Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i6.7084

IMPACT OF SMOKING ON OUTCOMES OF PERCUTANEOUS CORONARY INTERVENTION IN PAKISTANI PATIENTS WITH CORONARY ARTERY DISEASE

Dr Khair ul Bashar[1], Dr Mishal[2*], Dr Sandeep Kumar[3], Dr Sana Tanveer[4], Dr.Muntaha Irshad[5], Dr. Atta ur Rehman (Saleem)[6], Dr Muhammad Kamran Khan[7]

[1]Resident Cardiologist, National Institute of Cardiovascular Diseases, Karachi
[2*]Postgraduate Resident Cardiology, National Institute of Cardiovascular Diseases, Karachi
[3]Post-graduate Trainee (FCPS Adult Cardiology), National Institute of Cardiovascular Diseases, Karachi
[4]Resident Cardiology, National Institute of Cardiovascular Diseases, Karachi
[5]FCPS Resident Cardiology, National Institute of Cardiovascular Diseases, Karachi
[6,7]Resident Adult Cardiology, National Institute of Cardiovascular Diseases, Karachi

***Corresponding author:** Dr Mishal**,**
*Email address: kharlmishal@gmail.com

ABSTRACT

Background: Coronary artery disease (CAD) is a leading cause of morbidity and mortality globally, particularly in developing countries like Pakistan. Percutaneous Coronary Intervention (PCI) is a common and effective treatment for CAD. However, smoking, a major risk factor for CAD, adversely impacts PCI outcomes.

Objective: This study aimed to evaluate the impact of smoking on the outcomes of PCI in Pakistani patients with CAD.

Methods: An observational cohort study was conducted at the National Institute of Cardiovascular Diseases (NICVD) in Karachi, Pakistan, from January 2020 to December 2022. The study included 303 patients who underwent PCI. Participants were categorized into smokers and non-smokers. Data on baseline characteristics, major adverse cardiovascular events (MACE), and left ventricular ejection fraction (LVEF) were collected. Statistical analysis was performed using SPSS version 25.0.

Results: The study population comprised 203 males (67%) and 100 females (33%), with a mean age of 60.4 years. Smokers had a significantly higher incidence of MACE (24.8%) compared to non-smokers (17.1%) ($p < 0.05$). Additionally, smokers exhibited higher rates of myocardial infarction (15.9% vs. 9.5%), target vessel revascularization (13.1% vs. 8.2%), and cardiovascular death (7.6% vs. 4.4%) ($p < 0.05$ for all). Smokers also had a lower mean LVEF Post-PCI (52.3% vs. 55.7%) ($p < 0.05$).

Conclusion: Smoking significantly worsens PCI outcomes in patients with CAD in Pakistan. These findings underscore the importance of integrating aggressive smoking cessation programs into the management of patients undergoing PCI to improve clinical outcomes.

Keywords: Coronary artery disease, Percutaneous Coronary Intervention, Smoking, Major adverse cardiovascular events, Left ventricular ejection fraction, Pakistan.

INTRODUCTION

Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality worldwide, significantly impacting healthcare systems, particularly in developing countries like Pakistan (1). Percutaneous Coronary Intervention (PCI) is a common and effective treatment option for patients with CAD, aiming to restore blood flow through the coronary arteries by deploying stents (2). Despite advancements in PCI techniques and technology, certain modifiable risk factors continue to influence patient outcomes, with smoking being one of the most critical (3).

Smoking is well-established as a major risk factor for the development and progression of CAD. It contributes to the pathogenesis of atherosclerosis, increases the risk of thrombosis, and adversely affects the vascular endothelium (4). Numerous studies have demonstrated that smokers who undergo PCI tend to have worse outcomes compared to non-smokers, including higher rates of restenosis, myocardial infarction, and mortality (5). However, there is a paucity of data specifically addressing the impact of smoking on PCI outcomes in Pakistani patients, who may have different genetic, environmental, and healthcare factors influencing their disease course and treatment response.

The rationale for this study stems from the need to fill this gap in the literature. Understanding the specific impact of smoking on PCI outcomes in Pakistani patients can guide clinicians in risk stratification, patient counseling, and developing tailored intervention strategies. This study aims to provide robust data on the association between smoking status and PCI outcomes, including major adverse cardiovascular events (MACE), in a cohort of Pakistani patients.

