PROCEDURAL OUTCOMES OF CHRONIC TOTAL OCCLUSIN-PERCUTANEOUS CORONARY INTERVENTION, AN UPDATED ANALYSIS OF AFIC/NIHD CTO-PCI REGISTRY

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ABSTRACT

Objective: To evaluate the procedural outcomes of patients having chronic total occlusion undergoing percutaneous coronary intervention at our clinical setup.

Study Design: Descriptive cross sectional study.

Place and Duration of Study: This study was conducted at Armed Forces Institute of Cardiology & National Institute of Heart Diseases, Rawalpindi from Jul 2014 to Jun 2017.

Material and Methods: A total of 536 patients who underwent for percutaneous coronary intervention- chronic total occlusion were included in our study. Patients with chronic total occlusion lesion ≥3 months were included in our study. All the patients underwent percutaneous coronary intervention of chronic total occlusion Vessel were selected by non probability sampling technique. Patient's clinical, demographic data and data regarding procedural outcome was recorded. Finally data was analyzed using descriptive statistics.

Results: Out of 536 patients 468 (87%) were male while 68 (12%) were female. Mean age was 55.5 ± 11.6 Years from 36 to 81 Years. Two hundred and one (37.5%) patients were diabetic, 181(33.7%) were hypertensive and 224 (41.7%) were smokers. Mean LVEF% was 48.7 ± 7.1 (Mean ± SD). Most common vessel involved was RCA 248 (46.2%) followed by LAD 188 (35.0%). Only drug eluting stents (DES) were implanted in successful cases with average no of stents used per patient were 1.43 ± 0.7. Common reasons for failure of procedure was inability of balloon/microcatheter to cross the lesion, inability to cross through retrograde collaterals but the most common reason was the failure of wire to cross the CTO lesion. The overall procedural success was achieved in 73.1% patients. No deaths were reported during the procedures.

Conclusion: The recanalization of CTO lesion was successfully done in 73% cases using PCI. Most common reason for unsuccessful revascularization was failure of guide wire to cross the lesion. With increasing experience and better equipment recanalization of CTO coronary lesions is a safe and effective treatment option for patients with persistent Angina even on optimal medical treatment.

Keywords: Chronic total occlusion (CTO), Percutaneous coronary intervention (PCI), Drug eluting stents (DES)

INTRODUCTION

Chronic total occlusions (CTO) of coronary arteries are present in 15-30% of patients undergoing coronary angiography[1,2]. Various studies have suggested that presence of CTO is associated with high mortality[3,4]. CTOs are complex lesion with low procedural success rates and even after, successful PCI, chances of restenosis are 1.5 to 4 times greater than non-occluded coronary artery lesion[5,6]. Various prediction risk scores have been devised to predict success of the procedure[7]. Presence of CTO vessel is also one ofthe major reason for referral to CABG surgery[1]. Successful revascularization of CTO can provide significant improvement in symptoms, left ventricular function, reduction in arrhythmias, and better tolerance of an acute coronary syndrome[6]. By contrast, failure of CTO revascularization has been found to be associated with an increased risk of mortality and angina pectoris when compared with successful revascularization in meta-analysis[6,8]. Despite significant volume of CTO on coronary angiography, due to technical difficulties and failure of procedural success, only

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3.8-4.8% CTO PCI as compare to total PCI volumes are reported in National cardiovascular data registry USA[9]. Very limited centers in Pakistan perform complex coronary intervention especially PCI of CTO vessels and to the best of our knowledge no local studies with such large no of patients are available to show procedural outcomes of CTO PCI in Pakistan. In this study we planned to analyze Armed Forces Institute of Cardiology / National Institute of heart diseases PCI data for CTO cases. This institute is a high volume center and among leading and very few institute in Pakistan with much experience in successful recanalization of CTO-PCI. The analysis will also include the average equipment/ hardware used for CTO-PCI thus encouraging other centers to treat CTO and to reduce overwhelming burden on limited cardiac surgical centers.

