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ORIGINAL RESEARCH

Prevalence of peripheral vascular disease in diabetic foot infections

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ABSTRACT

Background and Objectives: Foot infections represent a common complication in diabetic patients, with reduced blood supply due to ischemia being a major contributing factor to disease morbidity. Peripheral vascular disease (PVD) has a higher prevalence and faster progression in diabetic patients, with prevalence varying among populations. This study aims to determine the prevalence of peripheral vascular disease in diabetic patients presenting with foot infections at a tertiary care center. **Methods:** This prospective analytical study was conducted at Government Stanley Medical College, Chennai, between February 2020 and February 2021. Patients admitted with diabetic foot infections who met inclusion criteria were enrolled. After documenting patient information, all subjects underwent clinical examination and lower limb arterial Doppler studies. The findings were tabulated and analyzed for correlations with various risk factors. **Results:** The study population comprised 73 patients (53.4% male, 46.6% female) with a mean age of 56.0±7.9 years. The prevalence of peripheral vascular disease was 31.5% among the study population, with most patients exhibiting below-knee vessel stenosis. Significant correlations were observed with age, duration of diabetes, and tobacco usage. Patients with peripheral vascular compromise demonstrated worse clinical presentations and outcomes compared to those without vascular compromise. **Conclusion:** A significant proportion of diabetic patients with foot infections have underlying peripheral vascular disease that may not always be clinically apparent. Early detection using arterial Doppler studies and ankle-brachial pressure index can facilitate timely intervention, potentially reducing amputation risk and improving outcomes.

Keywords: Peripheral vascular disease, diabetic foot, arterial Doppler, ankle-brachial pressure index

INTRODUCTION

Diabetes mellitus represents a global health challenge with increasing incidence, particularly in developing countries like India. Among its numerous complications, diabetic foot infections constitute one of the most common manifestations necessitating hospital admission. More than 50% of lower extremity amputations occur in diabetic patients, highlighting the significant morbidity associated with this condition [1].

The pathophysiology of diabetic foot infections involves multiple factors, with peripheral vascular disease playing a crucial role alongside neuropathy and trophic ulcers [2]. Vascular insufficiency compromises tissue perfusion, hampering both immune response and wound healing capabilities. Early detection of peripheral vascular disease in seemingly asymptomatic cases provides an opportunity for vascular intervention, potentially improving blood flow and reducing the risk of major limb amputations [3].

Arterial Doppler studies represent a valuable non-invasive diagnostic tool for determining the presence of peripheral arterial occlusive disease, identifying the level and extent of occlusion or stenosis, and assessing collateral circulation [4]. While Doppler studies provide essential diagnostic information, they often need to be coupled with angiography for planning vascular interventions.

The systematic evaluation of peripheral vascular disease in diabetic patients, particularly those presenting with foot infections, represents an essential component of comprehensive care. This information can contribute to the development of effective management protocols aimed at limiting the morbidity and social costs associated with diabetic foot complications.

Based on this aim of our study is to evaluate the prevalence of peripheral vascular disease in diabetic patients presenting with foot infections and to determine possible correlations between various risk factors and peripheral vascular disease and also to compare findings with existing studies of similar nature.

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MATERIALS AND METHODS

This prospective analytical study was conducted at the Department of General Surgery, in a tertiary care teaching hospital for a period of one year . The study population comprised all patients admitted with a diagnosis of diabetic foot infection who met the inclusion and exclusion criteria. Patients aged above 18 years with diabetic foot infections who were willing to undergo arterial Doppler study were included in the study. We excluded patients with a previous history of peripheral arterial disease or previous surgeries for arterial occlusive disease, those with necrotizing fasciitis and severe sepsis or previous amputations, and patients with obvious clinical signs of vascular insufficiency or ischemia including absent peripheral pulses.

For the purpose of this study, diabetic foot infection was defined as the presence of cellulitis of the foot, infected ulcers, abscess, or gangrene of one or more toes in patients with diabetes mellitus. After obtaining informed consent, comprehensive data was collected from each patient, including demographic information (name, age, sex), duration of diabetes, duration of infection, history of ischemic symptoms or treatment, history of hypertension, and history of tobacco use either by smoking or chewing.

