

Research Article

Prevalence and Clinical Correlates of Pedal Vascular Disease in Patients Admitted With Diabetic Foot Ulcers: An Observational Study from a Tertiary Care Centre in South India

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ABSTRACT

Background: Diabetic foot ulceration remains one of the most disabling consequences of diabetes mellitus, and coexisting lower-extremity arterial disease can substantially worsen tissue loss, infection, healing delay, and amputation risk.

Objective: To estimate the prevalence of pedal vascular disease among adults admitted with diabetic foot ulcers and to examine the distribution of selected demographic and clinical variables in relation to vascular status.

Methods: This observational analytical study included 354 consecutive adults with diabetes evaluated in a tertiary surgical unit during 2024-2025. Clinical history, vascular examination, ankle-brachial index, and arterial Doppler assessment were used for evaluation. Pedal vascular disease was defined using the study diagnostic framework based on vascular assessment, including ABI findings. Descriptive statistics were generated for the whole cohort. Categorical variables were compared with the chi-square test, and continuous variables were compared between vascular groups using the independent-samples t-test.

Results: The mean age of the cohort was 62.52 ± 13.02 years. Pedal vascular disease was identified in 200 of 354 patients, giving a prevalence of 56.5%. Hypertension was present in 66.9%, dyslipidemia in 57.9%, smoking history in 39.5%, alcohol use in 28.2%, peripheral neuropathy in 81.6%, and active foot ulceration in 87.3%. Patients with pedal vascular disease had slightly longer diabetes duration and marginally higher HbA1c values, but these differences were not statistically significant. The ABI was markedly lower in the pedal vascular disease group than in the non-disease group (0.64 ± 0.14 vs 1.10 ± 0.12 , $p < 0.001$). No statistically significant association was demonstrated for sex, hypertension, smoking, dyslipidemia, alcohol use, coronary artery disease, cerebrovascular disease, peripheral neuropathy, or foot ulcer presence.

Conclusion: More than half of this tertiary-care diabetic foot cohort had pedal vascular disease. The burden was high even though conventional clinical risk markers did not separate vascular groups significantly within this already high-risk inpatient population. Routine vascular assessment remains essential in all patients presenting with diabetic foot complications.

Keywords: Diabetic Foot Ulcer, Peripheral Arterial Disease, Pedal Vascular Disease, Ankle-Brachial Index, Diabetic Foot, South India.

INTRODUCTION

Diabetes mellitus continues to impose a major clinical and public-health burden because its chronic complications extend far beyond glycaemic disturbance alone. Among those complications, diabetic foot disease carries a particularly high cost in terms of prolonged

treatment, recurrent admissions, loss of mobility, and avoidable limb loss [1].

At the population level, diabetic foot ulceration is not an infrequent or marginal event. A global meta-analysis estimated a pooled prevalence of diabetic foot ulceration of 6.3%, with appreciable heterogeneity across regions and healthcare settings [2]. In India, where the

absolute burden of diabetes is large, the downstream load of foot complications is correspondingly substantial [3].

Once ulceration develops, tissue viability is shaped not only by infection and neuropathy but also by the adequacy of perfusion. Peripheral arterial insufficiency reduces oxygen delivery, impairs granulation, delays epithelialisation, and narrows the window for successful limb salvage [4]. For this reason, the diabetic foot should not be understood as a purely neuropathic problem.

In South India, earlier work from Chennai showed that peripheral vascular disease was already detectable in urban diabetic populations, although prevalence estimates varied with the population examined and the diagnostic thresholds used [5]. In patients who already have foot lesions, the vascular component is often more clinically consequential than it first appears.

Peripheral artery disease in diabetes tends to be diffuse, distal, and clinically silent. Neuropathy can blunt classic exertional symptoms, so patients may present late, when the first clear sign is a non-healing ulcer, digital necrosis, or spreading infection rather than intermittent claudication [6]. That diagnostic quietness is especially relevant in resource-constrained settings, where many patients arrive only after wound progression.

Global epidemiological work has also shown that peripheral artery disease is common, age-linked, and concentrated increasingly in low- and middle-income countries [7]. In practical terms, that means diabetic foot services in India must assume vascular disease is present until it has been actively assessed rather than clinically excluded on symptoms alone.

Although bedside pulse examination remains important, vascular assessment in diabetic foot practice has to be more deliberate. The ankle-brachial index, Doppler-based evaluation, and structured vascular work-up remain widely used tools in identifying lower-limb arterial disease and in guiding the need for further imaging or revascularisation planning [8].

