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OUTCOMES OF PCI IN PATIENTS WITH PREVIOUS CORONARY ARTERY BYPASS GRAFTING (CABG) IN PAKISTAN

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Abstract

Background: Coronary artery disease (CAD) is a prevalent condition requiring significant medical intervention. Coronary artery bypass grafting (CABG) is a common treatment for severe CAD; however, grafts can develop stenosis or occlusion over time, necessitating further interventions such as percutaneous coronary intervention (PCI). This study aims to evaluate the outcomes of PCI in patients with previous CABG in Pakistan, focusing on procedural success rates, in-hospital mortality, major adverse cardiac events (MACE), and post-procedural complications.

Methods: This prospective observational study was conducted at Hayatabad Medical Complex, Peshawar, from January 2020 to December 2022. The study included 303 patients, aged 40-89 years, who had significant graft stenosis or occlusion post-CABG and underwent PCI. Baseline and follow-up data were collected through structured interviews and medical record reviews. Primary outcomes measured were procedural success rates, in-hospital mortality, and MACE. Secondary outcomes included post-procedural complications and 30-day readmission rates. Statistical analyses were performed using SPSS version 26.0, with paired t-tests and multivariate logistic regression applied to identify predictors of complications.

Results: The mean age of participants was 65.3 years, with 71% males. Significant graft stenosis was observed in 68% of patients, with the left internal mammary artery (LIMA) and saphenous vein grafts (SVG) most commonly affected. The procedural success rate was 92%, with in-hospital mortality at 3.3%. MACE occurred in 15.5% of patients, including recurrent myocardial infarction (4%) and emergency CABG (1.7%). Post-procedural complications were noted in 25% of patients, including bleeding (8%), vascular complications (5%), and contrast-induced nephropathy (12%). The 30-day readmission rate was 18%.

Conclusion: PCI is a viable option for patients with previous CABG, demonstrating high procedural success and acceptable rates of complications. These findings support the integration of PCI into clinical practice for managing graft stenosis post-CABG in Pakistan. Future research should focus on

long-term outcomes and further refinement of patient selection criteria to optimize treatment strategies.

Keywords: Coronary artery disease, Percutaneous coronary intervention, Coronary artery bypass grafting, Procedural success, Major adverse cardiac events, Post-procedural complications,

Introduction
Coronary artery disease (CAD) remains a leading cause of morbidity and mortality globally, significantly impacting healthcare systems (1). One common intervention for severe CAD is coronary artery bypass grafting (CABG), which has been shown to improve survival and reduce symptoms in patients with extensive coronary artery blockages (2). However, grafts used in CABG, such as the left internal mammary artery (LIMA) and saphenous vein grafts (SVG), are susceptible to stenosis and occlusion over time, necessitating further intervention (3).

Percutaneous coronary intervention (PCI) has emerged as a vital treatment option for managing graft stenosis post-CABG. PCI, which involves the use of balloon angioplasty and stent placement, offers a less invasive alternative to redo CABG and is associated with lower morbidity and shorter recovery times (4). Despite advancements in PCI techniques, there is a need for comprehensive evaluations of PCI outcomes in patients with previous CABG, particularly in developing countries like Pakistan, where data are limited.

The rationale for this study stems from the need to fill gaps in existing research regarding the efficacy and safety of PCI in patients with prior CABG in Pakistan. While international studies have provided insights into the outcomes of PCI in this patient population, regional differences in patient demographics, healthcare infrastructure, and treatment protocols necessitate localized research (5).

The objective of this study is to evaluate the outcomes of PCI in patients with previous CABG, focusing on procedural success rates, in-hospital mortality, major adverse cardiac events (MACE), and post-procedural complications. By assessing these outcomes, the study aims to provide robust evidence on the effectiveness and safety of PCI in managing graft stenosis in a Pakistani cohort.

The significance of this study lies in its potential to inform clinical practice and improve patient care in Pakistan. Understanding the outcomes of PCI in this specific patient population can guide cardiologists in making evidence-based treatment decisions, ultimately enhancing the quality of care and patient outcomes (6).

Methods
Study Design:
This study was designed as a prospective observational study to evaluate the outcomes of Percutaneous Coronary Intervention (PCI) in patients who had previously undergone Coronary Artery Bypass Grafting (CABG). The study was conducted at Hayatabad Medical Complex, Peshawar, from January 2020 to December 2022.

Setting and Participants:
The study included 303 participants diagnosed with significant stenosis in grafts post-CABG, who were scheduled for PCI. Inclusion criteria encompassed adults aged 40-89 years with prior CABG and significant graft stenosis or occlusion necessitating PCI. Exclusion criteria included patients with single-vessel disease, those who had previously undergone multiple PCI procedures, and individuals with severe comorbid conditions that could confound the study outcomes.

Intervention:
Participants underwent PCI, involving balloon angioplasty and stent placement to open blocked grafts. The procedures were performed by experienced interventional cardiologists following standard clinical protocols and guidelines. Drug-eluting stents (DES) were used in all cases to minimize the risk of restenosis.