Each patient underwent thorough physical examination with specific attention to the type and extent of infection, as well as assessment of peripheral pulses, their character, and volume. The ankle-brachial pressure index (ABPI) was measured as a quantitative indicator of peripheral vascular status. Based on clinical presentation, diabetic foot infections were categorized into three groups: cellulitis requiring conservative management, foot abscess or infected ulcer requiring incision and drainage or minor debridement, and gangrene requiring toe amputations.

All enrolled patients underwent lower limb arterial Doppler studies performed by experienced radiologists at our institution. The findings were documented with emphasis on the presence of arterial stenosis or occlusion and the anatomical level of disease. The collected data was systematically tabulated for subsequent analysis of correlations between peripheral vascular disease and various risk factors. The study was conducted after obtaining ethical clearance from the institutional review board.

For statistical analysis, study subjects were described using percentages. Continuous variables were described using means and standard deviations, while discrete variables were presented as percentages. Statistical analysis was performed using IBM SPSS Statistics-20. P-values ≤ 0.05 were considered statistically significant in all analyses. The chi-square test was employed to assess the significance of associations between categorical variables, while the t-test was used to compare means between groups.

RESULTS

Demographic Characteristics

The study included 73 patients, with 39 males (53.4%) and 34 females (46.6%). The mean age of the study population was 56.0±7.9 years (range: 39-72 years). Males had a mean age of 55.1±7.8 years, while females had a mean age of 57.1±8.0 years, with no statistically significant difference between genders ($p>0.05$) (Table 1).

Table 1: Age and Gender Distribution of Study Population

Age group	Males		Females		Total	
	Frequency	%	Frequency	%	Frequency	%
35-39	1	1.4	0	0.0	1	1.4
40-44	4	5.5	0	0.0	4	5.5
45-49	5	6.8	9	12.3	14	19.2
50-54	5	6.8	5	6.8	10	13.7
55-59	14	19.2	6	8.2	20	27.4
60-64	6	8.2	7	9.6	13	17.8
65-69	4	5.5	5	6.8	9	12.3
70-74	0	0.0	2	2.7	2	2.7
Total	39	53.4	34	46.6	73	100.0
Mean±SD	55.1±7.8		57.1±8.0		56.0±7.9	

Clinical Presentation

The most common clinical presentation was ulcer (56.2%), followed by cellulitis (26.0%), toe gangrene (9.6%), foot abscess (5.5%), and abscess (2.7%) (Table 2).

Table 2: Clinical Presentation of Diabetic Foot Infections

Diagnosis	Frequency	%
Abscess	2	2.7
Cellulitis	19	26.0
Foot Abscess	4	5.5
Toe Gangrene	7	9.6

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Ulcer	41	56.2
Total	73	100.0

Duration of Diabetes

Among the study participants, 58.9% had diabetes for less than 10 years, while 41.1% had diabetes for 10 years or more (Table 3).

Table 3: Duration of Diabetes

Years	Frequency	%
< 10	43	58.9
10+	30	41.1
Total	73	100.0

Tobacco Usage

Tobacco usage was significantly higher among males (38.5%) compared to females (8.8%) ($p<0.05$). Overall, 24.7% of the study population reported tobacco use (Table 4).

Table 4: Tobacco Usage by Gender

Tobacco Usage	Males		Females		Total		Significance
	Frequency	%	Frequency	%	Frequency	%	
Yes	15	38.5	3	8.8	18	24.7	χ^2=8.589, p=0.003
No	24	61.5	31	91.2	55	75.3	
Total	39	100.0	34	100.0	73	100.0	

Prevalence of Peripheral Arterial Disease (PAD)

The prevalence of peripheral arterial disease among the study population was 31.5% (23 patients), with 68.5% (50 patients) showing no evidence of PAD. The difference was statistically significant ($p<0.001$) (Table 5).

Table 5: Prevalence of Peripheral Arterial Disease

PAD	Frequency	%	Significance
Yes	23	31.5	χ^2=9.986, p=0.002
No	50	68.5	

Level of Vascular Involvement

Among patients with peripheral vascular disease, the most common patterns of involvement were D-ATA, D-PTA (6.8%) and DPA (6.8%), followed by D-PTA (4.1%), D-ATA (4.1%), and P-ATA, D-PTA (4.1%). Other patterns included P-ATA (2.7%), P-PTA (2.7%), and POP (2.7%) (Table 6).