Against this background, the present study was undertaken in a tertiary government teaching hospital in Chennai to estimate the prevalence of pedal vascular disease among patients admitted with diabetic foot ulcers and to describe the clinical profile of this cohort in relation to vascular status. The study also sought to examine whether commonly recognised variables such as hypertension,

dyslipidaemia, smoking history, and glycaemic burden showed measurable separation between patients with and without pedal vascular disease in this inpatient setting.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based observational analytical study was carried out in the Institute of General Surgery, Madras Medical College, and Rajiv Gandhi Government General Hospital, Chennai, Tamil Nadu, India.

Study Period: Patients were evaluated during 2024–2025 after scientific and institutional ethics approval had been obtained.

Study Population: Adults older than 18 years with diabetes mellitus and a foot lesion below the ankle were eligible for inclusion. The study focused on admitted patients undergoing vascular assessment in the surgical unit.

Inclusion Criteria: Diagnosed diabetes mellitus; age more than 18 years; and a full-thickness skin ulcer below the ankle or related diabetic foot presentation requiring inpatient assessment.

Exclusion Criteria: Known peripheral vascular disease documented before the index admission, non-salvageable limbs requiring primary amputation at presentation, haemodynamic instability precluding vascular assessment, and Charcot neuroarthropathy.

Sample Size and Sampling Method: Using an expected prevalence of 36% and a 5% absolute precision, the calculated minimum sample size was 354. Consecutive sampling was followed until the target sample size was reached.

Clinical Evaluation: A structured history was taken for age, sex, duration of diabetes, smoking history, alcohol use, hypertension, dyslipidaemia, coronary artery disease, cerebrovascular disease, and foot ulcer status. Peripheral neuropathy and pedal pulses were assessed clinically.

Vascular Assessment: All patients underwent vascular assessment using the ankle-brachial index and arterial Doppler examination. Pedal vascular disease was identified according to the study diagnostic framework, which

incorporated ABI-based and vascular examination findings.

Variables: The principal outcome variable was pedal vascular disease diagnosis. Secondary descriptive variables included demographic profile, diabetes duration, HbA1c, hypertension, dyslipidaemia, smoking, alcohol use, coronary artery disease, cerebrovascular disease, peripheral neuropathy, ABI, and foot ulcer presence.

Statistical Analysis: Data were tabulated and analysed using standard descriptive and inferential methods. Continuous variables are expressed as mean $\pm$ standard deviation, while categorical variables are presented as numbers and percentages. The chi-square test was used for categorical comparisons, and the independent-samples t-test was used for

continuous variables. A p-value below 0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethics Committee approval was obtained from Madras Medical College (IEC No. IEC-MMC/Approval/06112024). Confidentiality was maintained throughout the study, and clinical care was not altered by participation.

RESULTS

A total of 354 patients were analysed. The overall demographic distribution is presented in Table 1. The cohort had a mean age of 62.52 ± 13.02 years, and the largest age stratum was 71–80 years (94, 26.6%). The full age-group profile is illustrated in Figure 1. Sex distribution was nearly balanced, with 178 women (50.3%) and 176 men (49.7%), as shown in Table 1.

Table 1. Demographic Profile of the Study Population (N = 354)

Variable	N	%
Age group, years		
40-50	85	24.0
51-60	63	17.8
61-70	84	23.7
71-80	94	26.6
81-90	28	7.9
Sex		
Female	178	50.3
Male	176	49.7

Figure 1 depicts the age distribution of the cohort and mirrors the concentration of admissions in the seventh and eighth decades.

