

Short term outcome of primary percutaneous coronary intervention (PCI) in patients with acute myocardial infarction

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ABSTRACT

Background: Percutaneous Coronary intervention (PCI) is a routinely performed procedure in coronary care units. The aim of our study was to investigate the frequency of major adverse cardiac events (MACEs) after percutaneous coronary angiography in acute ST-elevation myocardial infarction (STEMI) patients in our institution. The objective of the study is to determine the frequency of MACEs after Percutaneous Coronary Intervention (PCI) in patients with acute myocardial infarction

Patients & Methods: This prospective observational study was carried out at Punjab Institute of Cardiology, Lahore from May 2017 to June 2017. A total 35 patients with STEMI who underwent Primary PCI were enrolled by consecutive sampling technique. An inclusion criterion was chest pain of 30 minutes to 12 hours duration with ECG showing ≥ 0.1 mm ST-elevation in at least two contiguous leads. An exclusion criterion was thrombolysis within last 24 hours, malignancy, stroke and Left Main or equivalent disease on coronary Angiogram. Patients were followed after 2 weeks till 1 month for any MACEs. (Including re-admission, need for repeat revascularization, stent thrombosis, recurrent acute MI, angina, stroke, and mortality). Frequency and percentages were calculated for MACEs by using SPSS 23.0.

Results: Out of 35 cases, 34 (97.1%) were male and 1 (2.9%) were female. Mean age was 47.11 ± 10.59 years, 14 (40%) patients had hypertension, 10 (28.6%) were diabetics and 12(34.3%) were current smokers while 4 (11.4%) were ex-smokers, 10 (28.6%) had family history of CAD, and 3 (8.6%) had hyperlipidemia. Successful revascularization with TIMI-III flow was attained in 34(97.1%) cases. 33minutes was mean door to balloon time. At one month follow-up, out of 35 patients, angina was reported only in 1 (2.9%) patient. There was no readmission, repeat revascularization, stent thrombosis, myocardial infarction, stroke and death reported in study subjects.

Conclusion: Successful revascularization by Primary PCI was associated with very few early MACEs. For the treatment of coronary artery disease, PCI is an effective option. It has a few early MACEs and uses less contrast and has fewer distal complications than conventional angioplasty and invasive procedures.

Keywords: PPCI, Acute STEMI, MACEs, Revascularization

INTRODUCTION

Coronary artery disease (CAD) is among the major causes of morbidity and mortality worldwide.¹ Most common presentation of CAD is the acute myocardial infarction with a documented mortality over 15% per year. A recent report estimated the global burden of cardiovascular disease during 2015 from across the globe and showed approx. 422.7 million cases of ischemic heart disease were reported while 17.92 million lives were claimed by this affliction in one-year alone.² Coronary artery aneurysm is a relatively uncommon condition characterized by aberrant dilation of a confined section or scattered segments of the coronary artery tree which is a uncommon findings at

autopsy and angiography. The estimated incidence ranges from 0.3-4.7%.³ According to 4th universal definition of MI, there are 5 types of acute myocardial infarction. Type 1 is being the most common which occurs due to plaque rupture and thrombus formation resulting in total occlusion of an epicardial artery.⁴

Coronary angioplasty also known as percutaneous coronary intervention (PCI) was first performed by Andreas Gruentzig in 1977. It is a percutaneous procedure to address atherosclerotic plaque induced stenoses of coronary arteries. The loss of forward blood flow beyond total occlusion results in myocyte necrosis and reduction in left ventricular function. To prevent this permanent damage to myocardium, early reperfusion is necessary. This can be achieved with either fibrinolytic therapy or PCI.⁵ Stent technology has progressed from bare-metal stents to a new generation of drug-eluting stents that have reduced reoperation rates and the requirement for repeat revascularization.

Conflict of Interest: The authors declared no conflict of interest exists.

