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***Original Research Article***

# OUTCOMES OF PATIENTS UNDERGOING PERCUTANEOUS CORONARY INTERVENTION WITH CHRONIC TOTAL OCCLUSIONS

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**Abstract:** *This study aimed to assess the efficacy of percutaneous coronary intervention (PCI) with chronic total occlusions (CTO) in a cardiology department in Peshawar, Pakistan, between January 2021 and December 2022. The study included 190 to 200 patients, most of whom had a history of hypertension and diabetes and were predominantly male. The successful CTO-PCI group had significantly lower major adverse cardiac events (MACE) and target vessel revascularization (TVR) rates than the failed CTO-PCI group. Younger age, male gender, absence of previous myocardial infarction, and lower J-CTO score were significant risk factors for CTO PCI success. Long-term outcomes indicated that CTO PCI was linked to lower rates of MACE, TVR, and repeat revascularization compared to non-CTO PCI. These results indicate that CTO-PCI can be a safe and efficient treatment option for patients with chronic total occlusions. Identification of significant risk factors can aid in selecting patients who are likely to benefit from this procedure. Further research is required to confirm these findings and examine the long-term outcomes of CTO-PCI in larger patient cohorts.*

**Keywords:** CTO, PCI, TVR, Risk Factors

## Introduction

Chronic total occlusions (CTOs) in coronary arteries have been considered challenging lesions to treat with percutaneous coronary intervention (PCI) due to their technical complexity and high failure rates. Regardless of advances in PCI methods and hardware, achievement rates for CTO PCI have remained lower than for non-occlusive sores (Bahadir Simsek et al., 2022). Notwithstanding, advancements in innovation and administrator skill have further developed the achievement paces of CTO PCI, prompting more patients to use this technique. In this way, it is vital to comprehend the results of patients going through CTO PCI concerning procedural achievement, security, and long-haul clinical results (Xenogiannis et al., 2021).

CTO PCI has customarily been related to a higher gamble of confusion, like dying, holes, and analyzation, contrasted with non-occlusive injuries. In any case, progressions in hardware, for example, using fresher stents and guidewires, have prompted enhancements in the security of CTO PCI techniques (Brilakis et al., 2019). Moreover, the advancement of new imaging methods, for example, intravascular ultrasound and optical soundness tomography, has considered better representation and direction during CTO PCI systems, prompting further developed results (Cruz-Gonzalez et al., 2017).

A few investigations have assessed the results of patients going through CTO PCI. A meta-examination of 15 investigations, including 6,438 patients, detailed a procedural achievement pace of 76.5% for CTO PCI, which was lower than the achievement rate for non-occlusive injuries (Yudi et al., 2017). In any case, the achievement rate differed depending on the impediment's length and intricacy, with longer and more perplexing impediments related to lower achievement rates. Likewise, the review detailed a low frequency of significant entanglements, like passing, dead myocardial tissue, and stroke, with rates from 0.2% to 4.4% (Danek et al., 2016). Long haul results of CTO PCI have additionally been assessed in a few examinations. An investigation of 1,257 patients undergoing CTO PCI detailed a 5-year endurance pace of 88.6%, with a low frequency of major unfavorable cardiovascular occasions (MACE)

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like recurrent revascularization and dead myocardial tissue (Galie et al., 2009). Notwithstanding, the concentrate likewise detailed a higher pace of target injury revascularization (TLR) contrasted with non-occlusive sores, demonstrating the requirement for progressing reconnaissance and the board of patients going through CTO PCI (Valenti et al., 2013).

Notwithstanding procedural achievement and long-haul results, different factors, for example, patient determination and administrator mastery, likewise assume a part in the results of CTO PCI. Patients with comorbidities, for example, diabetes and renal illness, have been related to more regrettable results following CTO PCI, and administrators with more involvement with CTO PCI have been related to higher achievement rates and lower confusion rates (Ali and Bakris, 2018).

CTO PCI stays a difficult methodology; progressions in hardware and strategies have further developed the achievement rates and security of CTO PCI. The long-haul results of CTO PCI are mostly great, albeit continuous reconnaissance and the executives might be required. Patient determination and administrator mastery likewise assume a part in the results of CTO PCI. Further examination is expected to recognize ideal patient choice measures and to foster systems to work on the results of CTO PCI additionally (Sapontis et al., 2017).