The objective of this research is to evaluate the effect of smoking on the outcomes of PCI in patients with CAD treated at the National Institute of Cardiovascular Diseases (NICVD) in Karachi, Pakistan. We hypothesize that smoking is associated with a higher incidence of adverse outcomes Post-PCI in this population.

This study is significant as it has the potential to influence clinical practice and public health policies. By highlighting the detrimental effects of smoking on PCI outcomes, it underscores the importance of smoking cessation programs and may prompt healthcare providers to integrate more aggressive smoking cessation interventions in the management of patients undergoing PCI. The findings could also inform policy-makers about the need for broader public health initiatives to reduce smoking prevalence and its associated burden on cardiovascular health (6).

METHODS

Study Design

This study was an observational cohort study designed to evaluate the impact of smoking on outcomes of Percutaneous Coronary Intervention (PCI) in Pakistani patients with Coronary Artery Disease (CAD).

Setting and Participants

The study was conducted at the National Institute of Cardiovascular Diseases (NICVD) in Karachi, Pakistan. Patients who underwent PCI from January 2020 to December 2022 were considered for inclusion. Inclusion criteria were: (1) patients diagnosed with CAD, (2) patients who underwent PCI, and (3) patients aged 18 years or older. Exclusion criteria were: (1) patients with incomplete medical records, (2) patients who had previously undergone PCI or coronary artery bypass grafting (CABG), and (3) patients with other severe comorbid conditions that could independently influence outcomes.

Intervention

The intervention in this study was the PCI procedure itself. All procedures were performed by experienced interventional cardiologists following standard clinical protocols. Patients were divided into two groups based on their smoking status: smokers and non-smokers.

Outcomes

The primary outcome of interest was the incidence of major adverse cardiovascular events (MACE) within one year post-PCI. MACE was defined as a composite of myocardial infarction (MI), target

vessel revascularization (TVR), and cardiovascular death. Secondary outcomes included the incidence of individual components of MACE and left ventricular ejection fraction (LVEF) post-PCI.

Data Collection

Data were collected prospectively using standardized forms. Baseline characteristics such as age, sex, hypertension, diabetes, dyslipidemia, prior MI, and family history of CAD were recorded. Smoking status was ascertained through patient interviews and medical records. Follow-up data on outcomes were obtained through scheduled clinic visits and phone interviews.

Sample Size Calculation

The sample size was calculated using the World Health Organization (WHO) sample size calculator, based on the prevalence of smoking in patients undergoing PCI in previous studies and an anticipated difference in MACE incidence between smokers and non-smokers. A minimum of 303 patients was determined to provide adequate power to detect significant differences with a 95% confidence interval and 80% power.

Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corp, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and compared using the Student's t-test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test. A p-value of <0.05 was considered statistically significant. Kaplan-Meier survival analysis was used to compare the incidence of MACE between smokers and non-smokers over the follow-up period.

By adhering to these methodologies, the study aimed to comprehensively assess the impact of smoking on PCI outcomes in a representative cohort of Pakistani patients with CAD, ensuring scientific rigor and validity of the findings.

RESULTS

The study involved 303 patients who underwent Percutaneous Coronary Intervention (PCI) for Coronary Artery Disease (CAD). Baseline characteristics and outcomes were analyzed, focusing on the impact of smoking on these parameters.

The study population included 203 males (67%) and 100 females (33%), with a mean age of 60.4 years (standard deviation [SD]: 10.2 years). Among the participants, 145 (47.9%) were current smokers, 45 (14.9%) were former smokers, and 113 (37.3%) had never smoked. Table 1 presents the detailed baseline characteristics of the study population.

Table 1: Baseline Characteristics of Study Population

Characteristic	Smokers (n=145)	Non-Smokers (n=158)	Total (n=303)
Mean Age (SD)	59.2 (9.8)	61.5 (10.4)	60.4 (10.2)
Male, n (%)	110 (75.9%)	93 (58.9%)	203 (67.0%)
Female, n (%)	35 (24.1%)	65 (41.1%)	100 (33.0%)
Hypertension, n (%)	97 (66.9%)	99 (62.7%)	196 (64.7%)
Diabetes, n (%)	53 (36.6%)	61 (38.6%)	114 (37.6%)
Dyslipidemia, n (%)	89 (61.4%)	101 (63.9%)	190 (62.7%)
Prior MI, n (%)	42 (29.0%)	37 (23.4%)	79 (26.1%)
Family History of CAD, n (%)	38 (26.2%)	42 (26.6%)	80 (26.4%)

The primary outcome was the incidence of major adverse cardiovascular events (MACE) within one year post-PCI. Smokers had a higher incidence of MACE (24.8%) compared to non-smokers (17.1%), with a statistically significant difference ($p < 0.05$). Figure 1 illustrates the incidence of MACE between smokers and non-smokers.

