

Immediate Procedural Success of Primary Percutaneous Intervention in Patients with Acute ST Segment Elevation Myocardial Infarction

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Author's Contribution

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Introduction

Patients presenting with an acute STEMI have a different urgency of revascularization compared to NSTEMI, a reflection of the severity of acute ischemic injury causing immediate necrosis. Whilst an urgent, early invasive or thrombolytic reperfusion strategy is central to the treatment of acute STEMI, this is not the preferred strategy of NSTEMI, unless certain high-risk features are present.¹

When considering absolute rates of in-hospital mortality amongst the two subsets of myocardial infarction, two large, multi-national registries have shown short-term (inpatient and 30-day) mortality rates for STEMI to be significantly higher than for NSTEMI. In the expanded

ABSTRACT

Objective: To determine the frequency of immediate procedural success of Primary PCI in patients with Acute ST segment elevation Myocardial infarction.

Methodology: This observational study was conducted at Cardiology unit of PIMS, Islamabad from April 2018 to October 2018. Study included 43 patients with STEMI. All of them had primary PCI. The main outcome variable was frequency of procedural success which was described as frequency distribution table.

Results: A total of forty three (n=43) patients of both gender with STEMI were enrolled in the study for primary angioplasty. Procedural success was achieved among all (100%) patients. There were 16.3% patients who developed contrast induced nephropathy (recovered), they all were diabetics. There were 4.6% patients who developed hematoma. No other complications seen.

Conclusions: Immediate procedural success of primary PCI is high (almost successful in every case) and should be offered to the patients with STEMI whenever the facility is available.

Keywords: ST-segment elevation myocardial infarction; primary percutaneous coronary intervention.

GRACE audit, in-hospital mortality was 6.2% and 2.9%, respectively.²

Primary percutaneous coronary intervention (PCI) is now considered the preferred reperfusion modality for patients presenting with ST-segment elevation myocardial infarction (STEMI) regardless of the hour of presentation as long as reperfusion can occur in a timely manner.³⁻⁸

Procedure success, defined as normal antegrade coronary blood flow, is achieved in > 95% of patients during daily practice.

Failed myocardial reperfusion is a complex, heterogeneous microvascular problem which manifest clinically as microvascular obstruction and is seen as a compromised TIMI flow score. Several mechanisms have been implicated, including intra-vascular problems, such

as distal embolization of thrombus/atheroma and extravascular problems, such as extrinsic microvascular compression due to intracellular (e.g. cardiomyocyte) and extracellular oedema.⁹

The growth of PCI has been remarkable. Stents are now used in more than 80% of PCI cases. This growth will probably be sustained for some time yet because new technologies have been found to result in improved outcomes. Over the past 2 decades, innovations in PCI have been paralleled by dramatic reductions in 30-day death, myocardial infarction, and target-vessel revascularization rates.

Improvements in catheter technique and the development of new devices and medications have paralleled our growing understanding of cardiovascular physiology, the pathogenesis of atherosclerosis, and the response to vascular injury. Intracoronary stents and atherectomy devices have been developed to increase the success and decrease the complications of conventional balloon dilation, as well as to expand the indications for revascularization. Interventionists now can safely treat more complex coronary lesions and restenosis.¹⁰

The development of drug-eluting stents has substantially reduced the problems of restenosis seen with bare-metal stents. At the same time, advances in intravascular ultrasonography (IVUS) and fractional flow reserve (FFR) evaluation have improved the understanding of coronary plaque morphology, plaque vulnerability, and coronary physiology.¹¹

Furthermore, many of these technologies are able to help identify patients who will benefit most from PCI, coronary artery bypass grafting (CABG), or medical therapy. Adjunctive pharmacologic therapies aimed at preventing acute reocclusion have also improved the safety and efficacy of coronary angioplasty.

Methodology

The Observational study was conducted at Cardiology Unit, PIMS, Islamabad from April 2018 to October 2018. Non-probability consecutive sampling technique was used. The sample size was 43 calculated according to WHO calculator, Confidence level 95%, anticipated population proportion of 90%, absolute precision required is 9%.

Inclusion Criteria: Both Gender, Age >30 years and < 75 years, Onset of ischemic symptoms in last 12 hours, ST segment elevation in ECG.

Exclusion Criteria: Preceding thrombolysis, Age < 30 years, Previous CABG, Prinzmetal Angina, Cocaine Poisoning

After approval of study from the hospital ethical committee, a written informed consent was taken from all of the patients admitted with Acute STEMI in Cardiology unit. All those who fulfilled the inclusion criterion were included in study and those patients who fulfilled the exclusion criteria were excluded. After selection of patient they were shifted to Angiography department, arterial sheath was passed in femoral or radial artery to assess the coronary arteries. Angiography was done and area of occlusion identified was ballooned/ stented by the interventional cardiologist. After this again dye was injected in the coronary vessels to see the grade of TIMI flow (success) achieved. The trainee researcher who entered the data in the proforma assisted all this procedure.