Table 6: Level of Vascular Involvement

Levels	Frequency	Percentage
D-PTA	3	4.1
D-ATA	3	4.1
D-ATA, D-PTA	5	6.8
DPA	5	6.8
P-ATA	2	2.7
P-ATA, D-PTA	3	4.1
P-PTA	2	2.7
POP	2	2.7
No	48	65.8
Total	73	100.0

Note: D-PTA = Distal Posterior Tibial Artery, D-ATA = Distal Anterior Tibial Artery, DPA = Dorsalis Pedis Artery, P-ATA = Proximal Anterior Tibial Artery, P-PTA = Proximal Posterior Tibial Artery, POP = Popliteal Artery

Outcome Classification

The most common management approach was debridement (DB) (65.8%), followed by conservative management (CONS) (23.3%), disarticulation (D/A) (5.5%), disarticulation with debridement (D/A, DB) (2.7%), and incision and drainage with debridement (I&D, DB) (2.7%) (Table 7).

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Table 7: Treatment Outcomes

Outcome	Frequency	Percentage
CONS	17	23.3
D/A	4	5.5
D/A, DB	2	2.7
DB	48	65.8
I&D, DB	2	2.7
Total	73	100.0

Note: CONS = Conservative Management, D/A = Disarticulation, DB = Debridement, I&D = Incision and Drainage

Ankle-Brachial Pressure Index (ABPI)

The mean ABPI in the study population was 0.9±0.1, which was statistically significant. Among the study participants, 29% had mild ischemic changes, while 2.7% had moderate ischemic changes.

DISCUSSION

Diabetic foot-related problems are steadily increasing due to the high prevalence of diabetes mellitus in the Indian population. This study aimed to estimate the prevalence of peripheral vascular disease in patients with diabetic foot infections presenting to a tertiary care hospital.

In our study, the mean age of presentation for peripheral vascular disease was 55.1±7.8 years in males and 57.1±8.0 years in females, with an overall mean age of 56.0±7.9 years (range: 39-72 years). These findings are consistent with other studies in the literature. Aging increases the propensity for skin damage, decreases angiogenesis, and increases susceptibility to infection, all contributing to the development of diabetic foot complications.

Our study demonstrated a male predominance (53.4% vs. 46.6%), which aligns with findings from previous studies. The Rochester and Framingham studies also reported a higher prevalence of peripheral vascular disease in males compared to females [5].

Tobacco usage was significantly higher among males (38.5%) compared to females (8.8%) ($p<0.05$). A study by Tyagi et al. similarly demonstrated the significant influence of tobacco on peripheral vascular disease [6]. The vasoconstrictive effects of nicotine and endothelial damage caused by tobacco constituents likely contribute to the accelerated development of peripheral vascular disease in tobacco users.

The majority of patients in our study presented with ulcers (56.2%) and cellulitis (26.0%), with only 9.6% presenting with gangrene. The predominance of ulcers and cellulitis suggests that most patients sought medical attention at relatively earlier stages of diabetic foot infection.

Many studies have demonstrated a correlation between the duration of diabetes and peripheral vascular disease, with maximum prevalence observed between 1-10 years of diabetes duration. In a study by T. Rathnaganpathi et al., the duration of diabetes was predominantly 6-10 years [7]. Our findings, with maximum prevalence of peripheral vascular disease observed in patients with diabetes duration of less than 10 years, are consistent with these previous studies.

Diagnosing peripheral vascular disease in diabetic patients presents challenges due to the frequent absence of typical symptoms. The ankle-brachial index represents a widely used diagnostic test for identifying vascular compromise in asymptomatic patients. In our study, the mean ABPI was 0.9±0.1, which was statistically significant. We found that 29% of patients had mild ischemic changes, while 2.7% had moderate ischemic changes.

These findings align with a study by T. Rathnaganpathi et al., which measured ankle-brachial pressure index in diabetic foot ulcers and found that 29% of patients had ischemic changes, with 12% showing severe ischemia and 17% demonstrating mild to moderate ischemic changes [7].

