

OUTCOME OF PERCUTANEOUS CORONARY INTERVENTION IN TOTALLY OCCLUDED CORONARY ARTERIES

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ABSTRACT

Objective: To review the outcome of percutaneous coronary intervention (PCI) in chronic total occlusion (CTO) of coronary arteries.

Study Design: Cross sectional descriptive study.

Place and Duration of Study: This study was carried out in the cardiology department of Pakistan Institute of Medical Sciences (PIMS) Islamabad, from Jan to Jul 2014.

Material and Methods: In this study a total of 50 patients with chronic totally occluded coronary arteries having percutaneous coronary intervention (PCI) were included. The main outcome variable was frequency of procedural success. PCI and stent implantation were performed in a standard manner by expert interventionists having more than fifteen years' experience of doing PCI. Thrombolysis in Myocardial Infarction (TIMI) flow was noted at the end of CTO PCI by observer.

Results: The mean age of the patients was 60.44 ± 9.214 years. There were 32 (64%) male patients with male to female ratio of 1.78:1. The CTO of left anterior descending (LAD) was seen in 23 (46%) patients, CTO of left circumflex (LCX) was seen in 14 (28%) patients and CTO of right coronary artery (RCA) was seen in 13 (26%) patients. In the study sample majority 40 (80%) of the patients had coronary artery disease (CAD) from 3-6 months and only 10 (20%) patients had a duration of CAD more than 6 months. The procedural success (TIMI flow ≥ 2) was achieved in 41 (82%) patients. Here was no significant association (p -value >0.05) of age and gender with procedural success. There was a highly significant (p -value <0.01) association between duration of CAD and procedural success.

Conclusion: PCI is recommended in patients with CTO of coronary arteries as the success rate was very encouraging i.e. 82%, whenever the facility is available.

Keywords: Chronic total occlusion of coronary arteries, Coronary artery disease, Percutaneous coronary intervention.

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INTRODUCTION

Coronary heart disease (CHD) is still an important reason of mortality. It is estimated that by 2020 CHD will be the major reason for death throughout the globe¹. It is therefore not surprising that coronary artery disease (CAD) will also be the prominent instigator of death in Pakistan as well. Blocking due to thrombolysis, identified with coronary angiography characterized by Thrombolysis in Myocardial Infarction (TIMI) flow of 0 lasting for more than three months is termed as chronic total occlusion (CTO) of coronary artery. History of angina or

myocardial infarction in same area confirmed by angiography is used to estimate the duration of occlusion. CTO of coronary arteries has very high prevalence rate of 35%-50% in patients of CAD undergoing diagnostic angiography^{2,3}. CTO with percutaneous coronary intervention (PCI) is more dangerous and challenging because it has very less rates of success in comparison to its complications and recurrence rate of restenosis⁴.

Andreas Gruntzig in 1977 introduced the percutaneous transluminal coronary angioplasty also known as PCI. It is used as an alternative to bypass surgery for coronary revascularization in selected patients. PCI of CTO is considered a new era of hope as most of the patients having CAD are diagnosed with at least one CTO. As majority

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Received: 08 Jan 2018; revised received: 17 Sep 2018; accepted: 19 Sep 2018

of the patients with CTO are frequently left un-revascularized due to higher rates of unsuccessful procedures previously and lack of technical expertise⁵. CTO-PCI has improved success rate of revascularizations which is further strengthened by use of drug eluting stents. It helps in improving patient's angina relief and heart function⁶.

With recent advancements in procedural techniques and technologies like dedicated guide wires and improvement in clinical expertise and skills have improved the outcome of PCI of CTO coronary arteries significantly.

MATERIAL AND METHODS

This descriptive cross sectional was conducted in Department of cardiology, Pakistan Institute of Medical Sciences, Islamabad from January 2014 to July 2014. Sample size was calculated with the help of WHO sample size calculator with following calculations, i.e. confidence level 95%, anticipated population proportion of 86.2%, absolute precision required was 10%. Sample size was 50 patients. Non-probability consecutive sampling technique was used and patients more than 40 years of age of both genders with total occlusion of coronary arteries were included. Patients having severe renal dysfunction, intolerance to Aspirin and Heparin or Iodine containing contrast medium were excluded.

The study was started after approval from the hospital ethical committee. Written informed consent was taken from all the patients included in the study. History was taken from all patients and detailed examination was done to confirm inclusion and exclusion criteria. After selection of patients, study proforma was filled. PCI and stent implantation was performed in a standard manner by expert interventionists having than fifteen years' experience of doing PCI. TIMI flow was noted at the end of CTO PCI by observer.

All collected data was entered and analyzed in the Statistical Package for Social Sciences (SPSS) Version 21.0. Mean and standard deviation was used for quantitative variables, while frequency and percentages were applied for qualitative variables. Chi-square test with Fisher

Exact test were applied and p -value ≤ 0.05 was taken as significant.

RESULTS

In this study a total of 50 patients of both genders with the mean age of 60.44 ± 9.214 years (range 40-70 years) were included. Majority 35 (70%) patients had age range of 56-70 years. There were 32 (64%) male patients in the study, while 18 (36%) patients were females. Male to female ratio was 1.78:1. The CTO of left anterior descending (LAD) was seen in 23 (46%) patients, CTO of left circumflex (LCX) was seen in 14 (28%) patients and CTO of right coronary artery (RCA) was seen in 13 (26%) patients. In the study sample majority 40 (80%) of the patients, duration of CAD was from 3-6 months and only 10 (20%) patients had a duration of CAD more than 6 months. The procedural success (TIMI flow ≥ 2) was achieved in 41 (82%) patients and in 9 (18%) patients the TIMI flow remained < 2 giving a procedural failure (table-I).

