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Short-and Long-Term Follow-up in the Elderly Patients with ST-Elevation Myocardial Infarction Receiving Primary Angioplasty or Thrombolytic Therapy

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Abstract

Introduction: The ischemic time serves as the most important parameter for treatment choice in patients with ST-elevation myocardial infarction (STEMI). The current study aimed at comparing the short- and long-term follow-up of elderly patients with STEMI undergoing primary angioplasty (PCI) or thrombolytic therapy.

Methods: The current cross sectional study was conducted on all patients aged > 65 years, admitted to the emergency department of Imam Hossein Hospital, Tehran, Iran from January 2014 to July 2016, diagnosed with STEMI. The demographics, medical history, family history, and mediation history were recorded for all patients. Patients received PCI or thrombolytic therapy based on the ischemic time and the treatment outcome and the following events were recorded. Patients were contacted after six months and data of their death or used treatments were recorded. All data were compared between the groups.

Results: Of all patients, 38 subjects received thrombolytic therapy and 62 PCI. There was no significant difference between the groups in terms of mean age and gender (P = 0.5 and 0.1, respectively). The frequency of positive medical history and smoking did not differ between the groups. There was no difference in the mean values of vital signs or serum parameters, mean ischemic time, left ventricular ejection fraction (LVEF), frequency of pulmonary emboli, cardiogenic shock, the involved vessel, and post-treatment complications between the groups (P > 0.05). Of the 14 cases that died after six months, five were in the thrombolytic therapy group and nine in the PCI group (P = 0.8). Mean hospital stay was not different between the groups (P = 0.5).

Conclusions: The results of the present study on two groups with similar demographics showed no significant difference between the groups in terms of the short- and long-term follow-up of PCI and thrombolytic therapy. The results indicated the appropriateness of treatment choice based on ischemic time and the available methods.

INTRODUCTION

Cardiovascular diseases (CVDs) are the leading cause of mortality worldwide [1], responsible for one in every 2-3 deaths (one death each 40 seconds) in the United States, causing death of more than 2200 Americans each day [2]. There is a significant difference between the low- and high-income countries in CVD-associated

deaths and the growing incidence of coronary artery disease (CAD) [3]. Asia accounts for the greatest mortality and morbidity caused by ischemic heart disease (IHD) and ischemic stroke in the world [4].In Iran, the annual IHD mortality rate is estimated as 14 per 1000 population over 40 years old with about 3 million individuals that need outpatient care [5].

The timely diagnosis is the key factor for the treatment success of acute myocardial infarction (MI), and electrocardiographic measurements, identifying ST-elevation myocardial infarction (STEMI), and serum parameters such as troponin and creatinine kinase (CK)-MB are suggested for early diagnosis [6]. Based on the ischemic time, the American College of Cardiology (ACC)/American Heart Association (AHA) suggested the choice of treatment [7]. An effective treatment to resolve the blocked cardiac vessel and restoring the blood perfusions is percutaneous coronary intervention (PCI), as well as coronary artery bypass graft (CABG) [8].Hence, several studies suggested the priority of PCI over thrombolytic therapy [9-11], while evidence suggest that the treatment choice and mortality rates of STEMI may depend on several factors including patients' characteristics [12]. Therefore, the results cannot be generalized to other populations.

Since patients with CAD have significantly lower quality of life in Iran [13], it is essential to study the short- and long-term follow-up for post-treatment morbidities to provide a better perspective towards the efficacy and priority of treatments [14]. Therefore, the current study aimed at comparing the short- and long-term follow-up of patients with STEMI undergoing PCI or thrombolytic therapy, selected based on ischemic time.

Methods

Study Design

The current study was conducted on all patients aged > 65 years referring to the emergency department (ED) of Imam Hossein Hospital, Tehran, Iran from January 2014 to July 2016, diagnosed with STEMI. Diagnosis of STEMI was based on ACC/AHA guidelines; the presence of typical angina for 30 minutes to 12 hours with electrocardiographic changes [7]. Patients receiving thrombolytic therapy in another center and referred to the current study department for rescue PCI were excluded from the study.