The prevalence of peripheral vascular disease in our study was 31.5%, which is consistent with previous studies. Marinelli et al. reported a prevalence of 33% [8], Migdalis et al. found 44% [9], and Muthiah A et al. observed 38% [10]. The consistency across studies underscores the significant burden of peripheral vascular disease in diabetic foot infections.

Our study demonstrated a predominance of distal vessel involvement. Distal anterior tibial artery (D-ATA) involvement was observed in 6.8% of cases, and combined involvement of distal anterior tibial artery and distal posterior tibial artery (D-ATA & D-PTA) was seen in 6.8% of cases. These findings correlate with existing literature documenting the preferential involvement of distal smaller arteries in diabetic vascular disease. One prior study reported involvement of the anterior tibial artery, posterior tibial artery, and both in 88% of cases, with 55% showing involvement of both vessels [11].

The treatment outcomes in our study revealed that 23.3% of patients required conservative management, 65.8% needed debridement, and only 5.5% underwent disarticulation. These findings align with previous studies, which typically report that most amputations in diabetic patients are minor procedures involving the toes and feet rather than major lower extremity amputations.

CONCLUSION

A significant proportion (31.5%) of diabetic patients presenting with foot infections have underlying

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peripheral vascular disease at various levels. These patients may not always demonstrate obvious clinical signs of vascular compromise, highlighting the importance of routine vascular assessment in this population.

Our study confirms that older diabetic patients have a higher risk of peripheral vascular compromise. Additionally, tobacco usage and specific clinical presentations increase the likelihood of concurrent peripheral vascular disease. Treatment outcomes, particularly the need for amputation, are more likely to be unfavorable in patients with both diabetes and peripheral vascular disease.

Early detection of peripheral vascular disease in diabetic patients presenting with foot infections, using arterial Doppler studies and ankle-brachial pressure index measurements, along with comprehensive clinical and laboratory assessment, can significantly improve long-term care for these individuals. Our findings, consistent with previous studies, emphasize the importance of screening diabetics for peripheral vascular disease and implementing appropriate interventions to improve outcomes.

Furthermore, our study underscores the value of smoking cessation and lifestyle modifications in individuals with risk factors for diabetes and peripheral vascular disease. Implementing these preventive measures could potentially reduce the burden of diabetic foot complications and associated morbidity.

REFERENCES

1. Muhammad R Khamash, Kaled A. Obeidat. Prevalence of Ischemia in Diabetic Foot Infection. World J. Surg. 27; 797-799, 2003.
2. BriddgesRMcI, Deitch EA. Diabetic foot infections: pathophysiology and treatment. Surg. Clin. North Am. 1994; 74; 537-555.
3. Rieber GE, Vileikyte L, et al. Causal pathways for incident lower extremity ulcers in patients with diabetes. Diabetes Care 1999; 22:157-162.
4. Bernstein EF, Fronek A: Current status of non-invasive tests in the diagnosis of peripheral arterial disease. SurgClin North Am 62:473-487, 1982.
5. Brandman O, Redisch W: Incidence of peripheral vascular disease in diabetes mellitus. Diabetes 2: 194, 1953.
6. Tyagi A et al. Int Surgery J. 2018 Mar; 5(3):931-936.
7. T Rathnaganpathi, T Ragupathy. Clinical Evaluation of Peripheral Vascular Disease in Diabetic Foot Ulcer, J Res Med Dent Sci, 2021, 9(6):312-318.
8. Marinelli MR, Beach KW, Glass MJ. Non-invasive testing vs clinical evaluation of arterial disease, a prospective study. JAMA. 1997; 241:2031-34.
9. Migdalis IN, Kourti A, Zachariadis D, Samartzis M. Peripheral vascular disease in newly diagnosed non-insulin-dependent diabetics. IntAngiol. 1992; 11:230-32.
10. Muthiah A et al. A study on diabetic foot and its association with peripheral artery disease. Int Surgery J 2017 Apr; 4(4):1217-1221.
11. Strandness DE Jr, Priest RE, Gibbons GE: Combined clinical and pathologic study of diabetic and non-diabetic peripheral arterial disease. Diabetes 13:366, 1964.