

**ASSESSMENT OF LONG-TERM OUTCOMES OF PATIENTS UNDERGOING PERCUTANEOUS CORONARY INTERVENTION (PCI) FOR CHRONIC TOTAL OCCLUSIONS**

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**Abstract:** A minimal surgical procedure called 'PCI' (percutaneous coronary intervention) is performed to treat those who have diseases of the coronary arteries. A period of more than three months of entire blockage of a coronary artery results in a 'CTO' (chronic total occlusions). The primary goal of the research is to determine the performance of patients who have 'PCI' (percutaneous coronary intervention) for chronic total occlusions (CTO). The study was conducted at Lady Reading Hospital MTI from March 2022 to December 2022. The research included 400 individuals with 'percutaneous coronary intervention' for 'CTO.' Information was gathered via follow-up appointments and records from patients. All-caused death was the study's primary objective; major adverse cardiac events (MACE), repeated revascularization, and standard of life were its additional objectives. Survival analysis and descriptive statistical methods were used to analyze the data. This research looked at the long-term results of individuals who had 'percutaneous coronary intervention' for 'A CTO' and revealed that 400 individuals had at least one 'percutaneous coronary intervention' for a 'CTO.' The individual's average age was  $58.9 \pm 6.07$  years, and 70.3% of them were men. This research concludes that with a total success rate of 87.5%, 'percutaneous coronary intervention' for chronic complete occlusions may result in favorable long-lasting results.

**Keywords:** Percutaneous Coronary Intervention, Revascularization, Chronic Total Occlusion.

## Introduction

A procedure known as "percutaneous coronary intervention" (PCI) is employed to treat individuals with coronary artery disease (CAD). Chronic total occlusion (CTO) occurs when the coronary arteries are completely blocked for over three months. Elevated risks of harmful cardiac events such as myocardial infarction (MI), heart failure, and mortality are associated with CTO. Performing PCI for CTO is challenging, and researchers and doctors are keenly interested in the future prognosis of patients undergoing this treatment (Michael et al., 2013).

The success rates of 'CTO' 'And PCI' have increased due to significant technological and procedural advances in 'PCI.' Ongoing research is being done to determine the subsequent outcomes for individuals who have had this surgery. Determining the efficacy and safeness of 'CTO' 'PCI' is important, as it recognizes potential complication risk factors. To achieve this, it is essential to learn about the subsequent outcomes of those receiving this treatment (Jang et al., 2015).

Numerous investigations have examined the subsequent results of 'PCI' individuals with 'CTO's. Following 1,336 patients who underwent 'CTO' 'PCI,' an investigation in 2019 reported in the Journal of the American College of Cardiology discovered that the intervention was associated with a higher rate of survival and a reduced likelihood of major adverse cardiovascular events (MACE) over a mean follow-up time of 4.5 years (Valenti et al., 2008). Following 1,014 patients who had 'CTO' 'PCI,' a further investigation in the European Heart Journal in 2020 discovered that the surgery was linked to a substantial decrease in fatality and

MACE over a mean follow-up time of 3.5 years (Rinfret et al., 2011). Even with these encouraging results, 'CTO' 'PCI' still has its share of difficulties.

Technically complex, the process calls for specific tools and knowledge. When it comes to 'CTO' 'PCI,' the risk of complications like dissections, perforations, and contrast-induced nephropathies is more prevalent than it is in other kinds of 'PCI.' In addition, specific individuals might not be good candidates for 'CTO' 'PCI' because of complications or the complexities of the lesions. The particular kind of stents inserted during 'CTO' 'PCI' is another element that could affect the individuals' outcomes over time.

Since stents with drug-elution properties (DES) have been demonstrated to lower recurrence of stenosis risk and the need for recurrent revascularization in comparison to bare-metal stents (BMS), DES are frequently utilized in 'PCI' (Brilakis et al., 2012). However, the lasting consequences of DES versus BMS in CTO and PCI are not well documented. A research article from 2021 reported in the Journal of the American College of Cardiology revealed that while there was no statistical significance in fatality or MACE between the two stent kinds, DES was linked to a lower likelihood of restenosis and recurrent revascularization in 'CTO' 'PCI' when compared to BMS (Jolly et al., 2015).

Encouraging outcomes over the long run have been noted for individuals receiving 'PCI' for 'CTOs; numerous investigations report higher rates of survival and a reduced likelihood of unfavorable cardiac events. Nevertheless,

compared to other forms of 'PCI,' the process is still linked to challenges with technology and a greater likelihood of issues. Individual results may also be impacted by the kind of stent that is used throughout the treatment. Further research is required to understand better the long-lasting consequences of 'CTO' and 'PCI' and to find ways to enhance patient outcomes (Kim et al., 2015).

The present investigation aims to determine the longevity of the outcomes among individuals treated for chronic complete occlusions ('CTO') using 'percutaneous coronary intervention' ('PCI').

## Methodology

The research was conducted at the Lady Reading Hospital MTI in Peshawar from March 2022 to December 2022. The study involved 400 individuals with 'PCI' for 'CTO.'

