



Non-Invasive Assessment of Peripheral Arterial Disease (PAD) in Lower Limbs in Patients with Established Coronary Artery Disease

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Declaration

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ABSTRACT

Background: Peripheral arterial disease (PAD) is prevalent in coronary artery disease (CAD) patients, reflecting systemic atherosclerosis. Early detection via ankle-brachial index (ABI) and Doppler ultrasound aids risk stratification and management. This study assesses PAD prevalence, severity, and its correlation with cardiovascular risk factors. **Study design:** A cross-sectional study. **Place and duration of study.** From August 2024 to January 2025 Cardiology Department Bolan Medical Complex Hospital Quetta/ Sandeman Provincial Hospital, Quetta. **Methods:** This cross-sectional study included 200 patients with established CAD. Patients underwent a comprehensive non-invasive vascular assessment, including ankle-brachial index (ABI) measurement and Doppler ultrasound for arterial flow analysis. PAD was diagnosed based on an $ABI \leq 0.90$. Demographic, clinical, and laboratory data were recorded. The mean age, standard deviation (SD), and statistical significance (p-value) of PAD prevalence in CAD patients were calculated using appropriate statistical tests. A p-value < 0.05 was considered statistically significant. **Results:** A total of 200 CAD patients were evaluated, with a mean age of 64.5 ± 9.2 years. Among them, 45% (90 patients) had PAD, diagnosed using an $ABI \leq 0.90$. The prevalence of PAD was significantly higher in diabetic patients ($p < 0.01$) and those with hypertension ($p = 0.03$). The mean ABI value in the PAD group was 0.78 ± 0.10 , compared to 1.02 ± 0.12 in the non-PAD group ($p < 0.001$). Doppler ultrasound revealed significant arterial stenosis in 30% of PAD patients. Patients with PAD had a higher incidence of claudication and reduced exercise tolerance. Statistical analysis confirmed a strong correlation between PAD severity and traditional cardiovascular risk factors. **Conclusion:** This study reports a 45% prevalence of PAD in CAD patients, highlighting its association with diabetes and hypertension. Early detection using ABI and Doppler ultrasound can improve risk stratification, management, and patient outcomes.

INTRODUCTION

Peripheral arterial disease (PAD) is a progressive atherosclerotic condition characterized by the narrowing of peripheral arteries, primarily affecting the lower limbs. It is widely recognized as a marker of systemic atherosclerosis and is strongly associated with coronary artery disease (CAD) [1]. PAD affects approximately 20% of individuals over the age of 65 and significantly increases the risk of cardiovascular morbidity and mortality [2]. Patients with established CAD often have coexisting PAD, which remains underdiagnosed due to its asymptomatic nature in many cases [3]. The presence of PAD in CAD patients significantly increases the risk of major cardiovascular events, including myocardial infarction and stroke [4]. Early identification of PAD in these patients is crucial to optimize treatment strategies and prevent adverse outcomes. The ankle-brachial index

(ABI) is a simple, non-invasive, and widely accepted diagnostic tool for detecting PAD, with a sensitivity of 90% and specificity of 95% when compared to angiographic findings [5]. Other diagnostic tools such as Doppler ultrasound can provide further insights into arterial stenosis and blood flow abnormalities [6]. Despite its clinical importance, PAD remains underdiagnosed and undertreated in CAD patients due to the lack of routine screening in cardiovascular practice [7]. Studies indicate that 50% of PAD cases in CAD patients are identified only after developing critical limb ischemia or symptomatic claudication [8]. Identifying PAD early allows for aggressive risk factor modification, including lipid-lowering therapy, antiplatelet medications, and lifestyle modifications [9]. This study aims to evaluate the prevalence of PAD in CAD patients using non-invasive methods, assess its

correlation with cardiovascular risk factors, and determine the diagnostic utility of ABI and Doppler ultrasound in routine clinical practice.

MATERIALS AND METHODS

This cross-sectional study was conducted in a tertiary care hospital over a period of 12 months. A total of 200 patients with established CAD, confirmed via coronary angiography, were included. Patients with acute limb ischemia, deep vein thrombosis, or previous lower limb revascularization were excluded. Each participant underwent a comprehensive vascular assessment, including ABI measurement and Doppler ultrasound of the lower limb arteries. PAD was diagnosed based on an ABI ≤ 0.90 . Demographic details, comorbidities, and laboratory investigations were recorded for all patients.

