Research Article

Interventional
Cardiology

One year follow-up of post percutaneous transluminal coronary angioplasty in patients with coronary heart disease

Shiliveri Sadhan Siddardha*,
Anjalee Chiwhane, Gajendra
Agrawal, Sunil Kumar, Sourya
Acharya

Department of Medicine, Jawaharlal Nehru
Medical College, Datta Meghe Institute of
Medical Sciences (Deemed to be University),
Wardha, Maharashtra, India

*Author for correspondence:
Shiliveri Sadhan Siddardha, Department
of Medicine, Jawaharlal Nehru Medical
College, Datta Meghe Institute of Medical
Sciences (Deemed to be University),
Wardha, Maharashtra, India, E-mail:
sadhansiddarth.shiliveri@gmail.com

Abstract:

Background: Globally, the Cardiovascular Diseases (CVDs) has become the number one cause of death. Antithrombotic therapy along with Percutaneous Coronary Intervention (PCI) is the most common preferred approach to improve clinical outcomes.

Aims: To know the clinical end points of Myocardial infarction like unstable angina, congestive cardiac failure and death in post Percutaneous Transluminal Coronary Angioplasty (PTCA).

Methodology: This study was designed as prospective observational study, carried out on myocardial infarction patients who have underwent PTCA surgery. These patients were subjected to detailed clinical examination with observation on signs of unstable angina, reinfarction and mortality. All the patients were called for follow up at 3, 6, and 12 months and they underwent clinical examination, ECG and 2D echo. The collected data was entered into excel chart and analysed using SPSS V.23. The Chi-square test was used and p-value less than 0.05 was considered as statistically significant.

Results: A total of 240 patients were included with mean age of 56.7 ± 9.6 years with a range and gender ratio of 3.1:1. Around half of the patients had anterior wall Myocardial Infarction (MI), 31.2% had inferior wall MI and 13.8% had lateral wall MI. Nine (3.8%) patients had global ischemia. All patients had undergone PTCA surgery. At 12 months follow-up, 8.33% had angina, 5.8% had reinfarction and 3.3% died during the study period.

Conclusion: Angioplasty in myocardial infarction cases is able to achieve good long-term results.

Keywords: Myocardial infarction . Percutaneous transluminal coronary angioplasty .Reinfarction

Introduction

Globally, the Cardiovascular Diseases (CVDs) has become the number one cause of death. Acute Coronary Syndrome (ACS), which encompasses ST-Segment Elevation Myocardial Infarction (STEMI), Non-ST-Segment Elevation Myocardial Infarction (NSTEMI), and Unstable Angina (UA), were the most common cause of mortality in patients with coronary artery disease [1].

There was a four-fold rise of coronary heart disease cases in India during the past 25 years. Epidemiological studies conducted in India had reported the prevalence of coronary heart disease with a range of 5% to 15% in urban and 3% to 8% in rural population. Previous epidemiologic studies had reported that at present there are over 40 million cases of coronary heart disease in India [2,3].

The rapid increase of coronary heart disease cases in India can be explained by the fact that there was increase in prevalence of coronary risk factors like smoking, central obesity, hypertension, diabetes,

atherogenic dyslipidemia, and physical inactivity. Change in lifestyle that occurred due to rapid urbanization that occurred during the past two decades had led to rapid rise in burden of coronary risk factors in India. When compared to Westerners at present the prevalence of CHD among youth, is almost twice in India [4].

With the blockage of antegrade coronary flow, acute myocardial infarction is caused, leading to myocardial ischemia and cell death [5]. The important predictors of the poor clinical outcome were the size of the thrombus, percentage of reduced coronary flow and reduced myocardial perfusion [6].

Antithrombotic therapy along with Percutaneous Coronary Intervention (PCI) is the most common preferred approach to improve clinical outcomes. Coronary-artery thrombus aspiration before PCI reduces the thrombus burden and improves ST segment resolution and coronary flow [7,8]. PCI directed at severely stenotic lesions are highly effective in relieving angina. The PCI mainly includes Percutaneous Transluminal Coronary Angioplasty (PTCA) and Coronary Artery Bypass Graft (CABG) surgery.

