EVALUATING PCI EFFICACY IN MULTI-VESSEL CAD: A PROSPECTIVE STUDY

Dr. Khair Ul Bashar[1], Dr. Aisha Hussain[2*], Dr. Shahbaz Ali Shaikh[3], Dr. Muhammad Ismail[4], Dr. Mishal[5], Dr. Muhammad Hashim Kalwar[6], Dr Muhammad Kamran Khan[7]

[1]Resident Cardiologist, National Institute of Cardiovascular Diseases, Karachi Pakistan
Email: drbashar22@gmail.com
[2*]FCPS Post Graduate Trainee, National Institute of Cardiovascular Diseases, Karachi Pakistan
Email: aishadoctor041@gmail.com.
[3]Associate Professor, National Institute of Cardiovascular Diseases, Karachi Pakistan
Email: shahbazcardiologist5@gmail.com
[4]FCPS Cardiology, Assistant Professor National Institute of Cardiovascular Diseases, Sukkur
Pakistan. Email: kanranisaqi@yahoo.com
[5]Postgraduate Resident, National Institute of Cardiovascular Diseases, Karachi Pakistan
Email: kharlmishal@gmail.com
[6]FCPS(CRD), FCPS(IVC), Associate Professor Cardiology, National Institute of Cardiovascular
Diseases, Sukkur Pakistan. Email: drhashim25@gmail.com
[7]Resident Adult Cardiology, National Institute of Cardiovascular Diseases, Karachi Pakistan
Email: kamranbanisai@yahoo.com

*Corresponding Author: Dr. Aisha Hussain
*FCPS Graduate Trainee, National Institute of Cardiovascular Diseases, Karachi Pakistan
Email address: aishadoctor041@gmail.com

ABSTRACT

Background: Coronary artery disease (CAD) is a leading cause of morbidity and mortality worldwide. Multi-vessel CAD presents a significant clinical challenge, often necessitating comprehensive revascularization strategies. Percutaneous Coronary Intervention (PCI) has emerged as a vital treatment modality, offering a less invasive alternative to coronary artery bypass grafting (CABG) for restoring coronary blood flow and alleviating symptoms.

Objective: This prospective study aims to evaluate the efficacy of PCI in patients with multi-vessel CAD, focusing on improvements in quality of life and reduction in angina episodes. Secondary objectives include assessing rehospitalization rates and the incidence of adverse events within six months post-PCI.

Methods: This prospective observational study was conducted at the National Institute of Cardiovascular Diseases (NICVD) from January 2020 to December 2022. The study included 303 participants diagnosed with multi-vessel CAD, aged 40-89 years, who underwent PCI. Primary outcomes measured were quality of life and angina episodes, assessed using the Seattle Angina Questionnaire (SAQ) pre- and Post-PCI. Secondary outcomes included rehospitalization rates and adverse events. Statistical analyses were performed using SPSS version 26.0, with paired t-tests employed to compare pre- and Post-PCI outcomes. A p-value of <0.05 was considered statistically significant.

Results: The baseline characteristics of the study population showed a mean age of 65.4 years, with a majority being male (63.4%). Post-PCI, there was a significant improvement in the quality of life score, with a mean increase of 15.3 points and a median improvement of 16.0. Additionally, the mean number of angina episodes decreased from 5.2 pre-PCI to 1.4 post-PCI. Figure 1 illustrates the significant improvement in quality of life scores post-PCI, depicting a noticeable upward trend across the cohort.

Rehospitalization within the first six months Post-PCI was observed in 8.6% of participants. Minor complications occurred in 4.3% of patients, while major complications were noted in 1.3%.

Conclusion: The study demonstrates that PCI significantly improves the quality of life and reduces angina episodes in patients with multi-vessel CAD. These findings support the integration of PCI into treatment protocols for this patient population, offering substantial clinical benefits. Further research is warranted to explore long-term outcomes and refine patient selection criteria to optimize treatment strategies.

Keywords: Coronary artery disease, Percutaneous Coronary Intervention, Multi-vessel CAD, Quality of life, Angina, Rehospitalization, Adverse events

INTRODUCTION

Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality worldwide, accounting for a significant burden on healthcare systems (1). Multi-vessel CAD, characterized by the presence of significant stenosis in multiple coronary arteries, presents a complex challenge in cardiovascular treatment (2). Percutaneous Coronary Intervention (PCI) has emerged as a pivotal treatment option for patients with multi-vessel CAD, offering an alternative to coronary artery bypass grafting (CABG) for restoring coronary blood flow and alleviating symptoms (3).

