ORIGINAL ARTICLE

Clinical Characteristics and Outcomes of Percutaneous Coronary Intervention in Patients with STEMI: A Single-Center Experience

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Abstract

Objective: Percutaneous coronary intervention (PCI) is the best-known intervention for reperfusion in patients experiencing ST-elevation myocardial infarction (STEMI). Early intervention improves short- and long-term outcomes of PCI, while a delay may reduce the benefits. This retrospective study was conducted to assess the clinical profile and outcomes in patients presenting with STEMI and undergoing primary PCI at a cardiac care center in Haryana (India).

Methods: In this retrospective study, the demographic characteristics, disease presentation, procedural details, and outcomes of 310 consecutive patients with STEMI who underwent PCI between 2010 and 2015 at a cardiac care center in North India, were analyzed. All patients were treated with standard primary PCI protocol.

Results: The mean age of the patients was 57.2±12.6 years. The average duration of chest pain was 230.3±186.2 minutes. Risk factors included previous history of coronary artery disease (CAD; 9.7%), diabetes mellitus (25.5%), hypertension (24.8%), smoking (24.5%) and family history of CAD (4.8%). About half of the patients had anterior wall myocardial infarction (AWMI). The median door to ballooning (DTB) time was 47 minutes. Overall, 29 out of 310 patients developed complications. In total, eleven patients of 310 had died (3.5%).

Conclusion: Primary PCI is effective in the management of STEMI in the Indian scenario. Despite the delayed presentation of STEMI patients to a cardiac intervention center, recommended DTB can still be achieved, which is important for better intervention outcomes. The study also confirms the younger age of STEMI patients in India, compared with Western population.

Introduction

Coronary artery disease is one of the most common causes of death in the Indian population,[1] with acute STEMI being its most dramatic manifestation, resulting in high morbidity and mortality.[2] Primary PCI is the standard of care for patients with STEMI. With advancements in procedural techniques, medications, and early intervention, the short- and long-term clinical outcomes of PCI have significantly improved.[3] However, in India multiple logistic problems limit the availability of primary PCI to the vast population. Nonetheless, the number of patients undergoing primary PCI is increasing owing to the growing economy.[4] According to the American College of Cardiology and American Heart Association (ACC/AHA) 2013 guidelines, primary PCI is the preferred mode of reperfusion in patients with STEMI with symptom onset within 12 hours. It is also recommended in patients who have STEMI with cardiogenic shock or acute severe heart failure, irrespective of the time from onset of myocardial infarction (MI). Primary PCI offers the greatest survival benefits in high-risk patients. A delay in intervention has been shown to reduce the benefits.[5] Evidence on early primary PCI is available from all over the world; however, there is limited data available in the Indian scenario.[6] This retrospective study was conducted to evaluate the primary PCI results in a suburban private multispecialty hospital in India.

Methodology

In this retrospective study, we screened our hospital database of consecutive STEMI patients who underwent primary PCI between March 2010 and July 2015. Patients with incomplete data and rescue percutaneous transluminal coronary angioplasty (PTCA) (n=42) were excluded from the study. The study cohort included a total of 310 patients with STEMI. The primary PCI procedure was performed using the standard protocol by three interventional cardiologists who lived within 5-6 km of the hospital. The services of the cardiologists were called once the patient arrived, the diagnosis was confirmed and a patient consent was obtained for primary PCI. By the time the cardiologist arrived, the patients were shifted to the cardiac care unit and prepared for primary PCI and the catheterization laboratory team was activated.

In our hospital, it is not mandatory to pay advance deposits, as this precondition will result in a significant delay in initiating the primary PCI. A consent to pay is sufficient to start the procedure. This facility helps to expedite the process.

Primary PCI was done for culprit artery; a soft wire was crossed across

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Table 1: Clinical findings

Characteristics	Frequency (%) / Mean ±SD
LVEF (%) On admission	41.52±8.72
LVEF (%) On discharge	45.38±10.1
Blood pressure (mmHg)	
Systolic	126.51±24.1
Diastolic	76.1±14
Serum creatinine (mg/dL)	0.93±0.37
Serum lipid profile (mg/dL)	
Total cholesterol	167.12±39.99
LDL	112.44±36.53
HDL	36.91±11.52
TG	135.14±89.23
Random blood sugar (mg/dL)	175.22±86.75
Cardiac enzymes (IU/L)	
CK 0 hours	736.91±1262.3
CK 12 hours	1935.45±1651.92
CK-MB 0 hour	84.37±137.35
CK-MB 12 hour	242.45±217.52

CAD: Coronary artery disease; LVEF: Left ventricular ejection fraction; LDL: Low-density lipoprotein; HDL: High-density lipoprotein; TG: Triglycerides; CK: Creatinine kinase.