In India according to the 2017-National Interventional Council data around 4 lakhs Percutaneous Coronary Intervention (PCI) procedures were performed. Non-ST Segment Elevation Myocardial Infarction (NSTEMI) or unstable angina followed by chronic stable angina, ST Segment Elevation Myocardial Infarction (STEMI) and primary PCI (PPCI) for STEMI are the major indications for PCI [9].

Every year more than 5 lakh stents have been deployed; of which, greater than 95% were Drug-Eluting Stents (DES) in the past 5 years. PCI was performed for single-vessel disease in 80% and for multi-vessel disease in 20% of cases respectively in the year 2017 all over India. Radial route was the most common route for PCI which accounts for more than 60% of cases. The reported in hospital mortality was 1.2% for all PCIs and 2.8% for PPCI. Emergency Coronary Artery Bypass Graft had to be carried out in 0.5%; acute renal failure due to contrast-induced nephropathy and major bleeding episodes were noted in 1.1% and 0.3% of cases, respectively [9].

Although much data is published regarding the procedure details and in hospital status of post PTCA in India they is a paucity of literature regarding the follow up after discharge of patients. The present study was conducted to know the clinical end points of Myocardial infarction like unstable angina, congestive cardiac failure and death in post percutaneous transluminal coronary angioplasty.

Materials and Methods

This prospective observational study was conducted in the Department of General Medicine, Jawaharlal Nehru Medical College (JNMC), Sawangi (Meghe) over a period of 2 years. The institutional ethical committee clearance was obtained before starting the study.

The inclusion criteria were adult patients of myocardial infarction who have underwent PTCA in cardiology department of our institute. Patients having comorbidities like chronic kidney disease, hepatic failure, respiratory failure, stroke patients and who have undergone previous CABG were excluded.

The sample size was calculated based on the estimated prevalence of 4.1% CAD cases taken from a previous study [10]. With 95% confidence interval and 3% absolute precision the minimum sample size calculated was 167. All the patients who underwent PTCA were considered for the study. Written informed consent was taken from patients willing to participate in the study.

These patients underwent detailed clinical examination with observation on signs of unstable angina, reinfarction and mortality. All the patients were called for follow up at 3, 6, and 12 months and they underwent clinical examination, ECG and 2D echo. The ECG was done by ECG300G which can collect 12 lead ECG signal and print waveform by the thermal printing system. The 2d echo was done by GE Vivid S70 along with modern XD clear probe series. Those patients unable to come for follow up was considered as loss to follow up. Those patients who attended cardiology department for follow up their reporting of clinical end points were taken from the cardiologist.

Those patients who died during the study either in the hospital or outside was considered for mortality data. The patients who died during the study period in the hospital the data was taken from the admission file and those who died outside the hospital information was telephonically collected.

The collected data was entered into MS-Excel 2013 spreadsheet. It was then was analysed using Statistical package for social sciences (SPSS) V.23. The continuous variables were reported as mean ± Standard Deviation (SD) while categorical variables were expressed as absolute values and percentages. The Chi-square test was applied to find the association and p-value less than 0.05 was considered as statistically significant.

Results

A total of 240 patients were included in the study. The mean age of the study participants was 56.7 ± 9.6 years with a range of 21-81.

The majority of the study population 36.7% was between 51–60 years followed by 35.4% in above 60 years age group. There were 182 (75.8%) males and 58 (24.2%) female patients. The gender ratio in the present study was M:F=3.1:1.

The history of smoking was present in 74 (30.8%) and alcohol in 61 (25.4%) cases. Out of 240 cases, 157 (65.4%) had history of hypertension and 82 (34.2%) had history of diabetes mellitus. The laboratory investigations revealed 101(42.1%) had dyslipidaemia.

Around 63 percent (151) patients had single vessel disease, 79 (32.9%) had double vessel disease and 10 (4.2%) had triple vessel disease. The most common vessel involved was left anterior descending artery. All the three vessels (LCX, LAD and RCA) were involved in 10 (4.2%) cases. The findings of 2D echo showed that ejection fraction was less than 35% in 18 (7.5%) cases. Ejection fraction was 35%-45% in 184 (76.7%) and more than 45% in 38 (15.8%) cases. Around half of the patients had anterior wall MI, 31.2% had inferior wall MI and 13.8% had lateral wall MI. Nine (3.8%) patients had global ischemia.