Citation: Zafar MK, Iqbal A, Nouman A, Akbar NT, Yousaf S, Faisal M. Short term outcome of primary percutaneous coronary intervention (PCI) in patients with acute myocardial infarction. J Fatima Jinnah Med Univ. 2021; 15(4):166-170.

DOI: <https://doi.org/10.37018/HLOB4294>

Surprisingly, first-generation drug-eluting stents exhibited a higher risk of stent thrombosis than their previous bare-metal stents, particularly for late and very late stent thrombosis. Current-generation drug-eluting stents have solved these issues and currently have lower stent thrombosis rates than first-generation drug-eluting stents, with rates that are likely lower than bare-metal stents.⁶

The results of clinical trial reported that the patients with stable angina were randomized to receive PCI. The results revealed that patient who received PCI significantly reduced symptoms of angina⁶, low cardiogenic shock and 30 day mortality.⁷

Elective PCIs were being extensively performed at our facility, but primary PCI program has recently been restructured to cater to larger number of pts presenting with STEMI. The key question, however, is whether we can truly offer this health care facility in a public sector tertiary care center with good success rate. The prime objective of our study is to investigate the frequency of major adverse cardiac events (MACEs) after percutaneous coronary angiography in acute STEMI patients in our institution.

PATIENTS AND METHODS

This prospective observational study was carried out at Punjab Institute of Cardiology, Lahore from May 2017 to June 2017. A total 35 patients with STEMI who underwent Primary PCI were enrolled by consecutive sampling technique. Inclusion criteria were chest pain of 30 min to 12h duration with ECG showing $\geq 0.1\text{mmST-}$ elevation in at least two contiguous leads. Exclusion criteria was, thrombolysis within last 24hours, chronic kidney disease (CKD), high bleeding risk (Previous history of Gastrointestinal bleeding, low weight), malignancy, stroke and Left Main or equivalent disease on coronary Angiogram. A written informed consent was taken and study perspectives were clearly explained to all patients. An ethical permission was got from institutional review board (IRB) of the institution.

At time of admission previous medical record was reviewed and thorough physical examination was done. Tablet Aspirin 300mg and Clopidogrel 600mg was given to all patients. A limited views diagnostic coronary angiogram was performed by senior consultant and culprit artery detected. Direct stenting was done in selected cases where premedication had already opened up vessels so it was not totally occluded at time of angiogram and showed $<90\%$ stenosis. While pre stenting balloon dilatations were done in most of

the cases. Selection of bare-metal stent (BMS) vs. drug-eluting stent (DES) was subject to availability of appropriate stent size and patient characteristics. Unfractionated heparin was given intravenously at 70-100units /kg body weight before PCI. Tirofiban (GP IIb/IIIa inhibitor) was given in selected cases with high clot burden. (Defined as linear thrombus dimension being ≥ 2 vessel diameter) Patients were discharged according to hospital criteria. Patients were followed after 2 weeks till 1 month. Thrombus aspiration was not done in any case. Procedural success was defined as no residual narrowing of more than 30% with TIMI III distal flow (defined as Antegrade flow into the bed distal to the stented site occurs as promptly as antegrade flow into the bed proximal to the obstruction,) It was visually assessed on angiogram. Post PCI ECG was done between 60 to 90 min after procedure. MACEs were re-admission, Repeat revascularization, stent thrombosis, recurrent acute MI, angina, stroke and mortality within 30 days.