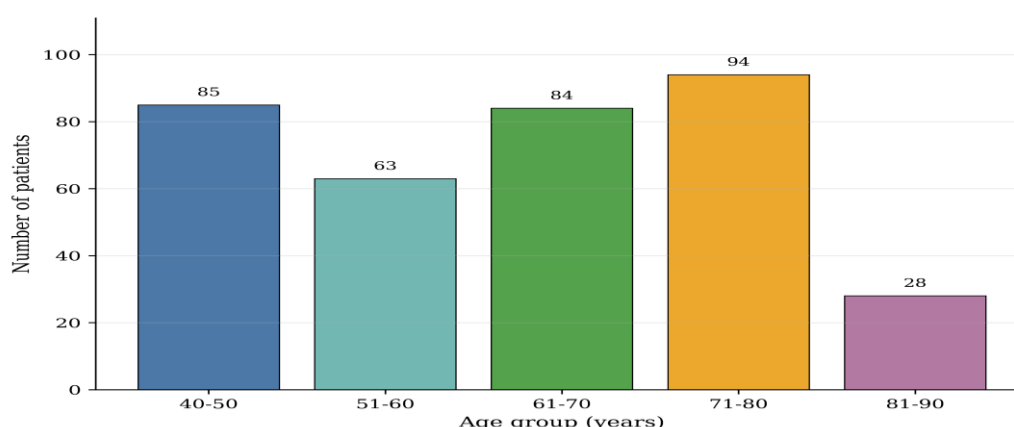


Figure 1. Age-Group Distribution of the Study Population

Note: Bar labels show the number of patients in each age category. Baseline clinical and vascular characteristics are summarised in Table 2. Hypertension was recorded in 237 patients (66.9%),

dyslipidaemia in 205 (57.9%), smoking history in 140 (39.5%), alcohol use in 100 (28.2%), coronary artery disease in 67 (18.9%), and cerebrovascular disease in 38 (10.7%). Peripheral neuropathy was present in 289

patients (81.6%), and 309 patients (87.3%) had an active foot ulcer at the time of assessment.

Pedal vascular disease was diagnosed in 200 of 354 patients, giving a prevalence of 56.5%. The overall distribution of pedal vascular disease is shown in Figure 2.

Selected comorbid and behavioural variables are displayed together in Figure 3. Hypertension and dyslipidaemia were the most frequent coexisting conditions, while smoking history remained common in nearly two-fifths of the cohort.

Table 2. Baseline Clinical and Vascular Profile of the Cohort (N = 354)

Variable	N	%
Hypertension	237	66.9
Dyslipidemia	205	57.9
Smoking history	140	39.5
Alcohol use	100	28.2
History of coronary artery disease	67	18.9
History of cerebrovascular disease	38	10.7
Peripheral neuropathy	289	81.6
Foot ulcer present	309	87.3
Pedal vascular disease diagnosed	200	56.5

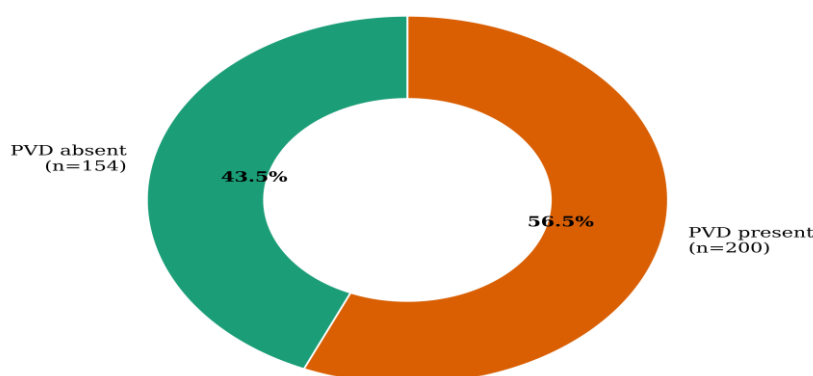


Figure 2. Overall Prevalence of Pedal Vascular Disease in the Cohort

Note: The donut chart displays the relative proportion of patients with and without pedal vascular disease.

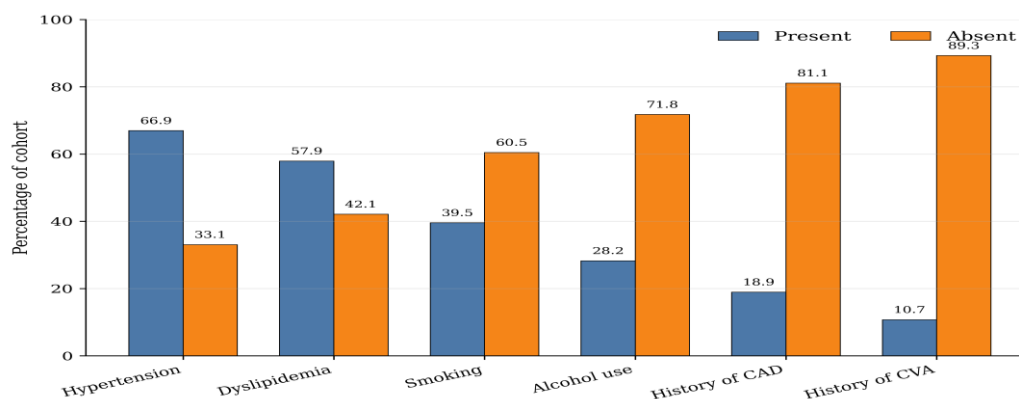


Figure 3. Prevalence of Selected Clinical and Behavioural Variables in the Cohort

Note: Percentages are shown above each bar; hypertension and dyslipidaemia were the most frequent coexisting conditions.

