

PREVALENCE OF PERIPHERAL VASCULAR DISEASE AMONG DIABETIC FOOT ULCERS IN NORTH KERALA: A CROSS-SECTIONAL STUDY

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Abstract

Background: Diabetes is a growing public health concern in India, with significant complications like Peripheral Vascular Disease (PVD). This study aimed to evaluate the prevalence of PVD in patients with Type 2 Diabetes Mellitus (DM) presenting with diabetic foot ulcers in North Kerala, India. We also compared various factors between this group and those presenting with Neuropathic ulcers (NPU). **Material & Methods:** We conducted a cross-sectional study among 200 diabetic foot ulcer patients at the Department of General Surgery, Government Medical College, Kannur, India, over a period of one year. We assessed foot ulcers, neuropathy, peripheral pulses, and blood pressure. Along with clinical examination, Ankle-Brachial blood pressure index (ABI) was used to diagnose PVD. Laboratory tests were also performed, including HbA1C, blood urea, and serum creatinine. **Results:** The mean age of the study population was 60.2 years, with a majority being males. PVD was diagnosed in 60 patients (30%). NIU (Neuro-ischemic ulcers) were more prevalent among male patients and those with a longer duration of diabetes and smoking history. **Conclusion:** PVD is a significant public health concern in India, especially among people with diabetes. This study underscores the need for nationwide awareness campaigns, improved PVD screening protocols, and effective diabetes management strategies.

INTRODUCTION

The rising burden of diabetes in India poses a significant threat due to its associated complications, including Peripheral Vascular Disease (PVD).^[1] PVD, a major diabetic complication, affects arterial flow to the limbs, leading to pain, claudication, and amputation. Early detection and management of PVD are crucial to prevent these devastating consequences.^[2] However, data on prevalence of PVD among Indian diabetics remains limited and geographically varied.^[3] The prevalence of PVD has been demonstrated to be higher among patients with diabetes mellitus (DM).^[4]

Diabetic foot ulcers can be classified into two primary types: Neuropathic ulcers (NPU) and Neuro-ischemic ulcers (NIU). In NIU, peripheral vascular disease coexists with neuropathy. The differentiation between NPU and NIU holds significant importance due to the necessity for distinct therapeutic approaches, while their prognoses exhibit

variations.^[5] In this study, our objective was to evaluate the prevalence of PVD in patients with Type 2 Diabetes Mellitus presenting with diabetic foot ulcers. Additionally, we aimed to compare various factors between this group and those presenting with NPU.

MATERIALS AND METHODS

A cross-sectional study was conducted among 200 diabetic foot ulcer patients in the Department of General Surgery at Government Medical College, Kannur, India, over a period of one year, from 1st October 2021 to 30th September 2022. The Institutional Ethics Committee approved the study. The Diabetic foot ulcers (DFU) were assessed using the University of Texas Diabetic Wound Classification system.^[6] Patients with only calluses, those without ulceration, non-diabetic patients with foot ulcers, and patients with a history of foot/leg amputation were excluded from the study. Following

the acquisition of informed written consent, a comprehensive patient history was taken, encompassing the duration of diabetes, a record of other comorbidities including hypertension, smoking history, presenting symptoms, and other diabetes-related complications. An examination included the assessment of the foot, peripheral pulses, and blood pressure.

An ulcer was defined as a full-thickness skin break. Neuropathy was characterized by the patient's inability to detect a 10 gm Nylon Monofilament on more than one site or a Vibration Perception Threshold exceeding 25 volts. Tendon reflex testing was done. The absence of pulses was defined as the lack of both the posterior tibial artery and dorsalis pedis artery pulses in the affected foot. Peripheral vascular disease was assessed using Ankle-Brachial blood pressure index (ABI).

When sensation was absent, foot ulcers were classified as neuropathic, but peripheral pulses remained intact. They were categorized as neuro ischemic ulcers (NIU) when sensation and peripheral pulses were absent. NIU was diagnosed in patients with an Ankle-Brachial pressure index (ABI) less than 0.9. Laboratory tests, including HbA1C, blood urea, and serum creatinine assessments, were done. The diagnosis of nephropathy and retinopathy was established following a consultation with a specialist, utilizing standard criteria.

The statistical analysis utilized SPSS version 25, employing t-tests, Fisher exact tests, and univariate analysis. A significance threshold of $p < 0.05$ was applied to determine statistical significance.

RESULTS

The mean age of the study population was 60.2 years, with the majority being males. The non-ischemic ulcers (NIU) were diagnosed in 60 patients. NIU was more prevalent among male patients. In our study, the average duration of diabetes was 10.2 years. Baseline characteristics of study population is shown in Table 1. The mean duration of diabetes for patients with NPU was 8.6 (SD-10.86) years, while for those using NIU; it was 12.36 (SD-11.28) years. This difference was found to be statistically significant ($p = 0.023$).