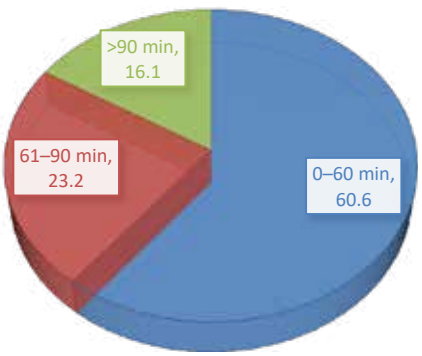

Fig. 1: Door to Ballooning time

the lesion and flow was assessed. If the flow was established with minimal visible thrombus, direct stenting was done; otherwise thrombosuction was done followed by predilatation, if needed and then the stent was implanted. Post stent dilatation was done with NC balloon if required.

Results

Demographics and Clinical Profile and Findings

In this study, the mean age of the patients was 57.2±12.6 years (median: 57 years; range: 23–90 years). Among these, 85.5% of the patients were male. The average duration of chest pain was 230.3±186.2 minutes. A previous history of CAD was present in 9.7% of the patients. Comorbidities, such as diabetes mellitus, were present in 25.5% of the patients, while 24.8% of the patients had hypertension. Approximately one-fourth (24.5%) of the patients were smokers. A family history of CAD was reported in 4.8% of the patients. Clinical findings, including blood pressure, lipid profile, and cardiac enzymes, are summarized in Table 1. The left ventricular ejection fraction at admission was 41.52±8.72%.

Table 2: Procedural details and medication

Characteristics	Frequency (%)
Procedure	
PTCA to LAD	157 (48.45%)
PTCA to LCx	42 (12.96%)
PTCA to RCA	121 (37.35%)
PTCA to LCA	4 (1.23%)
Medication	
Ecosprin	310 (100%)
Clopidogrel	220 (60.4%)
Prasugrel	26 (7.1%)
Ticagrelor	54 (14.8%)
Cilaslazole	167 (45.9%)
Statin-moderate dose	47 (12.9%)
Statin –high dose	254 (69.8%)
ACE inhibitors/ARB	301 (82.7%)
Betablocker	220 (60.4%)

Diagnosis

About half of the patients (50.31%) had single-vessel disease (SVD), while 29.36% of patients had double-vessel disease (DVD), and 19.99% of patients had triple-vessel disease (TVD). About half of the patients (49.35%) had AWMI and 36.77% of the patients had inferior wall MI. Inferior posterior wall MI was noted in 13.87% of patients.

Procedural details

The median door to ballooning (DTB) time was 47 minutes (Figure 1). All patients underwent PTCA as follows. Three patients required only thrombosuction and angioplasty without stent implantation. The details of the procedure conducted are presented in Table 2. Two patients required staged CABG for severe disease after culprit vessel angioplasty. Staged PTCA for other nonculprit vessel was performed in 38 (12.9%) patients before discharge.

In the majority of the patients (94.5%), the route of access was the right femoral artery, while the radial artery was the route of access in 5.5% of the patients. Predilatation was performed in 49.51% of the patients. Thrombus aspiration was done in 68.28% of the patients. Post-dilatation was required in 57.61% of the patients. Overall, drug-eluting stents were used in 84.84% of the patients, while bare-metal stents were used in 16.77% of the patients. Glycoprotein IIb/IIIa inhibitors were used in 63.87% of them patients. The use of antiplatelet agents, statins, and antihypertensive drugs is shown in Table 2.

Table 3: Overall outcomes/complications

Outcomes	Frequency (%)
Survival	303 (97.74)
Cardiogenic shock	16 (5.2)
Death	11 (3.5)
LVF	20 (6.45)
Stent thrombosis	1 (0.33)
Complete heart block	9 (2.9)
Ventricular tachycardia	7 (2.3)

Procedural Outcomes/Complications

The majority of the patients (90.61%) did not develop any complication. Only 29 (9.4%) patients developed complications, the most common being hypotension/bradycardia (2.9%, n=9) and complete heart block (2.3%, n=7). Only two patients developed severe bleeding requiring blood transfusion. Twenty patients developed left ventricular failure, while 16 patients developed cardiogenic shock. One patient developed stent thrombosis, which was managed with thrombosuction and balloon angioplasty. Staged PTCA was required in 38 (12.9%) patients (Table 3). Nine (2.9%) patients had complete heart block requiring TPI, and 7 (2.3%) patients had ventricular tachycardia within 1 week of PCI. Of the 310 patients, 11 (3.5%) patients died: 8 patients had cardiogenic shock (2 patients were diabetic and had severe TVD and poor LV function and TIMI flow I or II post procedure), 2 patients (aged 79 and 82 years, respectively) had multivessel disease; 2 patients had cardiac rupture on 2nd and 3rd day of PCI to RCA; and one patient developed pancreatitis, pneumonitis, acute renal failure, and died due to multiorgan failure.

Discussion

In this retrospective study conducted at a single cardiac care center, data from 310 patients with STEMI who underwent primary PCI were analyzed. The mean patient age in this cohort was 57.22 years, which was comparable to that reported (52 years) in a study conducted by Subban *et al.* This is considerably younger than patients presenting with STEMI in Western

countries and similar to the STEMI subset of the CREATE registry.[2,7] Age group distribution also showed higher percentage of younger patient's, 17.2% less than 45 years and 59.7% between 45-65 years, almost 77% patients were aged less than 65 years of age. This indicates that the STEMI population undergoing primary PCI is younger in India than in Western countries and that males may require more intensive management of cardiovascular (CV) risk factors than females.