The participants' information was collected by asking their attendants and recording in the study checklist by the research assistant; the collected data included demographic information, medical history, and drug history. Before catheterization or thrombolytic therapy, a blood sample was taken from all participants and immediately sent to the hospital's laboratory to measure the serum parameters.

The ischemic time was recorded for all patients based on the attendants' reports, and accordingly, the patient was candidate to receive PCI or thrombolytic therapy, based on ACC/AHA guidelines and the available method on the arrival of the patient [7]. The reteplase thrombolytic agent was used in the study. If the symptoms of heart failure or cardiogenic shock were observed in patients receiving thrombolytic or not resolving ST-elevation after 60 minutes, the patient was candidate for rescue PCI. Echocardiography was performed one day after revascularization to evaluate the left ventricular ejection fraction (LVEF).

Six months after discharge, the patient was contacted by telephone calls to check if he/she was alive, being re-admitted, or required angiography, revascularization, or any additional treatments. Also, the complications (gastrointestinal bleeding, stroke, and MI) were asked and recorded in the study checklist.

The study protocol was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences. Before enrolling the patients in the study, the design and objectives of the study were explained to them or their attendants and written informed consent was obtained. The participants were assured about the confidentiality of their information; data analysis and reports were performed anonymously.

Statistical Analysis

Data were transferred into the computer and analyzed with SPSS version 21.0 (IBM Corp. 2012. Armonk, NY: IBM Corp). Results of quantitative variables were expressed as mean ± standard deviation (SD) and those of the qualitative variables as frequency (percentage). The Kolmogorov-Smirnov test was employed to assess the normal distribution of data. Continuous variables were compared using t test or the Mann-Whitney U test when the data had non-normal distribution or the assumption of equal variances was violated across the study groups. Categorical variables were, on the other hand, compared using chi-square test. The association between the variables was tested by Pearson correlation coefficient. For all tests, P-value < 0.05 was considered statistically significant.

Results

Data of 100 patients were analyzed. Most participants (61%) were male. Mean ± standard deviation (SD) of patients' age was 72.68 ± 6.23 years (range 65 to 94). Of all patients, 38 cases received thrombolytic therapy and 62 PCI. Mean age of patients was not different between the groups (72.38 ± 6.17 years in PCI group vs. 73.15 ± 6.46 years in thrombolytic therapy group) (P = 0.5). Thirty four patients in PCI group and 27 in thrombolytic therapy group were male (P = 0.1). Median ischemic time was 2.5 hours.

The frequency of positive medical history and medications taken by patients did not differ between the groups, except for angiotensin-converting-enzyme inhibitor, which its frequency was significantly higher in the PCI group (Table 1).Only two patients (2%) had a positive family history of cardiac diseases; one in each

group (P = 0.7).Of all patients, 23 were smokers and five reported opium abuse; the frequencies of smoking and substance abuse were not different between the groups (P = 0.5 and 0.9, respectively).

There was no significant difference in the mean values of vital signs or serum parameters between the groups (P > 0.05) (Table 2).There was no significant difference between the groups in terms of ischemic time, LVEF, frequency of pulmonary emboli, cardiogenic shock, and vessel involvement (P > 0.05) (Table 3).

Table 1. Comparing the Frequency of Positive Medical History and Medications Used by Patients between the Study Groups