Out of 200 patients, 64 had a history of smoking. Among the 60 patients with NIU, 62.5% were smokers. Hypertension was found in 108 patients, and the majority of those with NIU also had hypertension. The median HbA1c levels for NPU and NIU were 9.2% and 9.8%, respectively. Among various parameters, only the history of smoking and the duration of diabetes were found to have a statistically significant association with NIU. Comparison of risk factors between neuropathic (NPU) and neuro-ischemic ulcers (NIU) are shown in Table 2.

Table 1: Baseline characteristics of study population

Variable	N (%)
Age	
<40	40(19.8)
41-60	56(28.1)
>60	104(52.1)
Gender	
Male	128(64)
Female	72(36)
Smoking history	
Yes	64(32)
No	136(68)
Hypertension	
Yes	108(54)
No	92(46)
CAD	
Yes	34(17)
No	166(83)
Stroke	
Yes	12(6)
No	188(94)
Nephropathy	
Yes	39(19.5)
No	161(80.5)
Retinopathy	
Yes	34(17)
No	166(83)
Treatment	
OHA (Oral Hypoglycemic Agents)	86(43.1)
Insulin	43(21.4)
Both	71(35.5)
Type of Diabetic foot ulcer	
Neuropathic ulcers (NPU)	140(70)
Neuro-ischemic ulcers (NIU)	60(30)

Table 2: Comparison of risk factors between neuropathic (NPU) and neuro-ischemic ulcers (NIU)

Variable	N	Neuropathic ulcers (NPU); N=140(70%)	Neuro-ischemic ulcers (NIU); N=60(30%)	p-value
Smoking history	64	24 (37.5)	40 (62.5)	<0.001
Hypertension	108	60 (55.5)	48 (44.5)	0.067
Coronary Artery Disease	34	18 (52.9)	16 (47.1)	0.436
Stroke	12	4 (33.3)	8 (66.7)	0.147
Nephropathy	39	24 (61.5)	15 (38.5)	0.181
Retinopathy	34	20 (58.8)	14 (41.2)	0.055

Table 3: The prevalence of peripheral vascular disease among diabetic foot ulcers varies in different studies

Studies	Year	Region	Prevalence	Risk factors for Diabetic foot ulcers
Krishnan; et al	2011	India, North Kerala	26.7	Age, Smoking, Physical inactivity, Diabetes and Female gender.
Khan; et al	2016-2018	India	30	Smoking, Hypertension, and Duration of diabetes
G Thulasikumar; et al	2017	India, Chennai	36	Duration of diabetes
Prathibha Divya Radha T; et al	2018	India, Chennai	20-30	-
M Satheesh Kumar	2016-2017	India, Chennai	12	Uncontrolled DM, Duration of Diabetes
Mucherla VN; et al	2011-2013	Andra Pradesh	10	Smoking, Uncontrolled DM, Hypertension, and Dyslipidemia
Meloni Marco	2021	Rome	50	-
Tresierra-Ayala MA; et al	2015	Peru	78	-
Khalid U ; et al	2021-2022	Pakistan	58.3	-

DISCUSSION

Peripheral Vascular Disease (PVD) manifests as chronic limb ischemia due to atherosclerosis affecting the peripheral arteries.^[1] In individuals with diabetes, atherosclerosis tends to develop prematurely and advance at an accelerated rate, often impacting crural arteries like the tibials and peroneals. Consequently, diabetic patients with PVD are at a higher risk of presenting with manifestations such as ischemic ulcers or gangrene compared to those without diabetes. Ankle-Brachial Pressure Index (ABI) can help in early detection and initiation of therapy for PVD.^[2-3]

In the present study, the prevalence of peripheral vascular disease (PVD) is 30%. This is in concordance with previous studies conducted in India.^[7-10] The prevalence of peripheral vascular disease among patients with diabetic foot ulcers varies in different studies as shown in Table 3.^[7-15] Our study highlights the high prevalence of PVD in Kerala. It emphasizes the importance of early management of peripheral vascular disease to prevent the development of neuro-ischemic ulcers in diabetic foot ulcer patients. The presence of PVD in DFU patients has a significant impact on limb salvage, as it affects the blood supply to the affected limb and can lead to complications such as non-healing ulcers and amputations.

The Mean age of patients in this study was 60 years. Our findings align with numerous studies conducted in both India and abroad.^[16-18] While assessing the risk factors for foot ulcers in patients with diabetes, we identified a statistically significant association between NIU and history of smoking, as well as the duration of diabetes. Smoking contributes to vascular wall thickening, reduced blood circulation, and ischemic changes in the affected neurons. In other studies, male gender, poor glycemic control, and

hypertension have been reported as risk factors for NIU.^[7-9,11,12] However, in the present study, these factors were not statistically significant. These risk factors can be modified to achieve the prevention, delay in formation, or improved healing of foot ulcers in diabetic patients.

CONCLUSION

PVD stands as a significant public health concern in India, disproportionately affecting people with diabetes. The high prevalence emphasizes the need for nationwide public awareness campaigns, improved PVD screening protocols, and effective diabetes management strategies. Further research focusing on cost-effective diagnostic tools and community-based interventions is crucial to combat this rising threat.

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