Continuous variables for the whole cohort and stratified by pedal vascular disease status are shown in Table 3. Mean age was similar in patients with and without pedal vascular disease (62.85 ± 13.39 vs 62.09 ± 12.57 years, $p = 0.584$). Diabetes duration was numerically longer in the pedal vascular disease group (16.14 ± 8.67 vs 14.86 ± 8.47 years, $p =$

0.167), and HbA1c was marginally higher (10.07 ± 2.16 vs 10.01 ± 2.06 , $p = 0.772$), but neither difference reached statistical significance.

ABI showed the clearest separation between groups. Patients with pedal vascular disease had a substantially lower mean ABI than those without disease (0.64 ± 0.14 vs 1.10 ± 0.12), and this difference was highly significant ($p < 0.001$), as detailed in Table 3.

Table 3. Continuous Variables Overall And According To Pedal Vascular Disease Status

Variable	Overall	PVD Absent	PVD Present	P Value
Age, years	62.52 ± 13.02	62.09 ± 12.57	62.85 ± 13.39	0.584
Duration of diabetes, years	15.58 ± 8.60	14.86 ± 8.47	16.14 ± 8.67	0.167
HbA1c, %	10.05 ± 2.11	10.01 ± 2.06	10.07 ± 2.16	0.772
ABI	0.84 ± 0.26	1.10 ± 0.12	0.64 ± 0.14	<0.001

Table 4 presents the categorical comparisons according to pedal vascular disease status. The proportion with pedal vascular disease was 56.2% among women and 56.8% among men ($p = 0.989$). Among patients with hypertension, 59.1% had pedal vascular disease compared with 51.3% of those without hypertension ($p = 0.202$).

Similarly, pedal vascular disease was present in 57.1% of patients with dyslipidaemia and 55.7% of those without dyslipidaemia ($p = 0.882$). Smoking history showed a comparable

distribution, with pedal vascular disease present in 57.9% of smokers and 55.6% of non-smokers ($p = 0.758$).

Alcohol use, coronary artery disease, cerebrovascular disease, peripheral neuropathy, and foot ulcer presence also did not demonstrate statistically significant differences between vascular groups (Table 4). Figure 4 visually depicts the distribution of pedal vascular disease across hypertension and smoking strata, showing only modest between-group differences in this inpatient cohort.

Table 4. Association of Selected Categorical Variables with Pedal Vascular Disease

Variable	Category	Total	PVD Present N (%)	P Value
Sex	Female	178	100 (56.2)	0.989
	Male	176	100 (56.8)	
Hypertension	No	117	60 (51.3)	0.202
	Yes	237	140 (59.1)	
Dyslipidemia	No	149	83 (55.7)	0.882
	Yes	205	117 (57.1)	
Smoking	No	214	119 (55.6)	0.758
	Yes	140	81 (57.9)	
Alcohol use	No	254	148 (58.3)	0.341
	Yes	100	52 (52.0)	
History of CAD	No	287	163 (56.8)	0.923
	Yes	67	37 (55.2)	
History of CVA	No	316	178 (56.3)	0.991
	Yes	38	22 (57.9)	