The reason for readmission after PCI was categorized as bleeding complications, contrast induced nephropathy, subacute stent thrombosis and staged PCI of non-culprit vessel. Reinfarction was detected if patient developed post procedure severe chest pain with new ECG changes consistent with ischemia and elevated Troponin level sat follow-up, new ischemic symptoms leading to hospital admission along with elevated troponin was defined as recurrent myocardial infarction. Patient's medical history, risk factors, intraoperative outcomes (Mean Door to balloon (DOB) time, radial or femoral access, diseased vessel, stent size, type of stent, Thrombus aspiration used, Direct or pre-dilated stent, TIMI III distal flow, Deferred Stent and Aggrastat) and major adverse cardiac events (re-admission, need for repeat revascularization, stent thrombosis, recurrent acute MI, angina, stroke, and mortality) was observed on predesigned questionnaire. Continuous data were expressed as mean \pm standard deviation. Categorical data were expressed as percentages and frequencies. Statistical package for social sciences (SPSS-23) was used to analyze data

RESULTS

Primary percutaneous coronary intervention (PCI) was performed on 35 patients. 34 (97.1%) were male and 1 (2.9%) was female. The youngest patient was 25 and the oldest was 70 years old. Mean age was 47.11 ± 10.59 years (Table 1). 14 (40%) patients had Hypertension, followed by cigarette smoking as the second most prevalent risk factor. 12 (34.3%) were current Smokers

while 4 (11.4%) were Ex-smokers. 10 (28.6%) were Diabetics and, 10 (28.6%) had Family history of CAD, and 3(8.6%) had hyperlipidemia (Figure 1) Door-to-balloon time was 55 minutes maximum and 15 minutes minimum, while mean duration was 33 minutes. Radial access was used in 32 (91.4%) patients while femoral access was used in 3 (8.6%). 24 patients (68.6%) underwent PCI to LAD, 10 patients (28.6%) PCI to RCA, while D1 was stented in 1 (2.1%) patient. In most of the lesions, medium stent size (15-30mm) was used. DES was deployed in 33 (94.3%) while DES and BMS were used in 2 (5.7%) patients. Thrombus aspiration was not done in any case. During procedure, lesions were pre-dilated with compliant balloon in 27 (77.1%) of patients while in 8 (22.9%) patients, lesion was directly stented. Aggrastat (tirofiban) was used in 22 (62.9%) patients. A final result of TIMI-3 flow was achieved in 34 (97.1%) patient's while TIMI-1 flow in 1 (2.9%) (Table 1).

Table 2, show the frequency of major adverse cardiac events. The incidence of re-admission, repeat revascularization, stent thrombosis, recurrent acute MI, stroke and mortality, within 30 days was not seen in any patient. However, angina was reported in 1 (2.9%) patient.

Table 1. Baseline characteristics of patients

Baseline Characteristics	Number	Percentage (%)
Age (years) Mean±SD	47.11±10.59	
Gender		
Female	1	2.9
Male	34	97.1
Intra-operative outcomes		
Mean DOB time (min-max)	33 (15-55)	
Access used		
Radial	32	91.4
Femoral	3	8.6
Culprit vessel		
LAD	24	68.6
RCA	10	28.6
D1	1	2.9
Stent size		
Small (12-15)	1	2.9
Medium (15-30)	20	5.7
Large (30-38)	12	34.3
Extra-large (48)	2	5.7
Stent type		
DES	33	94.3
DES & BMS	2	5.7
Thrombus aspiration used	0	0
Direct stent	8	22.9
Predilated	27	77.1
TIMI Flow Grade		
Grade 1	1	2.9
Grade 3	34	97.1
Deferred stent	0	0
Aggrastat	22	62.9

DISCUSSION

Best reperfusion strategy for patients with acute STEMI has been one of the longest running debate. Reperfusion strategies both fibrinolytic therapy and PCI have drastically improved outcome of STEMI patients.