	Total, No. = 100	PCI group, No. = 62	Thrombolytic group, No. = 38	P value
Past medical history				
Dyslipidemia	24 (24)	16 (25.8)	8 (21)	0.58
Hypertension	62 (62)	41 (66.1)	21 (55.2)	0.27
Diabetes mellitus	38 (38)	27 (43.5)	11 (28.9)	0.14
Renal failure	3 (3)	1 (1.6)	2 (5.2)	0.29
Dialysis	1 (1)	1 (1.6)	0 (0)	0.43
Peripheral artery disease	0 (0)	0 (0)	0 (0)	–
Coronary artery disease	20 (20)	14 (22.5)	6 (15.7)	0.41
Cerebrovascular ischemia	6 (6)	3 (4.8)	3 (7.8)	0.53
Previous myocardial infarction	9 (9)	7 (11.2)	2 (5.2)	0.30
Heart failure	0 (0)	0 (0)	0 (0)	–
Previous PCI	9 (9)	5 (8)	4 (10.5)	0.67
Previous CABG	4 (4)	2 (3.2)	2 (5.2)	0.61
Medications used				
Aspirin	30 (30)	18 (29)	12 (31.5)	0.78
Clopidogrel	7 (7)	3 (4.8)	4 (10.5)	0.29
Beta–blocker	22 (22)	14 (22.5)	8 (21)	0.85
Statins	13 (13)	7 (11.2)	6 (15.7)	0.51
ACEi	27 (27)	21 (33.8)	6 (15.7)	0.04

Data in table are presented as No. (%).

PCI: Percutaneous coronary intervention, CABG: Coronary artery bypass grafting, ACEi: Angiotensin-converting-enzyme inhibitor.

Table 2. Comparing the Vital Signs of Patients and Serum Parameters between the Two Study Groups

	Total, No. = 100	PCI group, No. = 62	Thrombolytic group, No. = 38	P value
Systolic blood pressure, mmHg	127.35 ± 35.27	126.38 ± 35.66	128.88 ± 35.09	0.7
Diastolic blood pressure, mmHg	79.56 ± 14.67	78.60 ± 15.38	81.16 ± 13.50	0.4
Heart rate, beat/minute	80.70 ± 15.35	81.53 ± 16.00	79.42 ± 14.43	0.5
Oxygen saturation, percent	93.66 ± 4.52	93.48 ± 5.04	93.92 ± 3.71	0.7
White blood cell count, u/L	9.36x109 ± 3.31x109	9.17x109 ± 3.55x109	9.66x109 ± 2.91x109	0.4
Hemoglobin, mg/dl	12.93 ± 1.67	12.69 ± 1.57	13.33 ± 1.78178	0.07
Platelet count	225042.10 ± 66388.75	227474.57 ± 53102.16	221055.55 ± 84486.66	0.6
Creatinine, mg/dl	1.21 ± 0.58	1.23 ± 0.67	1.20 ± 0.42	0.7
Cholesterol, mg/dl	164.73 ± 38.15	165.15 ± 42.48	164.22 ± 32.60	0.9
Low density protein, mg/dl	97.42 ± 28.70	97.30 ± 32.26	97.60 ± 23.90	0.9
High density protein, mg/dl	39.45 ± 8.76	39.22 ± 8.67	39.72 ± 8.99	0.8
Triglyceride, mg/dl	117.22 ± 73.08	111.37 ± 65.01	124.30 ± 82.30	0.4
Fasting blood sugar, mg/dl	175.35 ± 101.64	190.89 ± 103.21	149.89 ± 94.97	0.05

Data in table are presented as Mean ± SD

Table 3. Comparing the Cardiac Parameters of Patients between the Two Study Groups

Variable	Total, No. = 100	PCI group, No. = 62	Thrombolytic group, No. = 38	P value
Ischemic time, hours	5.21 ± 7.60	4.95 ± 6.91	5.57 ± 8.52	0.7
Left ventricular ejection fraction, %	40.98 ± 11.65	41.66 ± 11.92	40.34 ± 11.56	0.6
Positive pulmonary emboli	4 (4%)	2 (3.2%)	2 (5.2%)	0.6
Positive cardiogenic shock	14 (14%)	11 (17.7%)	3 (7.8%)	0.1
Primary CK-MB, u/L	59.03 ± 72.54	66.20 ± 85.24	48.19 ± 46.33	0.2
Maximum CK-MB, u/L	192.36 ± 183.31	184.82 ± 187.11	202.10 ± 180.87	0.6
First troponin, ng/L	3.21 ± 7.08	3.61 ± 7.34	2.62 ± 6.75	0.5
Second troponin, ng/L	13.25 ± 11.26	12.28 ± 11.35	14.60 ± 11.17	0.3
Involved vessel				0.1
Anterior	12 (12%)	7 (11.2%)	5 (13.1%)	
Anteroseptal	7 (7%)	2 (3.2%)	5 (13.1%)	
Anterolateral	4 (4%)	4 (6.4%)	0 (0%)	
Extensive	3 (3%)	2 (3.2%)	1 (2.6%)	
Inferior	18 (18%)	11 (17.7%)	7 (18.4%)	
Inferior and right ventricule	5 (5%)	4 (6.4%)	1 (2.6%)	