All the 240 cases had follow up at the end of 3 months post PTCA. At the end of 3 months, 7 (2.9%) had angina, 3 (1.3%) had reinfarction and 1 (0.4%) died during the study period. At 6 months post PTCA 231 cases had follow up, out of which 7 (3%) had angina, 6 (2.6%) had reinfarction and 4 (1.7%) died. At 12 months post PTCA 216 cases had follow up, out of which 6 (2.8%) had angina, 5 (2.3%) had reinfarction and 4 (1.8%) died during the study period (Table 1).

Table 1: Outcomes at the end of 3, 6 and 12 months.

Outcome	Post PTCA To 3 Months (n=240)	Between 3-6 Months (n=231)	Between 6-12 Months (n=216)
Angina	7(2.9%)	7(3.0%)	6(2.8%)
Reinfarction	3(1.3%)	6(2.6%)	5(2.3%)
Death	1(0.4%)	4(1.7%)	4(1.8%)

At the end of follow-up period, the major cardio vascular events were significantly high in diabetes mellitus when compared to the non-diabetic patients (angina 13.4% vs. 5.7%, reinfarction 10.9% vs. 3.2% and death 7.3% vs. 1.3%) (Table 2).

Table 2: Relationship between diabetes and major cardiovascular events at the end of follow-up.

		Diabetes mellitus Present	Absent	
Angina	Present	11(13.4%)	9(5.7%)	p–value=0.04 (Sig.)
	Absent	71(86.6%)	149(94.3%)	
Reinfarction	Present	9(10.9%)	5(3.2%)	p–value=0.01 (Sig.)
	Absent	73(89.1%)	153(96.8%)	
Death	Present	6(7.3%)	2(1.3%)	p–value=0.01 (Sig.)
	Absent	76(92.7%)	156(98.7%)	
Sig: Significant				

At the end of follow-up period, the major cardio vascular events were significantly high in hypertension when compared to the non-hypertensive patients (angina 10.2% vs. 4.8%, reinfarction 8.3% vs. 1.2% and death 5.1% vs. 0%) (Table 3).

Table 3: Relationship between hypertension and major cardiovascular events at the end of follow-up.

		Hypertension Present	Absent	
Angina	Present	16 (10.2%)	4 (4.8%)	p–value=0.15 (NS)
	Absent	141 (89.8%)	79 (95.2%)	
Reinfarction	Present	13 (8.3%)	1 (1.2%)	p–value=0.02 (Sig.)
	Absent	144 (91.7%)	82 (98.8%)	
Death	Present	8 (5.1%)	0	p–value=0.03 (Sig.)
	Absent	149 (94.9%)	83 (100%)	
Sig: Significant				

At the end of follow-up period, the major cardio vascular events were significantly high in patients with dyslipidemia when compared to the patients with abnormal lipid levels (angina 14.8% vs. 3.6%, reinfarction 9.9% vs. 2.9% and death 6.9% vs. 0.7%) (Table 4).

Table 4: Relationship between dyslipidaemia and major cardiovascular events at the end of follow-up.

		Dyslipidemia Present	Absent	
Angina	Present	15(14.8%)	5(3.6%)	p–value=0.15 (NS)
	Absent	86(85.2%)	134(96.4%)	
Reinfarction	Present	10(9.9%)	4(2.9%)	p–value = 0.021 (Sig.)
	Absent	91(90.1%)	135(97.1%)	
Death	Present	7(6.9%)	1(0.7%)	p–value = 0.008 (Sig.)
	Absent	94(93.1%)	138(99.3%)	
Sig: Significant				

On comparison with various determinants in relation to follow-up up-to 12 months at various intervals, the prevalence of angina was significantly higher (p<0.05) in patients who had history of smoking, hypertension, diabetes mellitus and dyslipidemia (Table 5).

Table 5: Angina in relation to duration post PTCA during follow-up at various intervals.

