa receptor antagonist, procedural success, or major adverse cardiac events. [26] Di Mario et al [27] reported major bleeding in 10 patients in their primary PCI group and 7 in their standard care/rescue group (3.4% vs 2.3%; *P*=0.47). In another study, the rates of death/myocardial infarction and bleeding complications were significantly higher in the thrombolysis with rescue PCI group than in the primary PCI group (10.0% vs 1.0%; *P*=0.0380 and 28.10% vs 8.91%; *P*=0.0001, respectively). [28] With respect to the prediction of major complications after PCI, we managed to show only the predicting value of advanced age for morbidity following the procedure. Kinnaird et al [29] demonstrated that the patients with major bleeding were older than those who had minor or no bleeding and more often experienced intraprocedural complications such as emergency use of intra-aortic balloon pumps. The authors also reported that the multivariate logistic regression analysis also identified the use of intra-aortic balloon pumps, procedural hypotension, and age over 80 years as the strongest predictors of major bleeding. In this regard, we only considered some postoperative variables as the predictors of the outcome, whereas more intraoperative and postoperative indices should be taken into consideration as the main indicators for post-PCI morbidity.

In conclusion, there were no significant differences in post-procedural complications

regarding major bleeding between the 2 procedures of rescue PCI and primary PCI. The main predictor for bleeding after PCI was advanced age among our study population.

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