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Original Research

Assessment of results of percutaneous coronary intervention for chronic total occlusions of coronary arteries: An observational study

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ABSTRACT:
Background: Chronic total occlusions (CTOs) are complex lesions identified in 15-30% of all patients referred for coronary angiography. Percutaneous coronary intervention (PCI) of chronic total occlusion (CTO) is one of the major challenges in interventional cardiology. Hence; the present study was conducted for assessing the results of percutaneous coronary intervention for chronic total occlusions of coronary arteries. **Materials & methods:** A total 50 subjects were enrolled. The study included subjects of all ages and genders, admitted as in patients for PCI and suffering from CTO. The indications for offering PCI intervention to CTO lesions were either clinical symptoms of ischemia, or demonstration of viable myocardium in the absence of symptoms and finally technical feasibility as judged by the operator himself. The femoral approach was followed for opening the CTO in all cases. For wire escalation the Step up approach was used starting with moderate stiffness and increased stiffness as procedure progresses. Left ventricular ejection fraction (LVEF) is the central measure of left ventricular systolic function. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software. **Results:** Single and double vessel involvement occurred in 36 percent of the patients (18 patients) and 38 percent of the patients (19 patients) respectively. Triple vessel involvement occurred in 26 percent of the patients (13 patients). Primary access site was right femoral and right radial in 64 percent of the CTO lesions and 26 percent of the CTO lesions respectively. Intramural hematoma was seen in 6 percent of the patients while post stenting slow flow was seen in 4 percent of the patients. Coronary dissection was seen in 4 percent of the patients. **Conclusion:** Percutaneous coronary intervention in chronic total occlusion is an effective therapeutic procedure. So, despite the technical difficulty of PCI in CTO lesion, this procedure can be done safely with relatively significant success rate.
Key words: Percutaneous coronary intervention, Chronic total occlusions

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INTRODUCTION

Chronic total occlusions (CTOs) are complex lesions identified in 15-30% of all patients referred for coronary angiography. However, percutaneous coronary intervention (PCI) rates for these lesions have been reported as only 10-15%, and most of the patients are treated with either medical therapy or coronary artery bypass grafting (CABG). Several studies have shown that successful PCI for CTO reduces symptoms of angina, improves exercise capacity, improves left ventricular function, and reduces the need for subsequent CABG. In addition, successful PCI for CTO has shown a long-term survival benefit and may increase tolerance of future cardiac events compared to patients with an unsuccessful PCI. Although success rates are lower than with PCI for non-CTO lesions, they have been seen to improve with the advent of sophisticated materials specifically designed for these lesions.[1-3]

Percutaneous coronary intervention (PCI) of chronic total occlusion (CTO) is one of the major challenges in interventional cardiology. The primary success rate is relatively low, mainly due to inability to cross the occlusion with the guidewire, while the recurrence rate is higher than that of subtotal stenoses. Moreover, the overall procedure and fluoroscopy times are longer and equipment use higher than with PCI of nonoccluded vessels.[4-6]

Several reports, usually based on single-center experience, have shown that the immediate success has improved over time, along with the increased experience and skill of the operators and the availability of new specialized guidewires or more sophisticated technologies for crossing occluded

arteries. In addition, randomized studies have demonstrated that stent implantation reduces restenosis and reocclusion rates. Furthermore, some retrospective studies suggest that successful PCI of a CTO confers a long-term survival advantage but this issue has not been investigated with prospective studies.[5-8]Hence; the present study was conducted for assessing the results of percutaneous coronary intervention for chronic total occlusions of coronary arteries.

MATERIALS & METHODS

The present study was conducted for assessing the results of percutaneous coronary intervention for chronic total occlusions of coronary arteries. A total 50 subjects were enrolled. The study included subjects of all ages and genders, admitted as in patients for PCI and suffering from CTO. The indications for offering PCI intervention to CTO lesions were either clinical symptoms of ischemia, or demonstration of viable myocardium in the absence of symptoms and finally technical feasibility as judged by the operator himself. The femoral approach was followed for opening the CTO in all cases. For wire escalation the Step up approach was used starting with moderate stiffness and increased stiffness as procedure progresses. Left ventricular ejection fraction (LVEF) is the central measure of left ventricular systolic function. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

RESULTS

Mean age of the patients was 61.5 years. 80 percent of the patients (40 patients) were males while the remaining were females. 72 percent of the patients (36 patients) had clinical presentation of chronic angina while the remaining 28 percent of the patients (14 patients) had clinical presentation of acute angina.Single and double vessel involvement occurred in 36 percent of the patients (18 patients) and 38 percent of the patients (19 patients) respectively. Triple vessel involvement occurred in 26 percent of the patients (13 patients).Primary access site was right femoral and right radial in 64 percent of the CTO lesions and 26 percent of the CTO lesions respectively. Intramural hematoma was seen in 6 percent of the patients while post stenting slow flow was seen in 4 percent of the patients. Coronary dissection was seen in 4 percent of the patients.