	Up-to 3 months Post PTCA (7/240) 2.9%	From 3 To 6 months (7/231) 3%	From 6 To 12 months (6/216) 2.8%	p-Value
Age	61.0 ± 11.9	59.6 ± 9.2	58.8 ± 7.3	>0.05, NS
Male	5/177(2.7%)	6/167(3.5%)	4/155(2.5%)	>0.05, NS
TC	193.7 ± 69.5	168.9 ± 50.7	162.2 ± 25.8	>0.05, NS
TG	131.4 ± 54.3	103.7 ± 42.9	106.3 ± 56.0	>0.05, NS
LDL	136.7 ± 57.1	119.3 ± 42.4	114.0 ± 24.2	>0.05, NS

HDL	37.9 ± 3.2	38.7 ± 5.5	38.9 ± 6.3	>0.05, NS
H/o smoking	5/69(6.7%)	6/63(8.7%)	5/58(7.9%)	<0.05. S
Alcohol	2/57(3.4%)	4/54(6.9%)	2/48(4%)	>0.05, NS
HTN	6/151(3.8%)	5/141(3.4%)	5/131(3.7%)	<0.05. S
DM	3/79(2.6%)	4/71(5.3%)	4/63(3%)	<0.05. S
Dyslipidemia	6/95(3.9%)	5/92(4.1%)	4/90(3.3%)	<0.05. S
NS: Not Significant; S: Significant				

On comparison with various determinants in relation to follow-up up-to 12 months at various intervals, the prevalence of reinfarction was significantly higher (p<0.05) in patients who had history of smoking, hypertension, diabetes mellitus and dyslipidemia (Table 6).

Table 6: Reinfarction in relation to duration post ptca during follow-up at various intervals.

	Up-to 3 months Post PTCA (3/240) 1.2%	From 3 To 6 months (6/231) 2.6%	From 6 To 12 months (5/216) 2.3%	p-Value
Age	55.7 ± 9.7	58.3 ± 9.4	59 ± 8.2	>0.05, NS
Male	3/179(1.6%)	5/168(2.9%)	3/156(1.9%)	>0.05, NS
TC	199.0 ± 64.1	177.7 ± 49.3	159 ± 27.5	>0.05, NS
TG	121.7 ± 67.2	102.8 ± 47.3	107.6 ± 62.5	>0.05, NS
LDL	145.0 ± 49.5	128.0 ± 39	110.4 ± 25.2	>0.05, NS
HDL	36.2 ± 4.1	38.5 ± 5.2	38.3 ± 5.3	>0.05, NS
H/o smoking	5/69(6.8%)	4/65(5.8%)	2/61(3.2%)	<0.05. S
Alcohol	1/58(1.7%)	3/55(5.2%)	1/49(2%)	>0.05, NS
HTN	4/153(2.5%)	5/142(3.4%)	4/132(2.9%)	<0.05. S
DM	4/78(4.9%)	4/71(5.3%)	3/64(4.5%)	<0.05. S
Dyslipidemia	5/96(4.9%)	3/94(3.1%)	4/88(4.3%)	<0.05. S
NS: Not Significant; S: Significant				

Discussion

A hospital based prospective observational study was conducted among patients with myocardial infarction who have underwent PTCA. The study was conducted among 240 patients with an aim to follow-up for period of 1 year. The clinical end points (angina, reinfarction and death) were recorded at 3, 6 and 12 months post PTCA. The mean age of the patients was 56.7 ± 9.6 years and male to female ratio was 3.1:1.

In the present study the reinfarction rate was 6.7% at the end of one year during follow-up. Similar to the present study Kip et al. [11], study on coronary angioplasty in diabetic patients had reported that at the end of 6 months during follow up, in diabetic cases the reinfarction rate was 9.3% and in nondiabetic cases it was 5.9%.

At 12 months follow-up, 8.33% had angina, 5.8% had reinfarction and 3.3% died during the study period. Similar to the present study Shiomi et al. [12], (ReACT Trail) during the first 1 year

of follow up no. of events were 7% and during the 5 year follow up the cumulative incidence were 10%. A report from NHLBI Dynamic Registry by Holubkov et al. [13], had reported that at 1-year follow up, 24.5% cases had angina which was higher than that observed in present study may be due to the sophisticated infrastructure and drug eluting stents available nowadays. Corrozza et al. [14], had reported that event-free survival rate was 88% at end of 6 months and 70% at end of 36 months follow-up and during the entire study period the mortality rate was 2.3%.