Data in table are presented as Mean ± SD

CK-MB: Creatine kinase-MB

Table 4. Comparing the Treatments Received during Hospitalization and the Post–discharge Complications between the Patients of the two Groups

	Total, No. = 100	PCI groupm No. = 62	Thrombolytic group, No. = 38	P value*
Frequency of medications prescribed				
Aspirin	98 (98%)	60 (96.7%)	38 (100%)	0.2
Clopidogrel	97 (97%)	59 (95.1%)	38 (100%)	0.1
Statins	88 (88%)	54 (87%)	34 (89.4%)	0.7
ACEi	58 (58%)	32 (51.6%)	26 (81.2%)	0.09
Beta–blocker	62 (62%)	35 (56.4%)	27 (71%)	0.1
Recurrent ischemia	1 (1%)	0 (0%)	1 (2.6%)	0.1
Recurrent myocardial infarction	2 (2%)	0 (0%)	2 (5.2%)	0.2
Post–treatment stroke	4 (4%)	2 (3.2%)	2 (5.2%)	0.6
Post–treatment gastrointestinal bleeding	0 (0%)	0 (0%)	0 (0%)	–
Death	14 (14%)	9 (14.5%)	5 (13.1%)	0.8

Data in table are presented as No. (%)

ACEi: Angiotensin-converting-enzyme inhibitor

The frequency of post-treatment complications including recurrent ischemia, MI, and stroke did not differ between the groups (P > 0.05) (Table 4). There was no case of gastrointestinal bleeding after treatment. Of the 14 cases that died after six months, five belonged to the thrombolytic therapy group and nine to the PCI group (P = 0.8). Mean hospital stay was not different between the PCI and thrombolytic therapy groups (8.83 ± 7.98 vs. 9.68 ± 5.38 days, respectively) (P = 0.5).

Discussion

The present study compared the short- and long-term follow-up outcomes of elderly patients with STEMI receiving PCI (N = 62) or undergoing thrombolytic therapy (N = 38), based on their ischemic time. As the results indicated, the hospitalization duration, six-month mortality rate, and post-treatment complications, including recurrent ischemia, MI, and stroke did not differ between the groups. These results indicated that PCI had no priority to the thrombolytic therapy in the studied patients.

Studies comparing the mortality rate after PCI and thrombolytic therapy reported controversial results. Rymuza et al., reported higher mortality rates in hospitals with no access to PCI, compared to those performing PCI in the first 24-hour and showed reduced early and long-term mortality rate of patients >80 years old with STEMI [15]. de Boer et al., studied patients > 75 years with acute MI and compared the mortality rates between PCI and streptokinase and rep orted significantly lower 30-day and 1-year mortality rate by PCI vs. streptokinase (9% vs. 29% and 13% vs. 44%, respectively) [16]. The results of the above mentioned studies on the elderly population [15, 16] were inconsistent with those of the current study, as they reported significant differences in mortality rate and post-treatment complications between the groups receiving PCI or thrombolytic medication. Also, a prospective observational cohort study on 26,205 patients with STEMI reported lower mortality rates in primary PCI compared to in-hospital thrombolysis, after adjusting for age [11]. One of the potential reasons for the difference between the results of the current study and the above-mentioned research could be the employment of thrombolytic therapy, since some used streptokinase, while some others used fibrin-specific medications [10]. Another contributing factor could be the effect of age on patients' outcomes, since older patients may have more underlying diseases, which in turn can increase mortality rate [17]; accordingly, studies including patients within different age groups could have different mortality rates following PCI or medication therapy.