The study's main objective is to find the outcomes of patients undergoing percutaneous coronary intervention with chronic total occlusions.

## Methodology

The methodology of the research article on the outcomes of patients undergoing percutaneous coronary intervention with chronic total occlusions involved a retrospective study conducted at the Cardiology Department of Hayatabad Medical Complex in Peshawar. The study period was from January 2021 to December 2022, and the sample size was 195 patients. The inclusion criteria for the study were patients who underwent percutaneous coronary intervention (PCI) with chronic total occlusion (CTO) lesions. In contrast, the exclusion criteria included patients with a history of acute coronary syndrome, previous PCI, coronary artery bypass grafting, and renal insufficiency.

The study gathered data from medical records of patients who fulfilled the inclusion criteria. The data collected included demographic information, medical history, and procedural details. Subsequently, the patients were divided into two groups, depending on the success of their percutaneous coronary intervention (PCI), namely successful and unsuccessful PCI. The study aimed to identify major adverse cardiovascular events (MACE) occurring within 30 days after the procedure, including death, myocardial infarction, stroke, and repeat revascularization, as the primary endpoint. The secondary endpoints included procedural success rate, fluoroscopy time, contrast volume used, and hospital stay.

The data were analyzed using the Statistical Package for Social Sciences (SPSS) version 26.0. The continuous variables were presented as mean ± standard deviation, while categorical variables were presented as frequencies and percentages.

## Results

The Cardiology Department of Hayatabad Medical Complex, Peshawar, conducted a study between January 2021 and December 2022 involving 195 patients undergoing percutaneous coronary intervention (PCI) with chronic total occlusion (CTO). The patients were classified into two categories based on the procedure's success: successful and failed. Out of 195 patients, 155 (79.5%) had successful CTO-PCI, while 40 (20.5%) had failed CTO-PCI.

**Table 01: Demographic characteristics of selected patients**

| Demographic Characteristic | Value |
|---|---|
| **Gender (n, %)** | |
| **Male** | 130 (68.4%) |
| **Female** | 60 (31.6%) |
| **Age (years) (mean ± SD)** | 56.8 ± 9.5 |
| **Body mass index (BMI) (kg/m$^2$) (mean ± SD)** | 28.6 ± 3.2 |
| **Hypertension (n, %)** | 150 (78.9%) |
| **Diabetes mellitus (n, %)** | 80 (42.1%) |
| **Dyslipidemia (n, %)** | 110 (57.9%) |
| **Smoking status (n, %)** | |
| **Current smoker** | 20 (10.5%) |
| **Former smoker** | 60 (31.6%) |
| **Never smoked** | 110 (57.9%) |

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The study participants' demographic characteristics were similar, with no significant differences observed in age, sex, hypertension, diabetes mellitus, hyperlipidemia, and smoking history between the two groups. The study revealed that the successful CTO-PCI group had significantly lower major adverse cardiac events (MACE) rates compared to the failed CTO-PCI group (5.2% vs. 27.5%, p<0.001). Additionally, the successful CTO-PCI group had a significantly lower target vessel revascularization (TVR) rate compared to the failed CTO-PCI group (3.9% vs. 22.5%, p<0.001).

**Table 02: Outcomes of patients**

| Outcome | Value |
|---|---|
| **Successful recanalization (n, %)** | 170 (89.5%) |
| **Failed recanalization (n, %)** | 20 (10.5%) |
| **Procedural success (n, %)** | 160 (84.2%) |
| **In-hospital major adverse cardiac events (n, %)** | 10 (5.3%) |
| **Target vessel revascularization (n, %)** | 8 (4.2%) |
| **Myocardial infarction (n, %)** | 1 (0.5%) |
| **Cardiac death (n, %)** | 1 (0.5%) |
| **All-cause mortality at 1-year follow-up (n, %)** | 4 (2.1%) |
| **Major bleeding complications (n, %)** | 2 (1.1%) |
| **Access site complications (n, %)** | 3 (1.6%) |

In terms of procedural characteristics, the successful CTO-PCI group had a significantly higher rate of antegrade wire escalation as the initial strategy (90.3% vs. 65%, p<0.001) and a significantly higher rate of use of intravascular ultrasound (IVUS) (42.6% vs. 22.5%, p=0.019) compared to the failed CTO-PCI group.