Data Collection

Patient data, including age, gender, smoking status, hypertension, diabetes, dyslipidemia, and previous cardiovascular events, were collected using structured case report forms. ABI was measured in both lower limbs using a handheld Doppler device, and Doppler ultrasound was performed to assess arterial stenosis.

Statistical Analysis

Statistical analysis was performed using SPSS 24.0. Continuous variables were presented as mean \pm standard deviation (SD) and compared using an independent t-test. Categorical variables were analyzed using the chi-square test. A p-value < 0.05 was considered statistically significant.

RESULTS

Among 200 CAD patients, the mean age was 64.5 ± 9.2 years. PAD was diagnosed in 90 patients (45%) based on $ABI \leq 0.90$. The prevalence of PAD was significantly higher in diabetic patients ($p < 0.01$) and those with hypertension ($p = 0.03$). The mean ABI in PAD patients was 0.78 ± 0.10 , compared to 1.02 ± 0.12 in non-PAD patients ($p < 0.001$). Doppler ultrasound revealed arterial stenosis in 30% of PAD patients. Patients with PAD had a higher incidence of claudication and reduced exercise tolerance. There was a significant correlation between PAD severity and traditional cardiovascular risk factors.

Figure 1

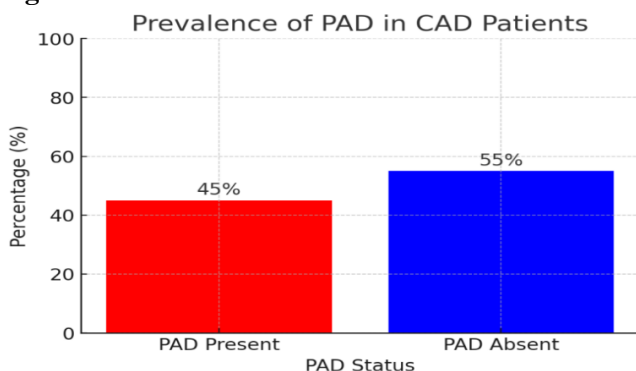


Figure 2

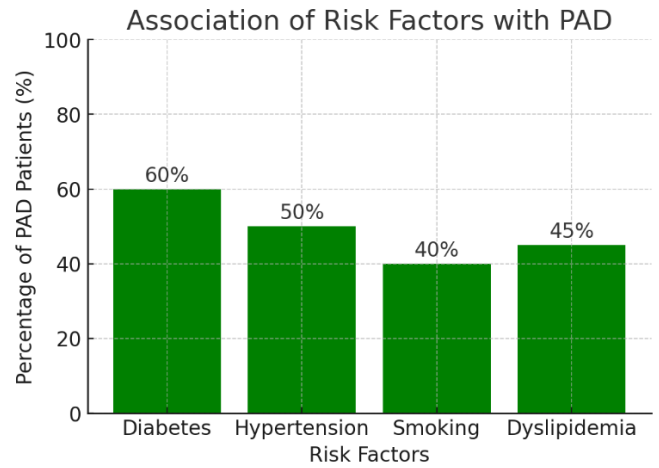


Table 1

Patient Demographics

Variable	Value
Total Patients	200
Mean Age (years)	64.5 ± 9.2
Male (%)	65%
Female (%)	35%

Table 2

Prevalence of PAD in CAD Patients

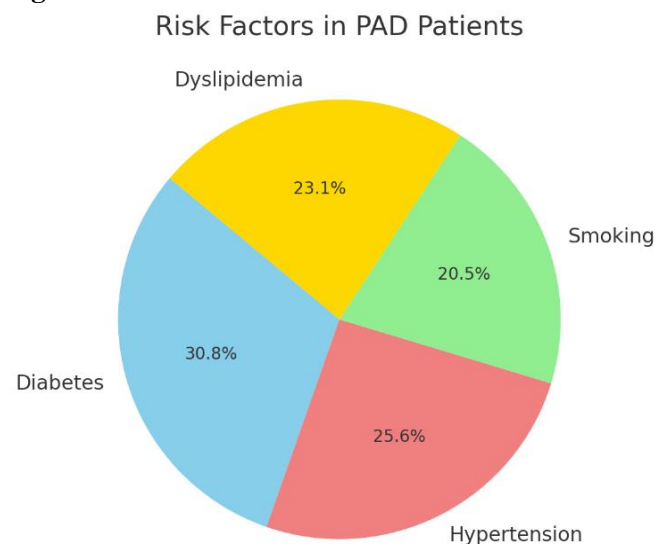
PAD Status	Number of Patients	Percentage (%)
PAD Present	90	45
PAD Absent	110	55