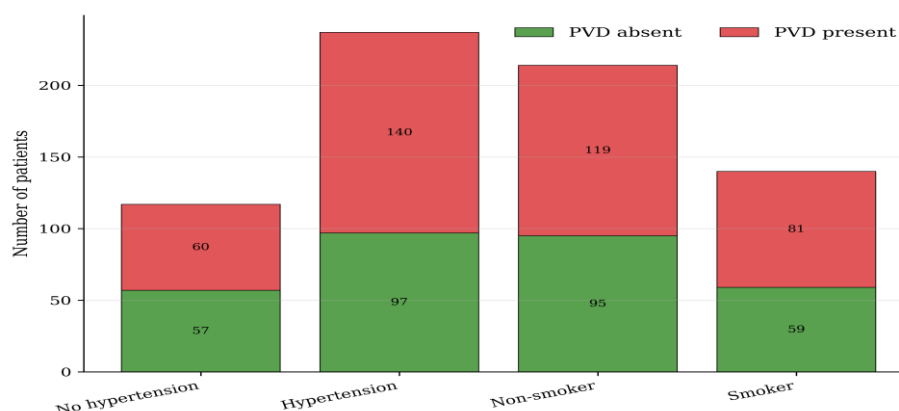


Figure 4. Distribution of Pedal Vascular Disease across Hypertension and Smoking Strata

Note: Stacked bars show the number of patients with and without pedal vascular disease within each exposure category.

DISCUSSION

The prevalence of pedal vascular disease in this study was 56.5%, which indicates a substantial vascular burden in patients admitted with diabetic foot complications. This proportion is clinically important because foot ulceration superimposed on impaired arterial inflow is precisely the combination associated with delayed healing and higher limb-loss risk [9].

The biological basis for that burden is well recognised. Diabetes accelerates endothelial dysfunction, inflammatory vascular injury, and atherosclerotic progression, while long-standing hyperglycaemia further compounds both macrovascular and microvascular compromise [10].

Smoking, hypertension, and dyslipidaemia remain biologically plausible contributors to lower-limb arterial disease, and their prevalence in the present cohort was high even though they did not separate the vascular groups statistically [11]. In an inpatient population already enriched for advanced diabetic foot disease, this lack of statistical separation may reflect shared risk accumulation across nearly all participants rather than the absence of clinical relevance.

The present findings, therefore, need to be interpreted as characteristics of a high-risk hospital cohort rather than of the general diabetic population. Earlier South Indian epidemiological work reported lower background prevalence estimates for peripheral vascular disease in community and urban diabetic samples [5]. Once patients progress to admission-level diabetic foot disease, however,

the vascular burden appears appreciably higher.

The absence of significant between-group differences for sex, hypertension, smoking, dyslipidaemia, alcohol use, coronary artery disease, cerebrovascular disease, peripheral neuropathy, and active ulcer status should not be over-read. First, the cohort was relatively homogeneous in clinical severity. Second, several of these variables were highly prevalent across both groups. Third, the cross-sectional hospital-based design is more suitable for describing burden than for establishing a stable causal hierarchy among risk factors.

What discriminated sharply was ABI. The marked ABI difference between vascular groups supports the practical value of systematic physiological assessment at admission. Contemporary diabetic foot guidance continues to recommend structured vascular evaluation because bedside impression alone can miss clinically relevant lower-extremity arterial disease [12].

This point has become even more important in recent multidisciplinary guidance on diabetes-related foot disease. Updated intersocietal recommendations emphasise that peripheral artery disease should be actively sought in every person with diabetes and foot ulceration because it changes prognosis, influences revascularisation decisions, and shapes wound-healing expectations [13].

The broader practical guidelines from the International Working Group on the Diabetic Foot likewise place routine vascular assessment alongside infection control, off-loading, wound care, and organisational multidisciplinary care as core components of good diabetic foot practice [14]. The present results fit that framework well: the main message is not that traditional risk markers are unimportant, but

that vascular disease is frequent enough in this setting to justify universal rather than selective assessment.

The study has limitations. It was conducted in a single tertiary centre and included admitted patients, which limits generalisability to outpatient and community settings. The design was cross-sectional, so temporal or causal inferences cannot be made. In addition, because ABI contributed to vascular classification, the striking ABI difference between groups is expected and should be interpreted as internal diagnostic consistency rather than as an independent predictor finding.

Even with these limitations, the study adds locally relevant evidence from a large government teaching hospital in South India. In settings where delayed presentation is common and neuropathy may mute classic ischaemic symptoms, a low threshold for vascular assessment is both clinically rational and operationally feasible.

CONCLUSION

Pedal vascular disease was present in more than half of the patients admitted with diabetic foot complications in this tertiary-care cohort. Conventional clinical variables such as smoking, hypertension, dyslipidaemia, and sex showed only modest and statistically non-significant differences between vascular groups, whereas ABI-based vascular assessment clearly distinguished disease status. Routine, early vascular evaluation should therefore remain a standard part of inpatient diabetic foot care.

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Conflict of Interest: None declared.

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