Data was analyzed in SPSS version 11. Mean and standard deviation was used for quantitative variables i.e. age, while frequency and percentage was used for qualitative variables i.e. gender, procedural success and mortality.

Results

A total of forty three (n=43) patients of both gender with STEMI were enrolled in the study for primary angioplasty. Exclusion criteria were strictly followed. Our results showed that the mean age of the patients was 55.91 ± 9.51 years [range 37 - 73 years]. Distribution of patients by age was mentioned in Table I.

Table I: Distribution of patients by age (n= 43)

Age (Years)	No.	Percentage
31-40	04	9.3
41-50	08	18.6
51-60	18	41.8
61-70	11	25.6
71-75	02	4.7
Mean±SD	55.91 ± 9.51	
Range (years)	37 - 73	

Patients were also distributed according to sex. There were 28 (65.1%) male patients in the study, while 15 (34.9%) patients were female. Male to female ratio was 1.86:1.

There were 26 (60.5%) patients who were known diabetics at the time of enrollment in the study, 24

(55.8%) were known hypertensive, 19 (44.2%) had hyperlipidemia and 17 (39.5%) were smokers (figure 1).

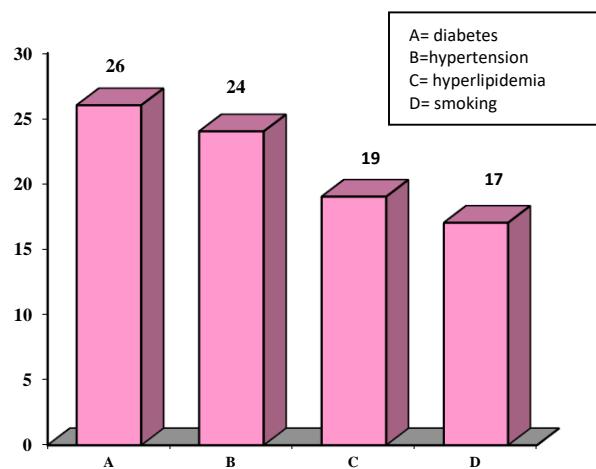


Figure 1. Risk factors present in study population

There were 22 (51.2%) patients who were taking anti-diabetics at the time of enrollment in the study, 16 (37.2%) were taking anti-hypertensive, 5 (11.6%) were on anti-platelets and 6 (14.0%) were taking other medications like statins etc (Figure 2).

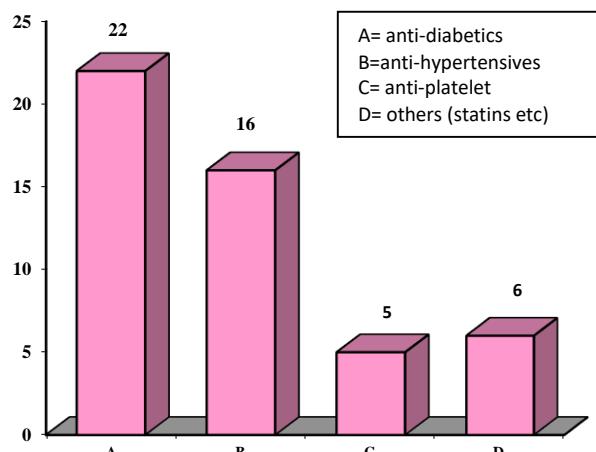


Figure 1: History of drug intake in study population

Femoral approach was used for catheterization in 40 (93.0%) patients and radial approach was used in 3 (7.0%) patients

To help prevent restenosis, Everolimus eluting stents were used in all patients. 2.25 x 15 mm size stents were used in 12 (27.9%), 2.5x13 mm size were used in 9 (20.9%), 3 x 18 mm size stents were used in 7 (16.3%) and 2.75 x 23 mm were used in 15 (34.9%) patients.

Ionic Iodine-based contrast media were used in all patients. Hypersensitivity or other allergic reactions were not observed in any patients.

Patients who had platelet counts who were not hypertensive and who had platelet counts more than 250,000 per microliter (mcL) were given glycoprotein IIb/IIIa inhibitors (n=17, 39.5%).

The mean TIMI score of the patients was 2.56 ± 0.50 (range 2 – 3). None of the patients in the study had TIMI score 0 or 1 after the procedure. There were 6 (14%) patients who had TIMI score 2 and 37 (86%) patients had TIMI score 3. (Table III)

Table III: Distribution of patients by TIMI score (n=43)

TIMI score	No.	Percentage
0	0	0
1	0	0
2	6	14
3	37	86
Mean \pm SD	2.56 ± 0.50	
Range	2-3	

Out of the 43 patients in the study, procedural success was achieved among all (100%) patients.

There were 7 (16.3%) patients who developed contrast induced nephropathy transiently (serum creatinine > 1.5 mg/dL). All 7 patients were diabetics. There were 2 (4.6%) patients who developed hematoma. No other complications seen (table 13). Mean hospital stay of study patients was $2.7 \text{ days} \pm 1.03 \text{ SD}$.