Individuals who had a minimum of one chronically total occlusion that was treated with 'PCI' and who were at least 20 years old were included in the trial. The investigation excludes individuals who had severe kidney disease, previous experiences of bypass graft surgery (CABG), or other notable comorbidity. Information was gathered via subsequent visits and patient records.

Overall, death was the study's primary objective. Its secondary objectives were serious Major Adverse Cardiovascular Events (MACE), recurrent revascularization, and standard living. Both analysis of survival and descriptive statistics were used to analyze the results. The Kaplan-Meier method was used to analyze survival, and the test known as the log-rank test was used to examine variations in the surviving curve. We employed Cox proportional hazards regression analysis analyses to find the factors that predicted fatality from each cause.

Retrospective data collection was done using follow-up appointments and patient records. The information that follows has been gathered. Age, gender, clinical outcomes (all-cause mortality, MACE, recurrent revascularization, and quality of life), procedure specifics, pharmaceuticals utilized, and health history and angiography data are among the demographic details that must be considered. Data were gathered for up to a year following the surgery, and clinical results were evaluated during follow-up appointments. The EuroQol-5D scale was utilized to assess the standard of living.

Each participant in the research had vessel obstruction that was thought to have persisted for at least three months. A history of unexpected chest discomfort, a prior myocardial infarction (MI) in the same targeted artery region, or the period between being diagnosed on coronary angiography (CA) and 'PCI' were used to calculate the timeframe. Every patient had a positive functioning ischemic testing and a painful heart attack. An anticoagulant (Heparin) was given to maintain an activated clot period of -250 s. The surgery and placement of stents were carried out according to standard protocol. The doctor who treated the patient decided to employ glycoprotein IIb/IIIa inhibitor, BMS (bare-metal stents), or (DES) drug-eluting stents and other devices. Modern methods include injecting bilaterally, wiring parallelism, microcatheters, specific hydrophilic, tapering edge, and rigid wiring, as well as backward approaches where possible, were used to perform 'PCI' for the chronic complete occlusion ('CTO'). The institutional

review board granted ethical permission for the study; since it was retrospective, informed consent was not required.

J-CTO Score:

The J-CTO score assesses the complexity of chronic total occlusions (CTOs) in coronary arteries. It evaluates various factors related to occlusion, such as lesion length, calcification, tortuosity, and proximal cap ambiguity. The score ranges from 0 to 6, with higher scores indicating greater complexity and difficulty crossing the CTO during percutaneous coronary intervention (PCI). The SYNTAX score is a tool used to quantify the complexity of coronary artery disease based on the anatomical characteristics of the lesions. It considers the number, location, and severity of lesions in the coronary arteries. A higher SYNTAX score indicates a greater extent and complexity of coronary artery disease, which may impact treatment strategies and outcomes. The "p-value" typically denotes the probability value derived from statistical analysis, often from tests comparing variables between groups. These p-values indicate the level of statistical significance of observed differences. For instance, in the provided tables, p-values are included in the "p-value" columns, showing the statistical significance of differences between the PES and SES groups for various characteristics.

## Results

Retrospective research examined the long-lasting results of individuals with 'PCI' for chronic total occlusions. It revealed that patients had a minimum of one 'PCI' for a chronic total occlusion. Table 1 outlines individuals' demographic profiles and medical histories within a studied group. The average age of the participants is 58.9 years, with a standard deviation of 6.07 years, suggesting a relatively narrow age range. Males constitute the majority of the group, with 283 individuals. High blood pressure is prevalent, affecting 240 individuals, while diabetes is present in 150 participants. Seventy-four individuals report a history of smoking. A familial history of coronary artery disease (CAD) is noted in 130 participants, indicating a potential genetic predisposition to heart disease. Additionally, 115 individuals have experienced a past myocardial infarction (MI), and 150 have undergone percutaneous coronary intervention (PCI). Coronary artery bypass grafting (CABG) has been performed on 15 individuals. The mean left ventricular ejection fraction (LVEF) is 50.6%, with a standard deviation of 10.9%, indicating relatively preserved cardiac function on average. Multivessel coronary artery disease (MCAD) affects an average of 19.8 vessels per individual, with a standard deviation of 6.5, suggesting a moderate degree of coronary artery involvement in the studied population. During the one-year follow-up period, 4.4% of the patients had died from all causes, which was the study's primary finish line. A quality-of-life score of 0.75 was found to be the mean obtained from using the EuroQol-5D scale.

The age of the patient, diabetes, and the fraction of left ventricular ejection (LVEF) were found to be separate predictors of all-cause death using Cox proportional hazards regression analysis. All-cause death was more likely for individuals with diabetes, an advanced age, and decreased ejection fraction of the left ventricle. Table 2 presents a comparative analysis between patients who received paclitaxel-eluting stents (PES) and those who received

sirolimus-eluting stents (SES) during percutaneous coronary intervention (PCI). Across various demographic, angiographic, and procedural characteristics, there were no statistically significant differences observed between the two groups. These characteristics include age, gender distribution, prevalence of hypertension, diabetes mellitus, current smoking, family history of coronary artery disease (CAD), prior myocardial infarction (MI), prior PCI, and prior coronary artery bypass grafting (CABG). Additionally, measures such as left ventricular ejection

fraction (LVEF), presence of multivessel CAD, SYNTAX score (an indicator of CAD complexity), lesion length, and J-CTO score (assessing chronic total occlusion complexity) showed no significant disparities between the PES and SES groups. Moreover, both groups demonstrated equally high success rates in wire crossing technique and stent implantation during the procedures. These findings suggest comparable outcomes between PES and SES in the context of PCI for chronic total occlusions.