Contrary to the results of the above mentioned studies [10, 11, 15, 16] and consistent with the results of the current study, some other studies reported no difference between the mortality rates of patients receiving PCI or thrombolytic therapy. The study by Bueno et al., investigated patients > 70 years old with STEMI and comparison of six-month mortality rate between the ones receiving tissue plasminogen activator or primary PCI, performed at two different centers, showed that the six-month mortality rate of the PCI group was not different from that of the medication therapy group [18]. Another study also reported no difference in 30-day mortality rate between patients with STEMI aged > 75 years treated with tenecteplase, compared to the ones treated with PCI [19]. The results of both of these studies were consistent with those of the present study, reporting no difference between PCI and thrombolytic therapy in the studied patients. A similar study also indicated no difference in mortality rate between patients receiving PCI and reteplase [20].

An important aspect in the treatment outcome of patients with STEMI, which may only contribute to the developing countries, is the lack of appropriate emergency services to take the patients to the hospital in the shortest interval. According to evidence, time is considered as an important factor in treatment success rate of PCI and the interval between arrest and balloon are considered golden minutes [21]. As suggested, the beneficiary effect of fibrinolysis on reducing the mortality rate, as compared with PCI, diminishes per 10 minutes' time delay [22].In the current study, among 62 elderly patients undergoing primary PCI, 14.5% died within six months, while in thrombolytic therapy group 13.15% died within the same period; hence, the mean ischemic time was not significantly different between

the groups. These results suggested the inappropriateness of emergency care services, even in the capital of Iran, which should be considered by the policy makers.

Other researchers suggested that even if PCI was not available at the admitted hospital, it is safe and feasible to transport the patient to a tertiary hospital with thrombolytic therapy facilities [23-25], which confirms the effectiveness of PCI. In the present study, the mortality rate of patients was lower than those of some previous studies in Iran and higher than those of some others performed worldwide. An epidemiologic study on 20,750 patients with acute MI reported a general mortality rate of 12.1%, while about 85% of deaths were related to patients with STEMI [26]. Another study also reported a mortality rate of 13.2% for MI, with significantly worse outcomes in patients with STEMI [27].The mortality rates reported in these studies, although similar to that of the thrombolytic group, cannot be compared with those of the current study, since they did not report the rates based on the type of MI (STEMI vs. non-STEMI) or the treatments received. Donyavi et al., reported a mortality rate of 24.6% after acute MI in Iranian patients [28], which was higher than the mortality rates of both groups in the present study, although they did not separate the rates based on the type of disease. An important findings of these studies indicated that the socio-demographic characteristics of patients, type of MI, and the concomitant diseases played a fundamental role in the mortality rate [26-28], which could also attribute to the difference in the reported mortality rates.

One of the limitations of the present study was the non-random inclusion of patients into the study and selection of patients from one center, which decreased the generalizability of the results, although the study site was a tertiary center in the city center with high patient load. Furthermore, allocation of the patients into the study groups was not randomized, and the medical indications, ie ischemic time, should also be considered. Nonetheless, the results showed that patients were matched by demographic characteristics (such as age, gender, frequency of underling diseases, and smoking), as well as serum parameters. Thus, the groups were similar, although other confounders might not have been investigated in the present study.

Conclusion

According to the literature, different results were reported and the superiority of PCI over thrombolytic therapy was not confirmed in the current study. The results of comparison of two groups of patients > 65 years with STEMI with similar baseline characteristics in the current study showed no differences in hospital stay, six-month mortality rate, and post-treatment complications, including recurrent ischemia, MI, and stroke between patients receiving PCI or thrombolytic medication. Since mortality rate and post-discharge complications depend on several factors, more studies are required to determine the differences between short- and long-term outcomes of patients from different age groups between the two treatments.

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