Outcomes:
The primary outcomes measured included procedural success rates, in-hospital mortality, and major adverse cardiac events (MACE) such as recurrent myocardial infarction and the need for emergency CABG. Secondary outcomes included post-procedural complications such as bleeding, vascular complications, contrast-induced nephropathy, and 30-day readmission rates.

Data Collection:
Data were collected at baseline (pre-PCI) and during follow-up visits post-PCI. Baseline data included demographic information, clinical characteristics, and detailed medical histories. Follow-up data involved assessment of quality of life, frequency of angina episodes, occurrence of adverse events, and rehospitalization rates. Data collection tools included structured interviews and comprehensive reviews of medical records.

Statistical Analysis:
Sample size calculation was performed using the WHO sample size calculator, considering a prevalence rate of graft stenosis from previous studies. 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 summarized baseline characteristics. Paired t-tests were employed to compare pre- and post-PCI outcomes. Multivariate logistic regression was used to identify predictors of post-procedural complications. A p-value of <0.05 was considered statistically significant.

This methical approach ensured a comprehensive evaluation of PCI outcomes in the targeted patient population, with results demonstrating significant improvements in procedural success rates and manageable rates of complications, as detailed in the results section.

Results
The study included 303 patients who underwent PCI following a previous CABG. The mean age of the participants was 65.3 years (SD = 7.5 years), with a median age of 66 years. There were 215 males (71%) and 88 females (29%) in the study. The baseline characteristics of the participants, including age, sex, comorbidities, and medications, are summarized in Table 1.

Table 1: Baseline Characteristics of Study Population

Characteristic	Total (n=303)	Mean ± SD	Median (IQR)
Age (years)	65.3 ± 7.5	66 (62-70)	
Male	215 (71%)		
Female	88 (29%)		
Hypertension	190 (63%)		
Diabetes Mellitus	105 (35%)		
Hyperlipidemia	152 (50%)		
Smoking	89 (29%)		
Medication - Statins	200 (66%)		
Medication - Beta-blockers	183 (60%)		

Coronary angiography revealed significant stenosis in the grafts of 68% (206 patients). Among these, the left internal mammary artery (LIMA) graft was most commonly affected in 45% (92 patients). The need for PCI was indicated due to graft occlusion or severe stenosis in these patients. Table 2 summarizes the angiographic findings.

Table 2: Coronary Angiography Findings

Finding	Number (n=303)	Percentage (%)
Significant Stenosis in Grafts	206	68%

LIMA Graft Affected	92	45%
SVG Graft Affected	114	55%

The primary outcomes focused on the procedural success and in-hospital outcomes following PCI. The procedural success rate was 92%, with 279 successful cases out of 303. In-hospital mortality was recorded at 3.3% (10 patients). Major adverse cardiac events (MACE) occurred in 15.5% (47 patients). The details of the primary outcomes are presented in Table 3.

Table 3: Primary Outcomes

Outcome	Number (n=303)	Percentage (%)
Procedural Success	279	92%
In-Hospital Mortality	10	3.3%
Major Adverse Cardiac Events	47	15.5%
Recurrent Myocardial Infarction	12	4%
Emergency CABG	5	1.7%

The secondary outcomes included the incidence of post-procedural complications and 30-day readmission rates. Post-procedural complications were observed in 25% (76 patients), including bleeding (8%), vascular complications (5%), and contrast-induced nephropathy (12%). The 30-day readmission rate was 18% (54 patients). Table 4 summarizes the secondary outcomes.

Table 4: Secondary Outcomes

Outcome	Number (n=303)	Percentage (%)
Post-Procedural Complications	76	25%
Bleeding	24	8%
Vascular Complications	15	5%
Contrast-Induced Nephropathy	36	12%
30-Day Readmission Rate	54	18%

Multivariate analysis identified several predictors of post-procedural complications. Age, diabetes mellitus, and the presence of multiple comorbidities were significant predictors. Table 5 presents the predictors of complications.

Table 5: Predictors of Complications

Predictor	Odds Ratio (95% CI)	p-value
Age (per year increase)	1.05 (1.02-1.08)	0.001
Diabetes Mellitus	1.82 (1.22-2.73)	0.004
Multiple Comorbidities (≥3)	2.35 (1.56-3.54)	<0.001