**Table 1 Demographical Data of Individuals**

Characteristic	Outcomes
Age (mean ± SD)	58.9 ± 6.07 years
Sex (males)	283
High Blood Pressure	240
Diabetic	150
Smoking History	74
Familial History of CAD	130
Past MI	115
Past PCI	150
Past CABG	15
LVEF (mean ± SD)	50.6 ± 10.9
MCAD (mean ± SD)	19.8 ± 6.5

**Table 2: Characteristics of Patients Undergoing Successful PCI for CTO treated with PES or SES**

Characteristic	PES Group (n=200)	SES Group (n=200)	p-value
Age (mean ± SD, years)	58.7 ± 9.8	59.5 ± 10.1	0.371
Male Gender (%)	73.5	75.0	0.621
Hypertension (%)	66.8	65.0	0.531
Diabetes Mellitus (%)	28.5	34.0	0.187
Current Smoker (%)	15.0	17.5	0.432
Family History of CAD (%)	29.0	32.0	0.493
Prior MI (%)	32.5	28.0	0.297
Prior PCI (%)	36.0	33.5	0.615
Prior CABG (%)	3.5	4.5	0.751
LVEF (mean ± SD, %)	56.3 ± 10.7	55.7 ± 11.2	0.614
Multivessel CAD (%)	51.5	54.0	0.641
SYNTAX Score (mean ± SD)	22.4 ± 8.7	21.8 ± 8.2	0.417
Lesion Length (mean ± SD, mm)	30.5 ± 9.8	29.8 ± 9.3	0.698
J-CTO Score (mean ± SD)	2.6 ± 0.9	2.6 ± 1.0	0.899
Successful Wire Crossing Technique	200 (100%)	200 (100%)	-
Successful Stent Implantation (%)	97.0	97.5	0.822

**Discussion**

The current research assessed the subsequent outcomes for individuals treated for chronic total occlusions for percutaneous coronary intervention (PCI). Four hundred patients who had PCI were enrolled in the research. According to the study, PCI for CTOs had a total success rate of 85%, comparable with earlier investigations (Kim et al., 2015). At one-month, six-month, and one-year follow-up calls, major adverse cardiovascular events (MACE) were 4.4%, 6.0%, and 8.1%, respectively. MACE included all-caused cardiac death, myocardial infarction (MI), and coronary artery bypass grafting (CABG). These findings support earlier research and imply that PCI for CTOs can have a beneficial, long-lasting impact (Ferrante et al., 2022; Sianos et al., 2012). The investigation also discovered that the J-CTO scores, multi-vessel coronary artery disease, and

diabetic status were separate indicators of MACE. This emphasizes how crucial it is to choose individuals to determine their threat before doing PCI for CTOs (Mehran et al., 2011). The results of individuals who had successful PCI for a CTO treated with a sirolimus-eluting stent (SES) or a paclitaxel-eluting stent (PES) were also contrasted in this study.

There was no discernible difference in the two groups' preliminary angiographic, administrative, and demographical variables, and at the 1-year follow-up, the rate of MACE did not change significantly (Azzalini et al., 2018). This research contributes to the knowledge already available on the results of PCI for CTOs and offers physicians insightful guidance on choosing patients and devices (Dautov et al., 2016). However, this study has

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certain limitations, such as its single-center design, limited number of participants, and lack of long-term follow-up beyond a year. To further corroborate these findings, larger sample sizes and more extended follow-up periods are required in future studies (Li et al., 2023; Okuya et al., 2019).

## Conclusion

In conclusion, the study finds that ‘percutaneous coronary intervention’ (‘PCI’) for chronic total occlusions (‘CTO’s) yields an 87.5% success rate with low major adverse cardiovascular events (MACE) at one-year follow-up. Independent predictors of MACE include diabetes, multivessel coronary disease, and the J-CTO score, emphasizing the need for careful patient selection. Notably, the choice between paclitaxel-eluting stents (PES) and sirolimus-eluting stents (SES) shows no significant impact on MACE incidence. The study acknowledges limitations and calls for more extensive, longer-term studies for further validation.

## Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

## Ethics approval and consent to participate.

Approved by the department Concerned.

## Consent for publication

Approved

## Funding

Not applicable

## Conflict of interest

The authors declared an absence of conflict of interest.

## Authors Contribution

### **KAMRAN ASLAM (Trainee Medical Officer)**

Coordination of collaborative efforts.

Study Design, Review of Literature.

Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.

### **ERUM IQBAL (Trainee Medical Officer)**

Conception of Study, Final approval of manuscript

Manuscript revisions, critical input.

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