Diabetes, hypertension, and smoking were identified to be the major CV risk factors among STEMI patients undergoing primary PCI, in this study. The prevalence of these risk factors was comparatively lower than that reported in another Indian single-center study.[2]

Majority of procedures (94.5%) were performed through femoral route, but lately radial route was also being used more frequently (5.5%). Default strategy of primary PCI was thrombosuction followed by stenting. Later, direct stenting without thrombosuction was also frequently used. Still predilatation was required in 49.5% cases. In primary PCI, postdilatation was reserved only for patients with less than acceptable result after stenting because of fear of slow flow/no reflow. Post dilatation was required in 57.6% of the patients.

In the present study, drug-eluting stents were used in the majority of the patients (84.84%), while bare-metal stents were used in 16.77% of the patients. A study reported that in patients with STEMI and cardiogenic shock, stents were used in about 90% of patients. More than 60% of used stents were bare-metal stents, while drug-eluting stents were used in about 40% of patients.[8]

It has been noted that during primary PCI in STEMI, microvascular obstruction persists despite the restoration of epicardial flow, due to atheromatous and thrombotic embolization as well as vasospasm. Glycoprotein IIb/IIIa inhibitors were used in a significant proportion of patients (63.9%). As a standard strategy, all these patients received intracoronary bolus, prolonged infusion for 12-24 hours was used if there was slow flow/ no reflow. In such cases, the local administration of pharmacotherapy offers several hundred-fold higher concentrations of drugs in the epicardial artery and microcirculation as compared with systemic administration. This may probably increase the dose-dependent antiplatelet and antithrombotic effects focusing on the culprit lesion. The intracoronary administration of glycoprotein IIb/IIIa inhibitors ensures rapid action, greater effectiveness, and higher safety.[9] In this study, intracoronary glycoprotein IIb/IIIa inhibitors were used in 63.87% of the patients.

In this study, in-hospital mortality was 2.3% compared with 4.2% reported by Subban *et al.* More than 90% of the patients did not develop any complications. Hypotension/ bradycardia and complete heart block were the most common complications.

The average duration of chest pain at the time of arrival was 230.34±186.21 minutes in this study. Early PCI has been associated with reduced complications of STEMI resulting from longer ischemic times or unsuccessful fibrinolytic therapy; it also allows earlier hospital discharge and resumption of daily activities. There is generally a delay in the onset of symptoms of STEMI and the patient reaching hospital for medical care, both of which may be attributed to symptoms other than chest pain, assumption that symptoms are self-limited and not serious, fear of embarrassment in case of false alarm, symptoms assumed to be related to other preexisting conditions, and lack of knowledge of need of rapid action.[5]

A standard measure for assessing a hospital's capability for managing STEMI with mechanical perfusion is DTB time.[2] The importance of shorter DTB time in the management of STEMI has been well recognized. Both ACC and ESC have suggested a DTB time of 90 minutes or a PCI-related delay of 60 minutes as standard. Generally, it includes the time from arrival at the hospital to ECG, the decision of PCI, patient's consent, STEMI team activation, financial process, and sheath to balloon time.[10] In this study, the median DTB was 47 minutes. In the Indian scenario, a delay on the part of the patient in giving consent and a delay in financial processes contribute significantly to delay in DTB.[11]

The major logistic problems that hinder the timely availability of primary PCI to patients in India include: mode of transportation to the cardiac care centre, availability of interventional cardiologists, financial constraints. In India, most of the patients reach the hospital through their own means of transport, and this delay can have a significant impact on treatment outcomes. The availability of ambulance services to all patients needs to be tackled appropriately. The second logistic problem is the availability of interventional cardiologists. Majority of the hospitals in India do not have on-site interventional cardiologists. However, in our centre, the services of interventional cardiologists are called for as soon as the patient arrives, the diagnosis is confirmed and a patient consent is obtained for primary PCI. The third logistic problem is the financial constraint. Majority of the patients in India are self-paying and are not covered under medical insurance by the government. Finances are important factors that determine the treatment outcomes of acute myocardial infarction. However, in our center, payment of advance deposits is not mandatory; a consent to pay is sufficient to begin the procedure. Taken together, the immediate availability of an interventional cardiologist and a facility to begin the procedure without paying advance deposits may have largely contributed to the improved treatment outcomes in our study.

Limitations

The main limitations of this study are the relatively smaller sample size and lack of follow-up. Further, these observations are reported from a single center and may not be generalized. However, this study highlights the benefits of early primary PCI in patients with STEMI.

Conclusion

This study has shown that primary PCI is effective in the management of STEMI in the Indian scenario. Despite logistic problems contributing to late presentation of patients with STEMI in India, it was possible to achieve recommended door to balloon time in our study, since we had an on-site interventional cardiologist available immediately and our center does not mandatorily require payment of advance deposits to begin the procedure. Thus, primary PTCA protocol could be activated in the casualty itself. The study also confirms the younger age of STEMI patients in India, compared with

Western population. The risk profile of very young STEMI patients in India is similar to that reported in the Western populations.

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