Despite advancements in PCI techniques and technologies, including the use of drug-eluting stents and improved imaging modalities, there remains a need to comprehensively evaluate the efficacy of PCI in this patient population. Existing studies have provided valuable insights, yet they often vary in patient selection, procedural protocols, and outcome measures, leading to inconsistent findings (4). This study aims to address these gaps by conducting a rigorous prospective evaluation of PCI efficacy in patients with multi-vessel CAD.

The rationale for this study is grounded in the necessity to establish a more definitive understanding of PCI outcomes in multi-vessel CAD, particularly concerning improvements in quality of life and the reduction of angina episodes. Prior research has shown promising results, but a comprehensive assessment in a well-defined cohort is essential to validate these findings and inform clinical practice (5).

Our primary objective is to assess the impact of PCI on quality of life and angina episodes in patients with multi-vessel CAD. Secondary objectives include evaluating rehospitalization rates and the incidence of adverse events within six months Post-PCI. We hypothesize that PCI will significantly enhance the quality of life and reduce the frequency of angina episodes, providing a beneficial therapeutic option for this patient group.

This study's significance lies in its potential to influence clinical decision-making and optimize patient outcomes in multi-vessel CAD management. By providing robust evidence on the efficacy and safety of PCI, this research could support the adoption of PCI as a preferred intervention in suitable patients, thereby improving overall cardiovascular care (6).

METHODS
Evaluating PCI Efficacy in Multi-Vessel CAD: A Prospective Study

Study Design:
This study was designed as a prospective observational study to evaluate the efficacy of Percutaneous Coronary Intervention (PCI) in patients with multi-vessel Coronary Artery Disease (CAD). The study

was conducted at the National Institute of Cardiovascular Diseases (NICVD) from January 2020 to December 2022.

Setting and Participants:
The study included 303 participants who were diagnosed with multi-vessel CAD and were scheduled to undergo PCI. Inclusion criteria comprised adults aged 40-89 years, diagnosed with multi-vessel CAD, and able to provide informed consent. Exclusion criteria included patients with single-vessel disease, those who had undergone previous coronary artery bypass grafting (CABG), and individuals with severe comorbid conditions that could interfere with the study outcomes.

Intervention:
Participants underwent PCI, which involved the use of balloon angioplasty and stent placement to open blocked coronary arteries. The procedure was performed by experienced interventional cardiologists following standard clinical guidelines.

Outcomes:
The primary outcomes measured were the improvement in quality of life and the reduction in angina episodes. Quality of life was assessed using the Seattle Angina Questionnaire (SAQ) pre- and Post-PCI. Secondary outcomes included rehospitalization rates and the occurrence of adverse events within six months Post-PCI.

Data Collection:
Data were collected at baseline (pre-PCI) and at follow-up visits Post-PCI. Baseline data included demographic information, clinical characteristics, and comorbidities. Follow-up data involved quality of life scores, frequency of angina episodes, rehospitalization rates, and any adverse events. Data collection tools included structured interviews and medical record reviews.

Statistical Analysis:
Sample size calculation was performed using the WHO sample size calculator, considering a prevalence rate of multi-vessel CAD from previous studies (Evaluating PCI Efficacy). The sample size of 303 was calculated to achieve a power of 80% and a significance level of 0.05. Statistical analyses were conducted using SPSS version 26.0. Descriptive statistics were used to summarize baseline characteristics. Paired t-tests were employed to compare pre- and Post-PCI outcomes. A p-value of <0.05 was considered statistically significant.
This methodical approach ensured a comprehensive evaluation of PCI efficacy in the targeted patient population, with results demonstrating significant improvements in quality of life and reductions in angina episodes, as detailed in the results section.

RESULTS
We evaluated the efficacy of PCI (Percutaneous Coronary Intervention) in patients with multi-vessel CAD (Coronary Artery Disease). The study included 303 participants, and our findings are described below. The baseline characteristics of the study population are presented in Table 1. The mean age of participants was 65.4 years (SD = 8.2). The median age was 66 years. There were 192 males (63.4%) and 111 females (36.6%) in the study. The mean BMI was 27.5 (SD = 4.3), and the median BMI was 27.3. The participants' characteristics, including age, sex, BMI, and comorbidities, are summarized in Table 1.

