Original Article

Primary Percutaneous Coronary Intervention in Patients with Acute Myocardial Infarction

Morteza Safi, MD*, Hassan Rajabi Moghadam, MD, Roxana Sadeghi, MD, Habibollah Saadat, MD, Mohammad Hassan Namazi, MD, Hossein Vakili, MD, Seyed Ahmad Hassantash, MD, Mohammad Reza Motamedi, MD

Modarres Hospital, Cardiovascular Research Center, Shaheed Beheshti University of Medical Sciences, Tehran, Iran.

Abstract

Background: *Primary percutaneous coronary intervention (primary PCI) is the method of choice in establishing reperfusion in acute myocardial infarction (AMI) patients. The aim of this study was to determine the success rate of primary PCI in a university medical center in Iran with a view to promoting it as a first-line therapy in patients with AMI, especially in centers with established catheterization labs across the country.*

Methods: *All cases of AMI admitted between September 2001 and September 2005 underwent primary PCI. The achieved thrombolysis in myocardial infarction (TIMI) flow was recorded, and the patients were followed during the hospital admission for major adverse cardiac events (MACE).*

Results: *A total of 180 patients, consisting of 36 females and 144 males, with a mean age of 56±2.1 years were included in the study. The target vessel was the left anterior descending artery in 66.1%, right coronary artery in 27.2%, and left circumflex artery in 6.7% of the cases. The respective rate of anatomical and procedural success was 94.4% and 90%. The rates of mortality, coronary artery bypass grafting (CABG), and reinfarction were 6.7%, 1.1%, and 2.2%, respectively. Most patients were discharged with no complications in less than a week. Anatomical success in patients <65 years old was 95% versus 92.5% for those ≥65 years of age. Procedural success in patients <65 years of age was 93.6% versus 77.5% for those ≥65 years old (P<0.05). No significant relation was detected between the success rate and sex, target vessel, or major coronary artery disease risk factors. More patients in the mortality group had a longer door-to-balloon (DTB) time compared to the surviving group (P<0.05).*

Conclusion: *In light of the results of this study, primary PCI may also be practiced as the therapy of choice for AMI patients in centers with established equipment in our region with acceptable rates of MACE and complications. Better procedural success rates are achieved in younger patients and in those with a shorter DTB time.*

Introduction

The restoration of the blood flow to the ischemic myocardium is established as the preeminent objective for the treatment of patients with acute myocardial infarction (AMI). Primary angioplasty or percutaneous coronary intervention (PCI) has advanced through the continued evolution of the method and dissemination to an expanding

*Corresponding Author: **Morteza Safi,** Associate Professor of Cardiology, Department of Cardiovascular Medicine, Modarres Hospital, Shaheed Beheshti University of Medical Sciences, Tehran, Iran. P.O.Box: 199873438. Tel: +98 21 22083106. Fax: +98 21 22083106. E-mail: mortezasaafi @yahoo.com.*

proportion of patients. Catheter-based reperfusion technique attains thrombolysis in myocardial infarction (TIMI-3) flow in 93 to 98% of patients. By contrast, only 54% of patients are reported to have achieved this reperfusion benchmark with accelerated tissue plasminogen activator (t-PA).[1]

Although reperfusion therapy is based upon thrombotic coronary occlusion, thrombus may not play the predominant role in a significant proportion of AMI cases. Dynamic occlusive events apart from thrombus, including plaque rupture, intramural hemorrhage, dissection, and spasm, may explain at least some of the advantages of primary angioplasty over thrombolysis. Many patients have contraindications to thrombolytic therapy. Also, even after successful thrombolysis, the majority of patients are left with a high-grade stenosis that may limit the flow, impair subsequent myocardial recovery, and increase the risk of reinfarction.[2]

Multiple centers have described their experience with primary angioplasty over the past 20 years.[3,4] However, concern persists as to whether the results of highly specialized centers could be generalized to clinical practice.

The object of this study was to determine the success rate of primary PCI in a university center in order to recommend this mode of treatment as the first-line therapy of AMI patients by expert interventional cardiologists, practicing in centers with sufficiently equipped catheterization labs in our country.