Discussion

Patients with ST elevation acute myocardial infarction comprise a heterogeneous population but Primary percutaneous coronary intervention has shown promising results in all types of patient population. Our study was conducted to see the outcome of primary PCI in a public sector hospital. The results of this study were in favor of primary PCI as the success rate was 100%.

There are few other studies, which have determined the outcome of primary PCI among patients with STEMI. The results of these studies are variable among different authors. Farman MT, et al ¹² conducted a prospective study among 113 patients with STEMI and agreed to go for primary PCI admitted in a tertiary care teaching hospital (National Institute of Cardiovascular Diseases Karachi). These observations are also similar to ours.

In another local study, Shaikh AH, et al¹³ determined the outcomes of primary percutaneous coronary intervention via trans-radial approach in a tertiary care cardiac centre. They retrospectively reviewed the medical records of 160 consecutive patients who presented to Tabba Heart Institute, a private-sector facility in Karachi, between January 2009 and January 2011 with acute ST-elevation myocardial infarction and were treated with primary percutaneous coronary intervention via trans- radial approach. They reported procedural success was 98% (n=157). Three (1.8%) patients died during hospitalization. Forearm haematoma (>5cm) was observed in three (1.8%) patients. the results are similar to our study (100% procedural success).

Another study was conducted by Shaikh AH, et al¹⁴ in which procedural success was assessed among 104 patients with STEMI. The main outcome parameters were 30 days' mortality, myocardial infarction, recurrent angina and congestive cardiac failure which were observed among 5.8%, 1% and 1% respectively. They also documented the procedural success which was bases on postprocedural TIMI score, the same as in ours as the success was achieved among 97% patients.

In a study by Ting HH¹⁵ a total of 1,007 elective PCI and primary PCI procedures performed from March 1999 to August 2005 at the Immanuel St. Joseph's Hospital–Mayo Health System (ISJ) in Mankato, Minnesota, were matched one-to-one with those performed at St. Mary's Hospital (SMH) in Rochester, Minnesota. Procedural success was 93% at ISJ (95% CI 90% to 96%) and 96% at SMH (p = 0.085)

The success rates of primary PCI for STEMI are high. A majority of patients (86%) in our study achieved a TIMI score of 3. Although thrombolytic therapy (Streptokinase) is widely available in urban Pakistan, the efficacy of this treatment in achieving TIMI 3 flow is around 50% at best¹⁶ In other studies discussing timely and optimal treatment of patients with STEMI authors advocated that setting up a health-care system enabling pre hospital diagnosis of STEMI with field triage of patients directly to catheterization laboratories at large-volume PCI centers will help to increase the proportion of patients with STEMI who will benefit from PPCI with near 100% procedural success.¹⁷ Efforts should be made to prevent contrast induced nephropathy, especially in diabetics. The two major theories are that ATN is caused by renal vasoconstriction resulting in medullary hypoxia, possibly mediated by alterations in nitric oxide,

endothelin, and/or adenosine, and that ATN is a direct result of the cytotoxic effects of the contrast agents. However, unlike other types of ATN, contrast nephropathy is usually characterized by relatively rapid recovery of renal function. It may be because the degree of tubular necrosis is much less severe than seen in other settings and the decline in glomerular filtration rate (GFR) is due to functional changes in tubule epithelial cells rather than necrosis. This phenomenon may be in part due to redistribution of membrane transport proteins from the basolateral to the luminal membrane. The reported incidence of contrast-induced nephropathy varies widely, largely depending upon the presence or absence of risk factors, primarily including underlying chronic kidney disease (CKD). The risk is very small among patients with baseline normal renal function, even among diabetic patients. The risk increases with the severity of underlying renal dysfunction, especially among diabetic patients who are at higher risk for contrast nephropathy, compared with nondiabetic patients.^{18,19,20} In one prospective study that directly compared diabetic and nondiabetic patients and were undergoing CT scan with contrast, diabetic patients had a higher incidence of contrast nephropathy, compared with nondiabetic patients⁽¹⁹⁾. The results are similar to our study as in our study all the patients who developed CIN were diabetics. The results are similar to our study as in our study all the patients who developed CIN were diabetics.

The above discussion yields that the procedural success with primary PCI range from 92% to 100%, which is quite high. However, this can only be preceded in the specialized units fully equipped and expert interventionists available.

Limitations: The study has limitation of having limited patients. Larger studies will be needed in primary PCI in our populations. Further we were limited to the immediate procedural success as TIMI flow and in-hospital death, MI, and target vessel revascularization. In further studies, long term procedural success death, MI, and target vessel revascularization may be seen with prolonged follow up.

Conclusion

Immediate procedural success of primary PCI is high (almost successful in every case) and should be offered to the patients with STEMI whenever the facility is available.

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