The results of analysis showed that there was no significant association (p -value > 0.05) of age and gender of the patient with procedural success. There was a highly significant (p -value < 0.01) association between duration of CAD and procedural success. According to the results, 40 patients were having disease for 3 to 6 months duration and successful PCI was seen in 37 (92.5%) patients while 10 patients were having disease > 6 months duration and successful PCI was seen in 4 (40%) patients. Which shows that patients having less than six month duration of CAD had significantly higher rate of procedural success in comparison to the patients having more than 6 months duration of CAD as elaborated in table-II.

DISCUSSION

In patients of CAD, CTO incidence is very common and it exists in about 50% of the CAD patients⁷. In majority of the patients of CTO complex lesions also exist, revealed by coronary angiography⁸ and it leads to significant morbidity and mortality. Medical therapy for CTO has many other advantages along with eradication

of clinical symptoms. The other benefits include improvement in long term heart function and survival rate of the patient^{6,9,10}.

Expansion of blood flow reperfusion and

ventricular and decreases the chance of adverse cardiac events¹¹. The revascularization procedure for CTO lesions is more challenging because many factors cause difficulty in this procedure. The most common factors include lesions

Table-I: Distribution of different characteristics of the patients.

Characteristics	Frequency	Percentage
Age of the Patient		
40-55	15	30.0
56-70	35	70.0
Total	50	100.0
Gender of the Patient		
Male	32	64.0
Female	18	36.0
Total	50	100.0
Duration of CAD		
3-6 months	40	80.0
>6 months	10	20.0
Total	50	100.0
Occluded Artery		
LAD	23	46
LCX	14	28
RCA	13	26
Total	50	100
TIMI flow		
<2	9	18
≥2	41	82
Total	50	100

Table-II: Association of different characteristics with procedural success.

Characteristics	Procedural success		Total	p-value
	No	Yes		
Age of the Patient				
40-55	2 (22.2%)	13 (31.7%)	15 (30.0%)	0.710
56-70	7 (77.8%)	28 (68.3%)	35 (70.0%)	
Total	9 (100.0%)	41 (100.0%)	50 (100%)	
Gender of the Patient				
Male	6 (66.7%)	26 (63.4%)	32 (64.0%)	1
Female	3 (33.3%)	15 (36.6%)	18 (36.0%)	
Total	9 (100%)	41 (100%)	50 (100%)	
Duration of CAD				
3-6 months	3 (33.3%)	37 (90.2%)	40 (80.0%)	<0.001
>6 months	6 (66.7%)	4 (9.8%)	10 (20.0%)	
Total	9 (100%)	41 (100%)	50 (100%)	

recovery of myocardial contractility is caused due to recanalization of total occlusion vessels and main function of PCI is therapeutic only. The PCI significantly improves the pump function of heart along with remodeling of inhibited left

level, clinical characteristics, equipment for intervention and techniques used for manipulation^{12,13}. The recent improvements in interventional technologies and techniques of manipulation by physicians has remarkably increased the

success rate of PCI procedure in patients with CTO lesions^{14,15}.

Previous studies have identified several baseline characteristics associated with CTO PCI failure such as older age, prior MI, prior coronary Artery Bypass Grafting (CABG), history of cardiac arrest, and target lesion in the RCA¹⁶. Older age is likely associated with more advanced coronary atherosclerosis and greater coronary artery calcification¹⁶. In the present study there was no significant association of age and gender of the patient with procedural success.

In recent years, a number of technological advances and procedural developments have increased the success of PCI for CTOs¹⁷. These include retrograde wiring through collateral channels and both antegrade and retrograde subintimal dissection and reentry techniques. Emerging data shows that success rates of 80% to 90% are consistently achievable in experienced hands with a safety profile comparable to standard risk-adjusted PCI¹⁸.

The results of this present study also showed a similar success rate that is the procedural success (TIMI flow ≥ 2) was achieved in (82%) patients and in (18%) patients the TIMI flow remained < 2 giving a procedural failure. In coronary interventions, the success rate of CTO for recanalization has fundamental importance¹⁹.

The result of analysis showed that there was a highly significant association between duration of CAD and procedural success. According to the results, in patients who had disease for 3 to 6 months duration the successful PCI was seen in (92.5%) patients while in patients having disease > 6 months duration, the successful PCI was seen in (40%) patients. Which shows that patients having less than six months duration of CAD had significantly higher rate of procedural success in comparison to the patients having more than 6 months duration of CAD.

The recanalization of CTO has long term effect on global and regional left ventricular function in patients of angina pectoris. Long-term patency after recanalization of CTO in patients

with angina pectoris is associated with improvement in global and regional left ventricular function. There is limited data on procedural success rate of CTO-PCI in our country²⁰.

So, on the basis of results of this study it can be recommended that patients with chronic totally occluded coronary artery lesions should be treated with PCI whenever the facilities are available and duration of CAD is less than six months. This also highlights the need that PCI should be considered as first line treatment wherever this facility is available, anatomy is suitable for PCI and duration of disease is less than six months. There is also need for future trials to compare the outcome of CTO PCI with CABG and medical therapy alone.

CONCLUSION

PCI is recommended in patients with CTO of coronary arteries as the success rate was very encouraging i.e. 82%, whenever the facility is available.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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