Kimura et al. [15], follow-up study on after PTCA had reported that during the 1st year, reinfarction was present in 4.9% cases and 6.3% died. They also found that the patient's event-free survival of bypass surgery, myocardial infarction and revascularization of the target lesion was 80% at end of one year follow-up whereas in the present study the overall mortality rate was 3.3%.

The presence of diabetes mellitus, hypertension and dyslipidaemia in patients with coronary atherosclerotic disease is a marker of poor prognosis. The metabolic and endothelial changes present in these conditions and the higher chance of rupture of the plaque, thrombus formation, and exacerbation of the intimal hyperplasia are determinant factors of a higher incidence of complications and restenosis in these patients when they undergo percutaneous coronary interventions [16].

At the end of follow-up period, the angina, reinfarction and mortality were significantly high in diabetes mellitus when compared to the non-diabetic patients. Similar to the present study Yao et al. [17], predictors for death had reported that diabetes mellitus had significant association with mortality. However, Klugherz et al. [18], had reported that no significant association between events free survival and diabetes mellitus which was in contrast to the present study due to strict dietary habits maintained by the population after being diagnosed as diabetic.

The rate of major cardio vascular events were significantly high in hypertension when compared to the non-hypertensive patients and the increased rate of adverse events in hypertensive patients may be due to exacerbation of left ventricular dilatation and remodelling after myocardial infarction. Hypertension also accelerates the coronary atherosclerosis which leads to poor outcomes in long term follow-up [19].

Klugherz et al. [18], had reported that there was no significant association between events free survival and hypertension which is in contrast to the present study. Cecchi et al. [19], had found that hypertension alone is not independently associated with increased mortality, either at short term or long term follow-up, in STEMI and NSTEMI patients. Abrignani et al. [20], had also reported that that in patients with history of hypertension first attack of myocardial infarction had a better in-hospital outcome than no hypertensives which was contrast to the study findings.

At the end of follow-up period, the major cardio vascular events were significantly high in patients with dyslipidemia when compared to the patients with normal lipid levels In accordance

with the study findings Corrozza et al. [14], had reported a statistical significant association between comorbidities and restenosis in post PTCA patients. Zibaeenezhad et al. [21], had reported Major Cardiovascular Events (MACE) in 29.2% cases if multiple comorbidities were present during the follow up and a statistical significant association found between multiple comorbidities and MACE.

The effects on angioplasty in myocardial infarction in patients with smoking, diabetes, hypertension and dyslipidemia may be improved with relevance to the activation of the anti-aging gene Sirtuin 1. Sirtuin 1 is critical to the prevention of diabetes, dyslipidemia, hypertension and cardiovascular disease. Unstable angina and congestive cardiac failure may be controlled with relevance to Sirtuin 1 activation. The developing world is susceptible to the global chronic disease epidemic. Cell senescence and apoptosis is possibly correlated to Sirtuin 1 repression with diet and nutrition critical to Sirtuin 1 activation [22-24].

Conclusion

It can be concluded from the findings of the present study that angioplasty in myocardial infarction cases is able to achieve good long-term results. However, the major cardiovascular adverse events were higher in patients with history of smoking, diabetes, hypertension and dyslipidaemia and these patients with comorbidities and history of smoking need monitoring.

Acknowledgement:

Author Contributions:

Details of contribution of each authors regards manuscript work & production.

Funding

Competing Interests

All the authors of the present study does not have any conflicts of interest.

References

1. World Health Organization. Cardiovascular diseases. (2020)

2. Mohan V, Deepa R, Rani SS. Prevalence of coronary artery disease and its relationship to lipids in a selected population in South India. J Am Coll Cardiol. 38: 682–687 (2001).

3. Gupta R, Gupta VP, Sarna M. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. Indian Heart J. 54(1): 59–66 (2002).

4. Krishnan MN. Coronary heart disease and risk factors in India-on the brink of an epidemic? Indian Heart J. 64(4): 364-7 (2012).

5. Thygesen K, Alpert JS, Jaffe AS, et al. Third universal definition of myocardial infarction. Eur Heart J. 3(20): 2551-67 (2012).