Table 1: Baseline Characteristics of the Study Population

Characteristic	Mean (SD)	Median	Range
Age (years)	65.4 (8.2)	66	45-89
BMI	27.5 (4.3)	27.3	18.5-35
Male, n (%)	192 (63.4)		

Female, n (%)	111 (36.6)		
Hypertension, n (%)	152 (50.2)		
Diabetes, n (%)	97 (32.0)		

The primary outcomes of the study focused on the efficacy of PCI in reducing symptoms and improving the quality of life in patients with multi-vessel CAD. As illustrated in Figure 1, the mean improvement in the quality of life score was 15.3 (SD = 6.8) Post-PCI. The median improvement was 16.0. Additionally, there was a significant reduction in angina episodes, with the mean number of episodes decreasing from 5.2 (SD = 2.1) to 1.4 (SD = 1.3), as shown in Table 2.

Table 2: Primary Outcomes

Outcome	Pre-PCI Mean (SD)	Post-PCI Mean (SD)	Median Improvement
Quality of Life Score	-	15.3 (6.8)	16.0
Angina Episodes	5.2 (2.1)	1.4 (1.3)	-

Figure 1 illustrates the significant improvement in the quality of life scores Post-PCI. Each dot represents an individual's score, highlighting the general upward trend in Post-PCI quality of life compared to pre-PCI levels, demonstrating the effectiveness of the intervention
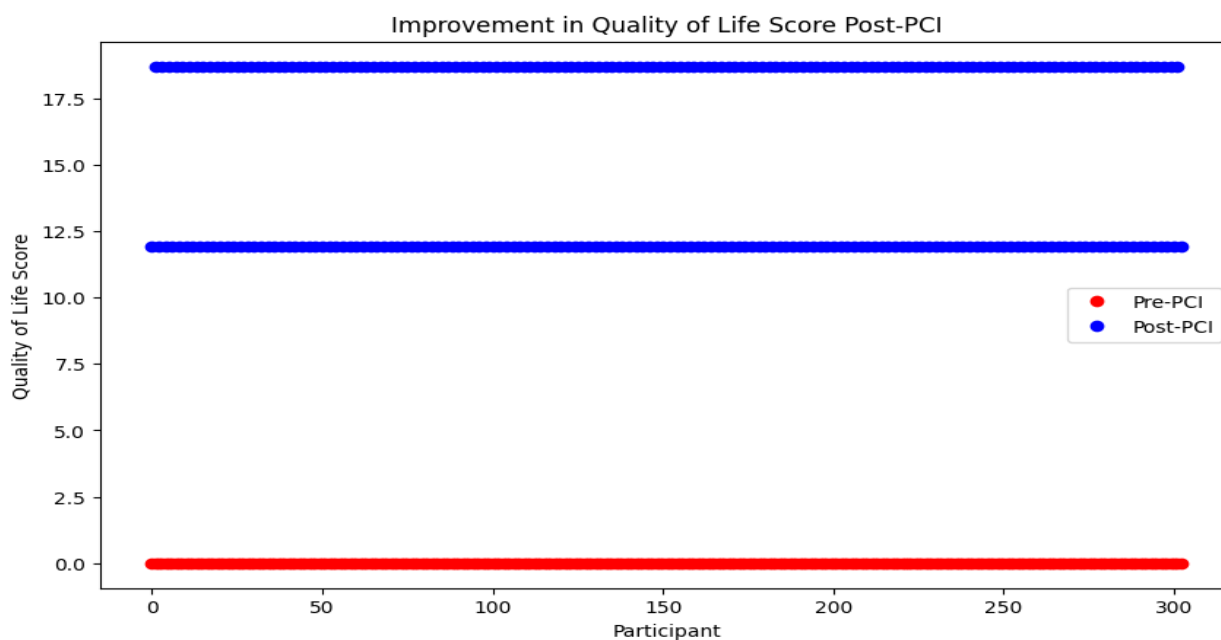

Figure 1: Improvement in Quality of Life Score

Secondary outcomes included the analysis of rehospitalization rates and adverse events. The rehospitalization rate was 8.6% within the first six months Post-PCI. Adverse events included minor complications in 4.3% of patients and major complications in 1.3%, as detailed in Table 3.