In PCI, the blocked vessel is reopened percutaneously to restore the blood flow. If it is performed in patients with acute STEMI, it is called primary angioplasty. Several RCTs have been published that have shown reduction in mortality, reinfarction and stroke in short term follow up for patients who have undergone primary angioplasty. Rate of successful revascularization is much higher with PPCI vs Fibrinolytics while incidence of intracranial bleeding and LV free wall rupture is much low.⁸⁻¹⁰

According to latest AHA Guidelines, a patient presenting with STEMI in 12hrs of pain onset, primary PCI is a Class- I recommendation and is associated with improved survival.¹¹ If it can be performed by an experienced team within 90-120 minutes after first medical contact. It has an established survival benefit over thrombolytic therapy in acute M.I.^{12,14} with a recommended Door to balloon time of 90min. A recent study shows even shorter DOB time has even better survival outcome.¹¹ Another added benefit of primary PCI is earlier mobilization and safe earlier discharge from hospital which among other benefits cuts down cost of prolonged hospital stay.¹⁴

Acute myocardial infarction is among the top culprits of mortality and morbidity in Pakistan. Despite the proven benefit of PPCI over fibrinolysis, the most frequent mode of revascularization in acute STEMI is thrombolytic therapy in our country. Studies have been done in Pakistan on the outcome of primary PCI in public and private sector hospital.^{15,17} These studies have shown good success ratio with favorable in hospital outcome comparable to worldwide studies results. Such study has never been done in our institute. This is the first study to report the short-term outcome of PPCI in patients presenting with STEMI in our institution. The study sought to establish that successful Primary PCI with good safety profile with regard to earlier MACES can be used as the preferred mode of revascularization in our public health care system.

In our study, majority of patients treated with primary PCI were male (97.1%) which reflects the current data that ischemic heart disease is more common in men. The mean age is 47 years which represents premature atherosclerosis in our population and is in line with data from other studies on STEMI

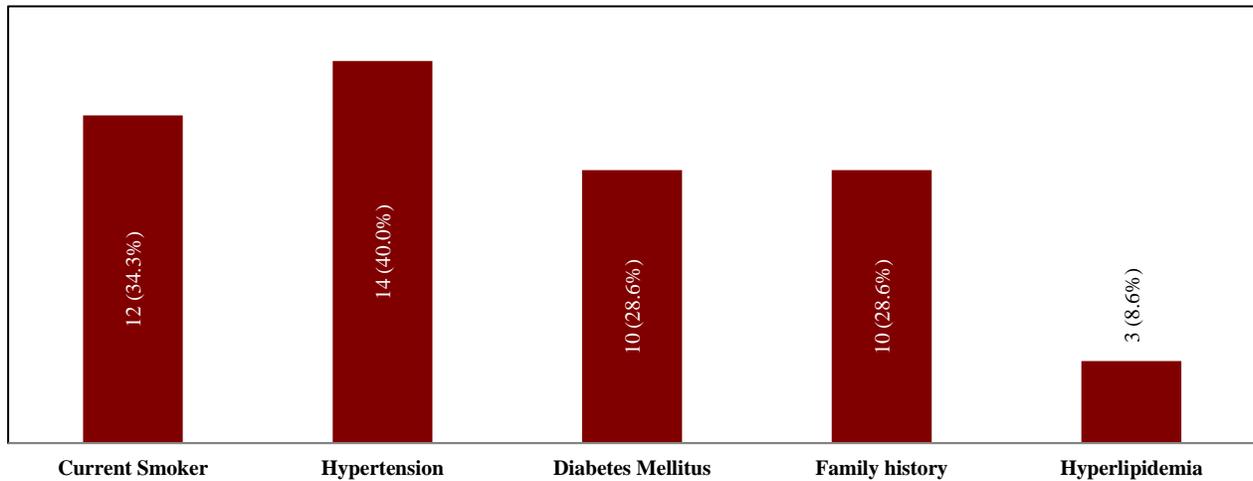


Figure 1: Risk Factors Coronary artery disease (CAD)

Table-2: Major Adverse Cardiac Events (MACEs) in study subjects

Major Adverse Cardiac Events (MACEs)	Number (n)	(%)
Readmission	0	0
Death	0	0
MI	0	0
Stent thrombosis repeat	0	0
Stroke	0	0
Angina	1	1 (2.9)

patients conducted in ASIA.^{18,19} In our study 33 minutes is the mean time from door to balloon which meets the current standard of 90 min for primary PCI.²⁰ This finding is not consistent with the findings of similar studies in Pakistan which show higher door to balloon time.¹⁶ All patients in this study underwent primary PCI in less than 90 min so we achieved the standard door to balloon time.