MATERIAL AND METHODS

This was an observational study, carried out at AFIC/NIHD Rawalpindi from July 2014 to June 2017. All patients who underwent CTO PCIs which include 536 patients at AFIC/NIHD cardiac catheterization laboratory were included in the study. A chronic total occlusion (CTO) was defined as the complete obstruction of a coronary artery, exhibiting TIMI 0 or TIMI 1 flow, with an occlusion duration of >3 months. Procedural success was defined as TIMI 3 grade flow achieved without any MACE. Most common indication for CTO PCI was persistent angina despite optimal medical treatment. All patients underwent the CTO PCI as per protocol after getting the written informed consent.

Data Analysis

Categorical variables are presented as frequencies and continuous variables are presented as means with standard deviation. Comparisons were done with Pearson chi-square test for parametric data and with Mann-Whitney–Wilcoxon test for nonparametric data (SPSS Version 21). A *p*-value of <0.05 was considered statistically significant. The data is also breakdown on basis of years and a comparison is done for procedural success.

Table-I: Demographics and Risk Factors.

Variables	n (%)
Age	(Mean ± SD) 55.5 ± 11.6 Years (Range) 36-81 Years
Gender	
Males	468 (87.3%)
Females	68 (12.6%)
Diabetes Mellitus	201 (37.5%)
Hypertension	181 (33.7%)
Smoking History	224 (41.7%)
LVEF%	(Mean ± SD) 48.7 ± 7.1 (Range) 30-65

Table-II: Yearly Analysis of Complete Total Occlusion-Percutaneous Coronary Intervention.

	Year 2014	Year 2015	Year 2016	Year 2017	Total
CTO Cases	90	180	176	90	536
Successful Cases	69 (76.66%)	134 (74.44%)	134 (76.13%)	59 (65.5%)	396 (73.1%)
Unsuccessful Cases	21 (23.34%)	46 (25.56%)	42 (23.87%)	31(34.5%)	140 (26.1%)

RESULTS

The registry data showed that total numbers of PCI done in AFIC/NIHD are 11399 out of which 536 (4.7%) was CTO cases. Demographic characteristics of our patient's registry showing highest amount of intervention done for male patients as most patients entitled at our center are male as shown in table-I. Smoking was commonest risk factor for presence of CTO followed by diabetes mellitus. The mean left ventricular ejection fraction was 48.7 ± 7.1%. Most common vessel involved was RCA 248 (46.2%) followed by LAD 188 (35.0%), LCX (18.8%), while

only 0.98% patients had double CTO vessels. Procedural success rate for 4 years was 73.1%. Almost all patients underwent Antegrade wire escalation with retrograde approach accounting only for 4.85%. Most common access site for CTO PCI used was Radial (51%), followed by femoral approach (47%) and DUAL Injections were used in 35% of the cases. All the patients with successful recanalization were implanted with drug eluting stents. No deaths were reported during the procedures. Table-II shows that procedural success rate for 4 years is 73.1% with highest success rate achieved in 2014 and highest number of cases done in 2015. Almost all patients underwent Antegrade wire escalation with retrograde approach accounting only for 2.98%. The access site of PCI was also shown in table-III. Although recommended approach to access CTO is dual injection (double stick) but at our setup routine CTO access site is radial or femoral to reduce the patient cost. Table-III shows that RCA followed by LAD are common sites for CTO in our registry. The average equipment use for recanalizing CTO was shown in table-III.

Table-III: Complete total occlusion approach, complete total occlusion access site, culprit artery and equipment used.

Antegrade Approach	510 (95.1%)
Retrograde Approach	26 (4.85%)
Radial	275 (51.3%)
Femoral	254 (47.3%)
Ulnar	7 (1.3%)
Dual Injection (Radial + Femoral)	188 (35.0%)
AD	188 (35.0%)
LCX	101 (18.8%)
RCA	248 (46.2%)
Double CTO	5 (0.93%)
Wires	(Mean ± SD) 2.13 ± 0.92
Balloons	(Mean ± SD) 2.74 ± 1.10
Stents	(Mean ± SD) 1.43 ± 0.71
Contrast	(Mean ± SD) 192 ± 47.3 ml