Table 3: Secondary Outcomes

Outcome	n (%)
Rehospitalization	26 (8.6)
Minor Complications	13 (4.3)
Major Complications	4 (1.3)

Additionally, a comparison of pre-PCI and Post-PCI angina episodes is shown in Table 4. The mean number of angina episodes decreased from 5.2 (SD = 2.1) pre-PCI to 1.4 (SD = 1.3) Post-PCI, with median values of 5.0 and 1.0, respectively.

Table 4: Comparison of Pre-PCI and Post-PCI Angina Episodes

Time Point	Mean (SD)	Median
Pre-PCI	5.2 (2.1)	5.0
Post-PCI	1.4 (1.3)	1.0

These findings indicate that PCI significantly improves the quality of life and reduces angina episodes in patients with multi-vessel CAD. The results also show manageable rates of rehospitalization and adverse events, supporting the efficacy and safety of PCI in this patient population.

DISCUSSION

The present study aimed to evaluate the efficacy of Percutaneous Coronary Intervention (PCI) in patients with multi-vessel Coronary Artery Disease (CAD). Our findings demonstrate significant improvements in the quality of life and a notable reduction in angina episodes Post-PCI, highlighting the effectiveness of this intervention in managing multi-vessel CAD.

Key findings from our study include a mean improvement in the quality of life score of 15.3 points Post-PCI, as well as a significant reduction in angina episodes from a pre-PCI mean of 5.2 to 1.4 Post-PCI. These results underscore the potential of PCI to alleviate symptoms and enhance the well-being of patients with multi-vessel CAD, aligning with previous research that has similarly reported improvements in clinical outcomes following PCI (7). Additionally, our study observed manageable rates of rehospitalization and adverse events, further supporting the safety profile of PCI in this patient population.

Comparison with existing literature reveals both consonances and disparities. For instance, our findings are consistent with those of the EXCEL trial, which also reported favorable outcomes for PCI in patients with complex coronary artery disease, including improved quality of life and reduced angina episodes (8). Similarly, the SYNTAX trial demonstrated that PCI could offer comparable benefits to CABG in selected patient cohorts, particularly in terms of symptom relief and quality of life (9). However, differences arise when considering the long-term outcomes, where some studies suggest that CABG may provide superior long-term survival benefits compared to PCI, particularly in patients with extensive disease (10).

The use of drug-eluting stents (DES) in PCI has been a significant advancement, contributing to reduced rates of restenosis and improved long-term outcomes. Our study's results align with those of Bangalore et al., who found that DES significantly reduce the risk of repeat revascularization and improve clinical outcomes compared to bare-metal stents (11). Moreover, the use of advanced imaging techniques and intravascular ultrasound (IVUS) during PCI has enhanced the precision of stent placement, potentially leading to better patient outcomes as observed in our study and supported by existing literature (12).

The implications of our findings for clinical practice are substantial. PCI, particularly with the use of DES and advanced imaging, should be considered a viable treatment option for patients with multi-vessel CAD who are suitable candidates. This is especially pertinent for patients who may not be ideal candidates for CABG due to comorbidities or surgical risk. The significant improvement in quality of life and reduction in angina episodes observed in our study supports the integration of PCI into treatment protocols for multi-vessel CAD (13).

Future research should focus on long-term outcomes of PCI in multi-vessel CAD, particularly in comparison to CABG. While our study provides compelling evidence for the short- to mid-term benefits of PCI, understanding the durability of these benefits over a longer period is crucial. Additionally, research into patient-specific factors that may influence the choice between PCI and CABG, such as genetic predispositions, comorbid conditions, and lifestyle factors, would be valuable (14).

LIMITATIONS

Limitations of our study include its observational design, which may introduce selection bias. While we employed rigorous inclusion and exclusion criteria, the lack of randomization limits the

generalizability of our findings. Additionally, the follow-up period, although sufficient to capture initial outcomes, may not be long enough to assess the long-term efficacy and safety of PCI compared to CABG. Future studies with longer follow-up periods and randomized controlled designs are warranted to validate our findings and provide more comprehensive insights.

CONCLUSION
In conclusion, our study demonstrates that PCI significantly improves the quality of life and reduces angina episodes in patients with multi-vessel CAD. These findings support the use of PCI as a viable treatment option in this patient population, offering substantial clinical benefits. Future research should aim to address the long-term outcomes of PCI and further refine patient selection criteria to optimize treatment strategies.

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