LAD is the culprit artery in most of patients (68.6%) in this study which is worrisome as most of our patients were young. Since LAD supplies most of the left ventricle in majority of population, this distribution of culprit vessel disease predicts a danger to the lives of young population.

Drug Eluting Stents (DES) were implanted in 94.3% patients. DES has been widely used in elective angioplasty as it reduces the risk of in-stent restenosis by inhibiting neointimal proliferation. This benefit of DES has resulted in its incremental use in AMI patients.²¹ A comparison of DES vs BMS in Primary PCI is presented by Kastrati et al in their report which clearly favors usage of DES in this setting.²² One worry with use of DES has been increased risk of stent thrombosis, as cytotoxic drug used in DES in order to decrease smooth muscle growth after implantation, also inhibits endothelialization and induces the expression of

tissue factor which activates coagulation. Furthermore, polymer used in these stents causes inflammation of coronary arteries which might also contribute to prothrombotic environment. However, no case of early stent thrombosis (ST) was documented in our patients treated with DES. Although some studies indicate that the incidence of late and very late ST is increased after DES implantation, long-term follow-up is needed in our case to document such complication.

The criteria of successful PCI in our study was post procedure achievement of TIMI-3 flow with visual residual stenosis of <30%. TIMI flow is a determinant of MACE after PCI. Patients with TIMI-3 flow have better survival rates and fewer complications.²² In our study 97.1% achieved TIMI-3 flow. No procedure related complications were reported.

At 01 month follow up after primary PCI, no death, readmission, stroke, M.I was seen in our study. Only angina was reported in 2.9% of study population. Rest of the patients remained asymptomatic.

CONCLUSION

Successful revascularization by Primary PCI was associated with very few early MACEs. It should be the preferred choice of reperfusion for revascularization in acute STEMI. Successful revascularization by Primary PCI was associated with very few early MACEs. For the treatment of coronary artery disease, PCI is an effective option. It has a few early MACEs and uses less contrast and has fewer distal complications than conventional angioplasty and invasive procedures. The study had a small sample size with a short follow up. Use of 1-year follow-up could affect the proportions of events related

to repeat revascularization. We need a larger study with long term follow-up to see if these results project on to a larger scale, with long term success rate.