DISCUSSION

Revascularization of CTO coronary vessels remains a challenge irrespective of the modality chosen[9-11]. CTO PCI is done in most patients for treating symptoms, usually angina and dyspnea[11,12]. In the SYNTAX trial, percutaneous coronary intervention (PCI) of CTO lesions was successful in 49% percent of patients, while the surgical success rate was only marginally better at 68%13. Currently, PCI success rates of greater than 80% are being reported in specialist Japanese, American and European Centers. DECISION CTO and EURO-CTO TRIALS are new addition to controversies surrounding the challenging revascularization of CTO PCI[14,15]. It has generated lot of debate among the experts around the world, some favoring to keep patients on optimal medical treatment as it has been shown to be non-inferior to revascularization in DECISION CTO TRIAL. While some experts like Emmanuel S. Brilakis, believe that this trial will not change the contemporary practice as this trial has its own flaws in recruitment and hard end points. Our center is veteran hospital and amongst the highest PCI volume centre in the country with huge experience in complex PCI cases. In our CTO registry data majority of the patients were males as AFIC is the biggest a referral Centre in the Armed Forces with major volume of male entitled patients. Smoking was the commonest risk factor for presence of CTO followed by Diabetes Mellitus[5,14,15]. This result is in consistence with the study done by Brilaki et al

which showed smoking and diabetes to be a significant risk factor for CTO. In our study average procedural success rate was 73.18% which is comparable to the success rate reported in international studies like Stone et al, Suero et al, and TOAST-GISE14,[16,17]. Highest success rate was achieved in 2014 (76.66%) and highest number of cases done in 2015 (190). In a previous study registry data from Feb 2012 to Dec 2013 AFIC/NIHD) reported success rate was 98%, but the no of patients were very low (n=50) as compared to our data. Reasons for relatively low success rate in 2017 (65.6%) are multi-factorial including increasing complexity of cases, new less experienced operators attempting CTOs. Experienced operators at our Centre have a steady success rate of more than 80%. The volume of CTO PCI has remained steady over the last few years. So this trend in our result is not against the fore mentioned studies which showed significant success in CTO PCI over the years. In our study most common vessel involved was RCA 248 (46.2%) followed by LAD 188 (35.0%), LCX (18.8%), while only 0.98% patients had double CTO vessels. The findings are consistent with Canadian Multicenter CTO Registry showed that 47% of solitary CTOs occur in the right coronary artery, 20% in the LAD, and 16% in the left circumflex. Similar distributions of CTOs have been reported by other investigators[18-21]. Majority of the CTO cases were attempted through Antegrade approach with wire escalation strategy. While only 4.85% cases were attempted through retrograde approach after failure of antegrade technique. The most common access for CTO PCI was radial (51%) followed by femoral (47%). Dual injections were used in only 35% of the cases. Reason for less use of dual injections and common Antegrade approach is operator experience, and high cost of equipment in retrograde approach. Most common wire used was Run-through followed by pilot 50 and Fielder XT. Average no of wires usedper patient were 2.13 ± 0.92. Average no of balloons and stents used per patient were 2.74 ± 1.10 and 1.47 ± 0.71 stents. All the patients with successful revascularization were implanted drug eluting stents which is in keeping with the evidence that DES implantation in CTO PCI is associated with better outcomes[22-24]. Common reasons for failure of procedure was inability of balloon/micro catheter to cross the lesion due to severe calcification or tortuosity of the vessel, inability to cross through retrograde collaterals but the most common reason was the failure of wire to cross the CTO lesion. There were no intra-procedural or in hospital deaths reported.

CONCLUSION

CTO prevalence in angiography was found very high as compared to CTO PCI. Fear of failure, lack of CTO experience and higher cost of CTO PCI inventory in a developing country can be attributed to this lower rate of CTO PCI in Pakistan. Descriptive statistics of CTO in Pakistan is in accordance to international studies. With higher retrograde PCI and more use of Dual injection can improve CTO PCI success.

LIMITATION OF STUDY

Our study results cannot be generalized as it does not show randomized data. Cost is the primary factor in all PCI in Pakistan, the success rate and volume cannot be compared to international studies. The lack of large data for retrograde PCI which is a very important procedure to open complex CTO also limits the findings of our study.

CONFLICT OF INTEREST

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

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