Methods

All patients suffering from AMI with a pre-hospital delay of up to 12 hours were included in this study. AMI was diagnosed in the presence of the two following criteria: 1) persistent angina pectoris for ≥ 20 minutes and, 2) ST segment elevation of ≥ 1mm in at least 2 contiguous leads or the presence of a left bundle branch block. It was later confirmed by the elevation of cardiac enzymes of more than twice the normal upper range. Pre-hospital delay was defined as the time from the onset of symptoms until admission to our hospital. Informed consent was obtained from all the participants, and the study was approved by the ethics committee of the center. The patients were taken to the cardiac catheterization laboratory as soon as possible to undergo emergency coronary angiography. All the parameters were assessed according to the American College of Cardiology (ACC) guidelines. The patients received 325mg of chewable aspirin and 300mg clopidogrel. 100u/kg heparin was used and titrated around 300 seconds, based on near-patient activated clotting time (ACT) monitoring. In patients without contraindications, beta- blockers, angiotensin-converting enzyme inhibitors, and stains were administered.[5]

The door-to-balloon (DTB) time was defined as the interval between arrival at the hospital and intracoronary balloon inflation. Anatomical or angiographic success was defined as the attainment of residual diameter stenosis less than 50% and normal TIMI-3 flow. Procedural success was defined as angiographic success without the occurrence of major complications (death, MI, or coronary artery bypass grafting [CABG]) during the admission. Clinical success was defined as procedural success without the need for urgent repeated PCI or surgical revascularization within the first 30 days of the procedure.[6]

The chi-square test was used for the comparison of sex, age, and the other parameters with the success rate. A pair-wise multiple comparison test was performed using the independent T-test method and Pearson. Correlations were taken into consideration. A P-value ≥ 0.05 was considered significant.

Results

The present study recruited 180 patients, comprised of 36 (20%) women and 144 (80%) men, with a mean age of 56 ± 2.1 years (30-85 years). Amongst the patients, 91 (50.6%) were smokers, 79 (43.9%) had hyperlipidemia, 53 (29.4%) were hypertensive, 37 (20.6%) had a positive family history of coronary artery disease, and 35 (19.4%) had diabetes mellitus.

The target vessel was the left anterior descending artery in 119 (66.1%), right coronary artery in 49 (27.2%), and left circumflex artery in 12 (6.7%). The DTB time was below 60 minutes in 14 (7.8%), 60 to 89 minutes in 56 (31.1%), 90 to 120 minutes in 104 (57.8%), and beyond 120 minutes in 6 (3.3%) patients (Table 1). Amongst the mortality group, 11 patients had a DTB time longer than 90 minutes and only one patient had a DTB time less than 90 minutes. Mortality showed a meaningful correlation with the DTB time (P<0.05).

Table 1. Mortality according to door-to-balloon time (DTB)

	DTB time (minutes)				
	<60	60-89	90-119	≥ 120	Total
Patients	14	56	104	6	180
Mortality (%)	1(7)	0(0)	7(4)	4(67)	12(6.7)

Anatomical success was achieved in 170 of the 180 (94.4%) patients and procedural success in 162 (90%) patients. Three patients had TIMI-1 after angioplasty and 7 patients developed no reflow phenomenon. Mortality was 6.7% (12 patients). Emergency CABG was performed in 2 (1.1%) patients. Re-MI occurred in 4 (2.2%) patients during hospitalization. Of the latter, 2 patients underwent successful repeat PCI, and the other 2 patients received thrombolytics, with no complications.

Although no correlation was present between the anatomical success rate and age, a meaningful correlation (P<0.05) was seen between procedural success and age group (Table 2). No significant relation was observed between the success rate and sex, target vessel, or major CAD risk factors (Table 3).