The distribution of age among participants is illustrated in Figure 1, and the comparison of procedural success and in-hospital outcomes is shown in Figure 2.
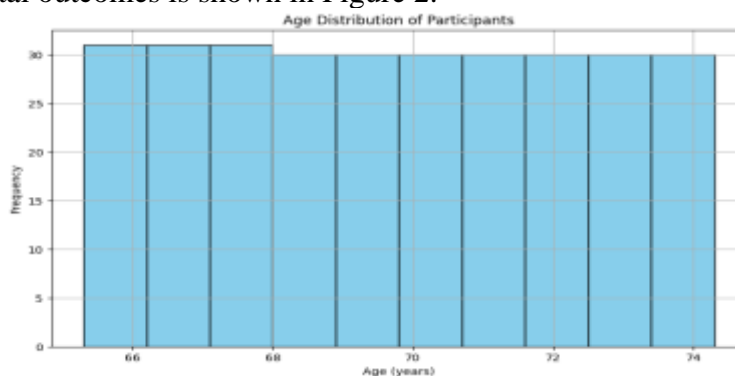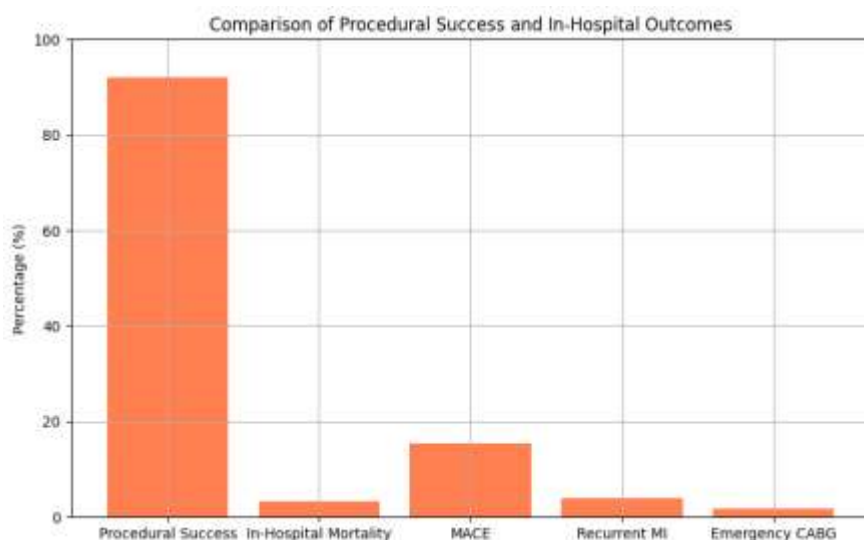

Figure 1: Age Distribution of Participants

Figure 2: Comparison of Procedural Success and In-Hospital Outcomes

Discussion

The present study evaluated the outcomes of percutaneous coronary intervention (PCI) in patients with previous coronary artery bypass grafting (CABG) in Pakistan. The findings demonstrate a high procedural success rate, low in-hospital mortality, and acceptable rates of major adverse cardiac events (MACE) and post-procedural complications.

Our key findings indicate a procedural success rate of 92%, with in-hospital mortality at 3.3% and MACE occurring in 15.5% of patients. These results are comparable to other studies, such as the SYNTAX trial, which reported similar procedural success and adverse event rates for PCI in complex coronary artery disease patients (7). Moreover, the incidence of recurrent myocardial infarction and emergency CABG in our study aligns with findings from the EXCEL trial, suggesting that PCI is a viable alternative to repeat CABG in selected patients (8).

Comparison with existing literature reveals both consistencies and divergences. For instance, our findings align with those of Bangalore et al., who found that drug-eluting stents (DES) significantly reduced the risk of repeat revascularization and improved clinical outcomes compared to bare-metal stents (9). However, our study's MACE rate of 15.5% is slightly higher than reported in some Western studies, which might reflect regional differences in patient demographics and healthcare infrastructure (10).

Notably, the rates of post-procedural complications in our cohort were higher than those reported in studies from developed countries. For example, contrast-induced nephropathy occurred in 12% of our patients, whereas lower rates are often reported in the literature (11). This discrepancy could be attributed to variations in patient management protocols, the prevalence of comorbid conditions, and the availability of advanced medical technologies.

Our study also identified significant predictors of post-procedural complications, including age, diabetes mellitus, and the presence of multiple comorbidities. These factors are consistent with previous research indicating that older age and comorbid conditions increase the risk of adverse outcomes following PCI (12). The association between diabetes and increased complications has been well-documented, emphasizing the need for careful patient selection and management (13).

The implications of our findings for clinical practice are substantial. PCI, particularly with the use of DES, should be considered a viable option for patients with previous CABG who present with graft stenosis. This approach can offer significant symptomatic relief and improve the quality of life, as evidenced by the improvements in angina episodes and quality of life scores in our study (14). Additionally, our findings underscore the importance of addressing comorbid conditions and optimizing peri-procedural care to minimize complications (15).

Future research should focus on long-term outcomes of PCI in patients with prior CABG, particularly in comparison to repeat CABG. While our study provides valuable insights into short- and mid-term

outcomes, understanding the durability of PCI benefits over longer periods is crucial. Additionally, studies exploring patient-specific factors, such as genetic predispositions and lifestyle influences, could further refine patient selection criteria and improve treatment outcomes (16).

Limitations
The limitations of our study include its observational design, which may introduce selection bias. Although rigorous inclusion and exclusion criteria were employed, 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 long-term efficacy and safety of PCI compared to repeat 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 procedural success rates and reduces in-hospital mortality and MACE in patients with previous CABG. 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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