6. Stone GW, Peterson MA, Lansky AJ, et al. Impact of normalized myocardial perfusion after successful angioplasty in acute myocardial infarction. J Am Coll Cardiol. 39: 591-7 (2002).

7. Svilaas T, Vlaar PJ, van der Horst IC, et al. Thrombus aspiration during primary percutaneous coronary intervention. N Engl J Med. 358: 557-67 (2008).

8. Costopoulos C, Gorog DA, Di Mario C, et al. Use of thrombectomy devices in primary percutaneous coronary intervention: a systematic review and metaanalysis. Int J Cardiol. 163: 229-41 (2013).

9. Arramraju SK, Koganti S, Janapati R, et al. The report on the Indian coronary intervention data for the year 2017-National Interventional Council. Indian heart journal. 71(2): 146-8 (2019).

10. Gupta R, Joshi PP, Mohan V, et al. Epidemiology and causation of coronary heart disease and stroke in India. Heart 94(1): 16-26 (2008).

11. Kip KE, Faxon DP, Detre KM, et al. Coronary angioplasty in diabetic patients: the national heart, lung, and blood institute percutaneous transluminal coronary angioplasty registry. Circulation. 94(8): 1818-25 (1996).

12. Shiomi H, Morimoto T, Kitaguchi S, et al. The ReACT trial: Randomized evaluation of routine follow-up coronary angiography after percutaneous coronary intervention trial. JACC: Cardiovascular Interventions. 10(2): 109-17 (2017).

13. Holubkov R, Laskey WK, Haviland A. Angina 1 year after percutaneous coronary intervention: a report from the NHLBI Dynamic Registry. Am Heart J. 144(5): 826-833 (2002).

14. Carrozza JP, Kuntz RE, Levine MJ, et al. Angiographic and clinical outcome of intracoronary stenting: immediate and long-term results from a large single-center experience. J Am Coll Cardiol. 20(2): 328-37 (1992).

15. Kimura T, Yokoi H, Nakagawa Y, et al. Three-year follow-up after implantation of metallic coronary-artery stents. New England Journal of Medicine. 334(9): 561-7 (1996).

16. Gupta R, Gupta VP, Sarna M. Prevalence of coronary heart disease and risk factors in an urban Indian population: Jaipur Heart Watch-2. Indian Heart J. 54: 59–66 (2002).

17. Yao HM, Wan YD, Zhang XJ, et al. Long-term follow-up results in patients undergoing Percutaneous Coronary Intervention (PCI) with drug-eluting stents: results from a single high-volume PCI centre. BMJ open. 4(8): e004892 (2014).

18. Klugherz BD, DeAngelo DL, Kim BK, et al. Three-year clinical follow-up after Palmaz-Schatz stenting. J Am Coll Cardiol. 27(5): 1185-91 (1996).

19. Cecchi E, D'Alfonso MG, Chiostri M, et al. Impact of hypertension history on short and long-term prognosis in patients with acute myocardial infarction treated with percutaneous angioplasty: comparison between STEMI and NSTEMI. High blood pressure & cardiovascular prevention. 21(1): 37-43 (2014).

20. Abrignani MG, Dominguez LJ, Biondo G, et al. In hospital complications of acute myocardial infarction in hypertensive subjects. Am J Hypertens. 8: 165–70 (2005).

21. Zibaeenezhad MJ, Mohammadi SS, Sayadi M, et al. The impact of diabetes mellitus and hypertension on clinical outcomes in a population of Iranian patients who underwent percutaneous coronary intervention: A retrospective cohort study. The Journal of Clinical Hypertension. 21(11): 1647-53 (2019).

22. Martins IJ. Anti-Aging Genes Improve Appetite Regulation and Reverse Cell Senescence and Apoptosis in Global Populations. Advances in Aging Research. 5: 9-26 (2016).

23. Martins IJ. Sirtuin 1, a Diagnostic Protein Marker and its Relevance to Chronic Disease and Therapeutic Drug Interventions. EC Pharmacology and Toxicology. 6(4): 209-215 (2018).

24. Martins IJ. Single Gene Inactivation with Implications to Diabetes and Multiple Organ Dysfunction Syndrome. J Clin Epigenet. 3(3): 24 (2017).