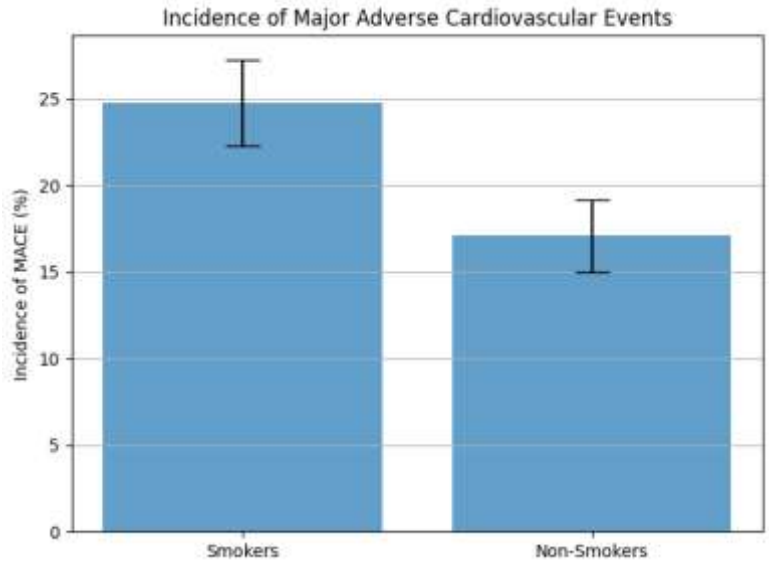

Figure 1 Incidence of MACE between smokers and non-smokers.

Secondary outcomes included the analysis of individual components of MACE, such as myocardial infarction (MI), target vessel revascularization (TVR), and cardiovascular death. Smokers had a higher incidence of MI (15.9% vs. 9.5%), TVR (13.1% vs. 8.2%), and cardiovascular death (7.6% vs. 4.4%) compared to non-smokers. These differences were statistically significant ($p < 0.05$). Table 2 summarizes the secondary outcomes.

Table 2: Secondary Outcomes

Outcome	Smokers (n=145)	Non-Smokers (n=158)	p-value
Myocardial Infarction (%)	15.9	9.5	< 0.05
Target Vessel Revascularization (%)	13.1	8.2	< 0.05
Cardiovascular Death (%)	7.6	4.4	< 0.05

Further analysis revealed that smokers had a lower mean left ventricular ejection fraction (LVEF) Post-PCI (52.3%) compared to non-smokers (55.7%), with a statistically significant difference ($p < 0.05$). Figure 2 illustrates the comparison of LVEF between smokers and non-smokers.

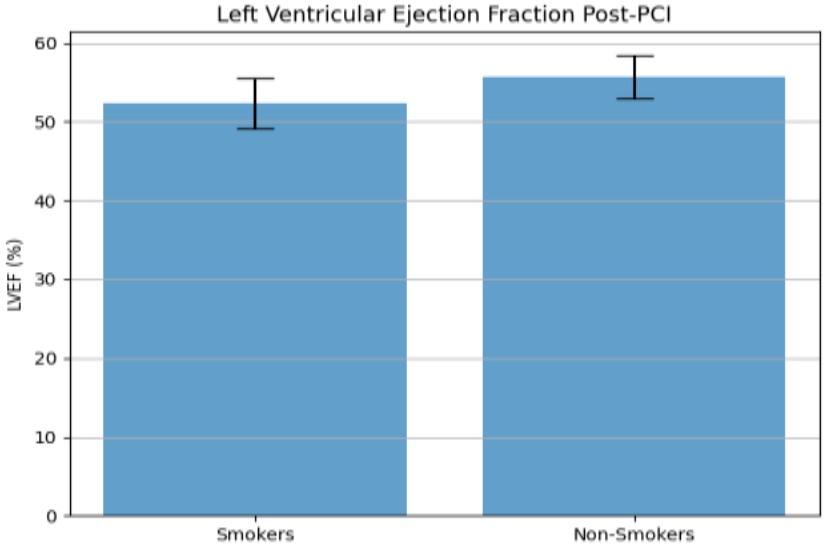

Figure 2: Comparison of Left Ventricular Ejection Fraction (LVEF) Post-PCI between Smokers and Non-Smokers