Table 1: Clinical presentation of enrolled patients

Clinical presentation		Number of patients	Percentage of patients
Acute angina	Yes	14	28
	No	36	72
Chronic angina	Yes	36	72
	No	14	24

Table 2: CAG findings

CAG findings	Number of patients	Percentage of patients
Single vessel	18	36
Double vessel	19	38
Triple vessel	13	26
Total	50	100

Table 3: Primary access site

Primary access site	No of CTO lesions	Percentage
Right radial	13	26
Right femoral	32	64
Right ulnar	2	4
Left femoral	3	6

Table 4: Procedural complications

Complications		Number	Percentage
Coronary complications	Intramural hematoma	3	6
	Post stenting slow flow	2	4
	Coronary dissection	2	4
Non coronary complications	Right femoral hematoma	2	4
	Contrast induced AKI	2	4

DISCUSSION

Chronic coronary occlusions (CTOs) are defined as lesions with Thrombolysis in Myocardial Infarction (TIMI) 0 flow older than three months (either angiographically proven or with high clinical likelihood). According to a recent Canadian registry,

CTOs are detected in about 30 % of patients with symptomatic coronary artery diseases (CAD). Likewise a very large German monitor controlled registry found that 27.5 % of 45,722 consecutive patients with CAD had a non-acute total occlusion. The overriding principle in medicine is to improve symptoms and/or prognosis. Thus revascularisation of CTO is indicated only in the presence of angina or ischaemia related to the respective territory. It has been shown that upon successful reopening angina will improve, functional tests will be normalised, left ventricular (LV) function will improve and coronary artery bypass graft (CABG) will be avoided. Improved LV dysfunction correlates with the presence of myocardial viability in the respective LV segments, and it has been shown to attain better prognosis.[8- 11]Hence; the present study was conducted for assessing the results of percutaneous coronary intervention for chronic total occlusions of coronary arteries.

Mean age of the patients was 61.5 years. 80 percent of the patients (40 patients) were males while the remaining were females. 72 percent of the patients (36 patients) had clinical presentation of chronic angina while the remaining 28 percent of the patients (14 patients) had clinical presentation of acute angina. Single and double vessel involvement occurred in 36 percent of the patients (18 patients) and 38 percent of the patients (19 patients) respectively.Haji GF determined the overall procedural success rate of percutaneous coronary intervention (PCI) for CTOs and examined the relation between variables such as; patients' characteristics, risk factors, lesion characteristics and procedural success rate. Clinical and coronary angiography data of (80) patients with CTO who underwent PCI wereanalyzed. There were (80) Patients with CTO ,They included 62 men (77.5%) and 18 women (22.5%) ,Age range 36-76 year with mean age 55±8.75 and male to female ratio was 3:1 .The procedural success rate of PCI was 66 patients (82.5%). All 23patients(100%) with lesion length less than 15 mm had successful PCI compared to 43 out of 57 patients in whom the lesion was more than 15mm (75.4%) p value < 0.01. The procedure was successful in 54 patients out of 60 with tapered stump(90%) compared to 12 out of 20 patients with abrupt stump(60%) p value <0.005.In CTO lesion with angulations less than 45 degree ,the procedure was successful in 27 patients out of 28 (96.4%)compared to 39 out of 52 patients in whom the angulations was more than 45 degree 52(75%) p value<0.01. The most common cause of procedural un success was inability of guide wire crossing through the totally occluded segments which represented 11(78.5%), Inability to cross the lesion with a balloon in 2 patients(14.2%) and inability to dilate balloon in one patient (7.1%) P<0.001. Percutaneous coronary intervention of chronic total occlusion is an effective therapeutic procedure with high success rate 82.5%.[10]

In the present study, triple vessel involvement occurred in 26 percent of the patients (13 patients). Primary access site was right femoral and right radial in 64 percent of the CTO lesions and 26 percent of the CTO lesions respectively. Intramural hematoma was seen in 6 percent of the patients while post stenting slow flow was seen in 4 percent of the patients. Coronary dissection was seen in 4 percent of the patients.Patel VG et al conducted a meta-analysis of 65 studies published between 2000 and 2011 reporting procedural complications of CTO PCI. A total of 65 studies with 18,061 patients and 18,941 target CTO vessels were included. Pooled estimates of outcomes were as follows: angiographic success 77%; death 0.2%; emergent coronary artery bypass graft surgery 0.1%; stroke <0.01%; myocardial infarction 2.5%; Q-wave myocardial infarction 0.2%; coronary perforation 2.9%; tamponade 0.3%; and contrast nephropathy 3.8%. Compared with successful procedures, unsuccessful procedures had higher rates of death, perforation, and tamponade. Among 886 lesions treated with the retrograde approach, success rate was 79.8% with no deaths and low rates of emergent coronary artery bypass graft surgery (0.17%) and tamponade (1.2%). CTO PCI carries low risk for procedural complications despite high success rates.[11]Brilakis ES et al analyzed the frequency and outcomes of CTO PCI compared with non-CTO PCI in elective patients, and of successful versus failed CTO PCI. CTO PCI represented 3.8% of the total PCI volume for stable coronary artery disease. Overall, patients undergoing CTO PCI required greater contrast volume and longer fluoroscopy time and had lower procedural success and higher major adverse cardiac event rates than non-CTO PCI patients. On multivariable analysis, several parameters were associated with a lower likelihood of CTO PCI procedural success, whereas operators' annual CTO PCI volume was associated with improved success without a significant increase in major complications. CTO PCI is associated with lower procedural success and higher complication rates compared with non-CTO PCI.[12]

CONCLUSION

Percutaneous coronary intervention in chronic total occlusion is an effective therapeutic procedure. So, despite the technical difficulty of PCI in CTO lesion, this procedure can be done safely with relatively significant success rate.

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