REFERENCES

- Nowbar AN, Gitto M, Howard JP, Francis DP, Al-Lamee R. Mortality from ischemic heart disease circulation: cardiovascular quality and outcomes. 2019; 2010:122:208-82.
- Roth GA, Johnson C, Abajobir A, Abd-Allah F, Abera SF, Abyu G et al. Global, regional, and national burden of cardiovascular diseases for 10 causes, 1990 to 2015. *J Am Coll Cardiol.* 2017;70(1):1–25.
- Yip HK, Chen MC, Wu CJ, Hang CL, Hsieh KY, Fang CY et al. Clinical features and outcome of coronary artery aneurysm in patients with acute myocardial infarction undergoing a primary percutaneous coronary intervention. *Cardiology.* 2002;98(3):132-40.
- Thygesen K, Alpert JS, Jaffe AS, Chaitman BR, Bax JJ, Morrow DA, et al. Fourth universal definition of myocardial infarction. *JACC* 2018;72(18):2231-2264.
- Ali K, Win M, Lang CC, Anglim N. Antianginal therapy before percutaneous coronary intervention in stable angina---a retrospective audit.
- Bhatt DL. Percutaneous coronary intervention in 2018. *JAMA.* 2018;319(20):2127-8.
- Miličević N, Stojković S, Miloradović V, Maksimović S. Advantages of percutaneous coronary intervention in relation to medication therapy in patients with stable angina pectoris (three-vessel coronary disease). *Scripta Medica.* 2018; 49(2):137-40.
- Grines CL, Browne KF, Marco J, et al. Primary angioplasty in myocardial infarction study group. A comparison of immediate angioplasty with thrombolytic therapy for acute myocardial infarction. *N Eng J Med* 1993; 328: 673-9.
- Moreno R, Lopez-Sendon J, Garcia E, et al. Primary angioplasty reduces the risk of left ventricular free wall rupture compared with acute myocardial infarction. *J Am Coll Cardiol.* 2002; 39: 598-603.
- Garcia E, Elizaga J, Perez N, et al. Primary angioplasty versus systemic thrombolysis in anterior myocardial infarction. *J Am Coll Cardiol.* 1999; 33: 605-11.
- O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, et al. ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *JACC* 2013;61(4):e78-e140.
- Keeley EC, Boura JA, Grines CL. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. *Lancet.* 2003;361:13–20
- Stone GW, Brodie BR, Griffin JJ, et al. Clinical and angiographic follow-up after primary stenting in acute myocardial infarction: PAMI stent pilot trial. *Circulation.*1999; 99: 1548-54.
- Stone GW, Brodie BR, Griffin JJ, et al. Prospective, multicenter study of the safety and feasibility of primary stenting in acute myocardial infarction: In-Hospital and 30-day results of the PAMI Stent pilot Trial. *J Am Coll Cardiol.* 1998; 31: 23-30.
- Iqbal R, Jahan N, Hanif A. Epidemiology and management cost of myocardial infarction in North Punjab, Pakistan. *Iran Red Crescent Med J.* 2015; 17(7): e13776.
- Jafary FH, Ahmed H, Kiani J. Outcomes of primary percutaneous coronary intervention at a joint commission international accredited hospital in a developing country- can good results, possibly similar to the west, be achieved? *J Invas Cardiol.* 2007; 17: 417-23.
- Shaikh AH, Siddiqui MS, Hanif B, Malik F, Hasan K, Adhi F. Outcomes of primary percutaneous coronary intervention in a tertiary care cardiac centre. *J Pak Med Assoc.* 2009; 59: 426-9.
- Farman MT, Sial JA, Khan NU, Rizvi SN, Saghir T, Zaman KS. Outcome of primary percutaneous coronary intervention at public sector tertiary care hospital in Pakistan. *JPMA.* 2011, 61(6):575-81.
- Sadrnia S, Pourmoghaddas M, Hadizadeh M, et al. Factors affecting outcome of primary percutaneous coronary intervention for acute myocardial infarction. *ARYA Atheroscler.* 2013; 9(4): 241-46.
- Khan M S, Jafary FH, Jafar TH, Fauqui AM, Rasool SI, Hatcher J, et al. Knowledge of modifiable risk factors of heart disease among patients with acute myocardial infarction in Karachi, Pakistan: A cross sectional study. *BMC Cardiovasc Disord.* 2006; 6: 18. doi: 10.1186/1471-2261-6-18.
- Kushner F G, Hand M, Smith S C, King SB, Anderson JL, Antman EM, et al. 2009 Focused updates: ACC/AHA Guidelines for the management of patients with ST-elevation myocardial infarction (updating the 2004 Guideline and 2007 focused update) and ACC/AHA/SCAI Guidelines on Percutaneous Coronary Intervention (updating the 2005 Guideline and 2007 focused update). *Cath Cardiovasc Interv* 2009; E144.
- Kastrati A, Dibra A, Spaulding C, Laarmann GJ, Menichelli M, Valgimigli M, et al. Meta-analysis of randomized trials on drug-eluting stents vs. bare-metal stents in patients with acute myocardial infarction. *Eur Heart J.* 2007;28:2706-2713.