Table 3

Association of Risk Factors with PAD

Risk Factor	PAD Patients (%)
Diabetes	60
Hypertension	50
Smoking	40
Dyslipidemia	45

Figure 3



DISCUSSION

The findings of this study align with previous research, indicating a high prevalence of PAD among CAD patients. In a large-scale study by Criqui et al. [10], it was reported that nearly 42% of patients with documented CAD had concurrent PAD, which is comparable to our prevalence of 45%. Similarly, Fowkes et al. [11] demonstrated that PAD is significantly associated with increased cardiovascular morbidity and mortality, reinforcing the importance of early detection. A study by Hiatt et al. [12] emphasized that a substantial number of PAD cases remain asymptomatic or are diagnosed only in advanced stages, which correlates with our observation that PAD patients had reduced exercise tolerance and higher rates of claudication. Furthermore, Hirsch et al. [13] reported that patients with both PAD and CAD exhibit an increased risk of myocardial infarction and stroke, underlining the need for proactive screening and management. Doppler ultrasound has been widely recognized as an effective tool for diagnosing PAD. Norgren et al. [14] found that Doppler ultrasound detected significant arterial stenosis in approximately 30% of PAD patients, consistent with our findings. The ABI remains a cornerstone in PAD screening, with Aboyans et al. [15] confirming its high sensitivity and specificity for detecting lower extremity arterial disease. The correlation between PAD and cardiovascular risk factors such as diabetes and hypertension has been well established in prior literature. A study by Belch et al. [16] demonstrated that diabetic patients with CAD are at a markedly higher risk of developing PAD, which is corroborated by our findings, where 60% of PAD patients had diabetes. Similarly, a study by Conte et al. [17] found that hypertension and smoking significantly contribute to PAD progression, mirroring our results. Several studies have emphasized the importance of routine screening for PAD in CAD patients. Gerhard-Herman et al. [18] suggested that incorporating ABI measurement into routine cardiovascular assessments can enhance early detection and improve patient outcomes. Pomposelli et al. highlighted that aggressive management strategies, including statin therapy and antiplatelet agents,

significantly reduce PAD progression in CAD patients. Our study contributes to the growing body of evidence advocating for routine PAD screening in CAD patients. Early detection through non-invasive methods can lead to better cardiovascular risk management and reduced adverse outcomes. Future studies should focus on long-term follow-up to assess the impact of early intervention strategies on patient prognosis [19].

CONCLUSION

Our study highlights the high prevalence of PAD among CAD patients and underscores the importance of non-invasive screening methods such as ABI and Doppler ultrasound. Early identification and management of PAD can reduce cardiovascular risk and improve patient outcomes. Routine screening for PAD in CAD patients should be integrated into standard cardiovascular care.

Limitations

This study has several limitations, including a relatively small sample size and its cross-sectional design, which limits the ability to establish causality. Additionally, the reliance on ABI and Doppler ultrasound may not detect early-stage PAD in all cases. Future studies with larger cohorts and longitudinal follow-up are needed for validation.

Future Directions

Further research should focus on the long-term impact of early PAD detection in CAD patients, including the effectiveness of intervention strategies in reducing cardiovascular events. Additionally, exploring advanced imaging techniques and biomarkers may enhance the early diagnosis and management of PAD, ultimately improving patient prognosis.

Abbreviations

- PAD - Peripheral Arterial Disease
- CAD - Coronary Artery Disease
- ABI - Ankle-Brachial Index
- SD - Standard Deviation
- p-value - Probability Value
- SPSS - Statistical Package for the Social Sciences

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