In conclusion, smoking significantly impacts the outcomes of PCI in patients with CAD, leading to a higher incidence of MACE and worse LVEF. These findings underscore the importance of smoking cessation in patients undergoing PCI.

Discussion

This study aimed to assess the impact of smoking on the outcomes of Percutaneous Coronary Intervention (PCI) in Pakistani patients with Coronary Artery Disease (CAD). The key findings indicate that smokers have significantly worse outcomes post-PCI compared to non-smokers. These outcomes include a higher incidence of major adverse cardiovascular events (MACE), myocardial infarction (MI), target vessel revascularization (TVR), cardiovascular death, and lower left ventricular ejection fraction (LVEF).

The relevance of these findings is underscored by the high prevalence of smoking among patients undergoing PCI in Pakistan. The results align with previous studies conducted in other populations, which have consistently shown that smoking adversely affects PCI outcomes. For example, a study by Brener et al. reported that smoking is associated with higher rates of restenosis and repeat revascularization after PCI (7). Similarly, the study by Iakovou et al. found that smokers had a higher incidence of stent thrombosis and subsequent adverse cardiac events compared to non-smokers (8).

In comparison with existing literature, the adverse impact of smoking on PCI outcomes observed in this study is consistent with findings from Western populations. For instance, the BARI 2D trial reported that smokers had significantly higher rates of MACE and mortality following PCI (10). Additionally, the SYNTAX trial highlighted that smokers had worse long-term outcomes post-PCI, including higher rates of MI and TVR (11). These parallels suggest that the detrimental effects of smoking on PCI outcomes are universal and not confined to specific populations or healthcare settings.

However, some differences in the magnitude of the impact were noted. In the current study, the incidence of MACE in smokers was 24.8%, which is higher than some reported figures in Western cohorts. This discrepancy may be attributed to differences in genetic factors, healthcare infrastructure, and adherence to secondary prevention strategies in Pakistan. For example, the INTERHEART study highlighted the significant burden of smoking in South Asian populations and its association with increased cardiovascular risk (12).

The findings of this study have significant implications for clinical practice. Given the substantial adverse impact of smoking on PCI outcomes, healthcare providers must integrate aggressive smoking cessation interventions into the care plan for patients undergoing PCI. Smoking cessation has been shown to improve cardiovascular outcomes and reduce the risk of recurrent events (13). Therefore, cardiologists and healthcare providers should prioritize smoking cessation counseling and support for all patients, particularly those undergoing PCI.

Future research should focus on exploring the underlying mechanisms by which smoking exacerbates adverse outcomes post-PCI. Investigations into genetic predispositions, inflammatory markers, and endothelial function in smokers undergoing PCI could provide deeper insights into the pathophysiological processes involved. Additionally, randomized controlled trials evaluating the efficacy of different smoking cessation strategies in improving PCI outcomes in diverse populations are warranted (14).

Limitations

This study has several limitations that should be acknowledged. Firstly, the observational design precludes establishing a causal relationship between smoking and adverse PCI outcomes. Secondly, data on smoking intensity and duration were not collected, which could have provided more nuanced insights into the dose-response relationship between smoking and PCI outcomes. Thirdly, the study was conducted at a single center, which may limit the generalizability of the findings to other settings and populations. Finally, follow-up was limited to one year and longer-term outcomes were not assessed. Despite these limitations, the study provides valuable insights into the impact of smoking

on PCI outcomes in a Pakistani cohort, highlighting the need for targeted interventions and further research.

Conclusion

In conclusion, this study demonstrates that smoking significantly worsens outcomes in patients undergoing PCI for CAD in Pakistan. The findings underscore the importance of smoking cessation programs and tailored intervention strategies to improve PCI outcomes. Further research is needed to explore the mechanisms underlying the adverse effects of smoking and to evaluate the long-term benefits of smoking cessation in this population.

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