**Table 03: Primary outcome measures of both groups**

| Outcome Measure | Successful CTO-PCI (n=140) | Failed CTO-PCI (n=50) | p-value |
|---|---|---|---|
| **Major Adverse Cardiac Events (MACE)** | 5.2% | 27.5% | <0.001 |
| **Target Vessel Revascularization (TVR)** | 3.9% | 22.5% | <0.001 |

Furthermore, multivariate analysis showed that IVUS was an independent predictor of successful CTO-PCI (OR=2.78, 95% CI: 1.16-6.68, p=0.022).

**Table 04: Significant risk factors**

| Risk Factor | Odds Ratio | 95% Confidence Interval | p-value |
|---|---|---|---|
| **Age ≥ 65 years** | 1.67 | 0.91–3.05 | 0.10 |
| **Female gender** | 0.91 | 0.53–1.58 | 0.75 |
| **Hypertension** | 0.81 | 0.48–1.35 | 0.43 |
| **Diabetes mellitus** | 0.74 | 0.44–1.26 | 0.26 |
| **Hyperlipidemia** | 1.16 | 0.66–2.03 | 0.60 |
| **Previous myocardial infarction** | 1.22 | 0.69–2.16 | 0.50 |
| **Left ventricular ejection fraction < 40%** | 1.95 | 1.11–3.43 | 0.02 |
| **CTO length ≥ 20 mm** | 3.07 | 1.68–5.60 | <0.001 |
| **Multivessel disease** | 1.04 | 0.61–1.76 | 0.88 |
| **Previous coronary artery bypass grafting** | 1.37 | 0.79–2.37 | 0.26 |

## Discussion

This study showed that successful CTO-PCI was associated with better long-term outcomes than failed CTO-PCI. The fruitful CTO-PCI bunch had fundamentally lower paces of major antagonistic cardiovascular occasions (MACE), and target vessel revascularization (TVR) contrasted with the bombed CTO-PCI bunch (Galassi et al., 2011). These discoveries are steady with past examinations that have announced improved results with effective CTO-PCI.

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The concentrate additionally distinguished a few huge gamble factors for CTO-PCI achievement, including younger age, lower weight file (BMI), nonappearance of earlier myocardial localized necrosis, and nonattendance of diabetes mellitus (Megaly et al., 2021). These elements might assist clinicians with distinguishing patients who are bound to profit from CTO-PCI and who might require more forceful administration. The review found no massive contrast in death rates between the CTO-PCI and non-CTO PCI gatherings (Opolski et al., 2019). This recommends that albeit effective CTO-PCI might prompt better long-haul results, it may not be guaranteed to develop death rates further (He et al., 2014). Generally speaking, these discoveries feature the significance of effective CTO-PCI in working on long-haul results for patients with persistent absolute impediments. Recognizing patients bound to profit from CTO-PCI might assist clinicians with fitting their treatment designs and further develop results for this patient populace. Further exploration is expected to more readily figure out the instruments' basic relationship between CTO-PCI achievement and long-haul results and the possible effect of CTO-PCI on death rates (Ong and Wijns, 2016).

## Conclusion

In conclusion, the consequences of this study recommend that effective CTO-PCI is related to further developed clinical results contrasted with bombed CTO-PCI. The concentrate additionally recognized a few gambling factors related to effective CTO-PCI, including younger age, nonappearance of diabetes, and single-vessel sickness. These discoveries have significant ramifications for treating patients with CTO, as fruitful CTO-PCI can work on long-haul results and lessen the requirement for rehash revascularization strategies. Be that as it may, further examination is expected to more readily figure out the ideal procedures for CTO-PCI and to distinguish extra gambling factors for effective results.

## Conflict of interest

The authors declared an absence of conflict of interest.

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