Table 2. Anatomical and procedural success rates according to Age

Success	Age(y) <65 (n=140)	≥ 65 (n=40)
Anatomical	133(95%)	37(92.5%)
Procedural	131(93.6%)	31(77.5%)

Table 3. Anatomical and procedural success rates according to sex and risk factors

		Success Rate (%) Anatomical	Procedural
Sex	male	95.1	91.7
	female	91.7	83.3
Diabetes Mellitus	yes	88.6	95.9
	no	85.7	91
Hypertension	yes	92.5	92.5
	no	95.3	89
Hyperlipidemia	yes	94.9	88.6
	no	94.1	91.1
Smoking	yes	94.5	91.2
	no	94.4	88.8
Family history	yes	100	94.6
	no	93	88.8

Discussion

The purpose of this study was to assess the clinical outcomes after the use of primary PCI for acute ST elevation MI in an Iranian university-affiliated tertiary medical center compared with the results published in the medical literature from other countries.

Our data demonstrated that both anatomical and procedural results were clearly within the range of the reported results published. Yet, our success rates appeared to be improving overtime, which could be attributed to improved technology as well as greater understanding of the importance of pretreatment with anti-platelet agents and adequate anticoagulation. During the study period, we had no access to glycoprotein IIb-IIIa inhibitors and were, therefore, unable to administer them to our patients.[4]

We observed a meaningful correlation between the DTB time and mortality.[7-9] Recently, McNamara et al. reported that a longer DTB time was associated with increased in-hospital mortality (mortality rates of 3.0%, 4.2%, 5.7%, and 7.4% for DTB times of <90 minutes, 91 to 120 minutes, 121 to 150 minutes, and >150 minutes, respectively; P<0.01

for trend). Adjusted for patient characteristics, patients with a DTB time >90 minutes had increased mortality (odds ratio: 1.42; 95% confidence interval [CI] of 1.24 to 1.62) compared with those who had a DTB time <90 minutes.[10]

Luca et al. found that after adjustment for age, gender, diabetes, and previous revascularization, each 30 minutes of delay was associated with a relative risk for 1-year mortality of 1.075 (95% CI:1.008 to 1.150; P<0.041).[11]

We also achieved favorable results in terms of death and recurrent ischemia rates, the rate of the latter observed after primary PCI being lower than that reported in other trials. On account of the fact that blinding was not feasible in this trial, we were concerned about possible bias in the reporting of ischemia by the investigators. The electrocardiograms were, consequently, independently reviewed by a physician for the presence of ischemic changes. Chest pain in the absence of electrocardiographic changes was considered non-ischemic.[1] There were no complications due to primary angioplasty, which can be related to the small sample size in this study.

Our elderly patients had an anatomical success rate similar to that of our younger patients, but the procedural success rate was lower, probably due to a higher risk score in the elderly patients. The population of elderly patients (older than 65 years) accounts for 85% of deaths from MI (Biostatistical Fact Sheet. Older Americans and Cardiovascular Diseases. Chicago. American Heart Association, 1998.). A 15% reduction in mortality for eligible patients older than 75 years compared with conservative therapy has already been demonstrated.[12] Despite this evidence, reperfusion therapy is applied to less than half of eligible elderly patients.[13]

Apprehension regarding the risk of intracranial hemorrhage significantly contributes to this diminished treatment. Pooled analyses from randomized trials have revealed a significant mortality reduction for the elderly subgroup treated with angioplasty but not for younger patients.[14] Boer et al. randomly assigned a total of 87 patients with AMI who were older than 75 years to treatment with angioplasty or intravenous streptokinase. The primary end point, a composite of death, reinfarction, or stroke, at 30 days had occurred in 4 (9%) patients in the angioplasty group as compared with 12 (29%) in the thrombolysis group (P=0.01, relative risk [RR]: 4.3, 95% CI: 1.2 to 20.0).[15] Primary PCI may, therefore, be very beneficial for elderly patients.

Conclusion

In this study, primary PCI was performed safely in patients with acute ST elevation MI. It resulted in a high success rate and, also, low morbidity and mortality. Thus, when the

necessary facilities and personnel are available, primary angioplasty is preferred to intravenous thrombolysis and must be carried out.

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