<u>Original Research Article</u>

Prevalence of Peripheral Vascular Disease in Diabetic Foot Ulcer Patients

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Abstract:

Background: Peripheral vascular disease (PVD) is a major macrovascular complication of diabetes mellitus. Patients with diabetes mellitus have an increased prevalence of PVD. However, due to associated neuropathy, common symptoms such as claudication are often masked and such patients often diagnosed late when limb threatening ischemia has already set in. Arterial colour Doppler ultrasonography and ankle brachial pressure index are easy, non-invasive and often underutilised tools for diagnosis of PVD. Hence, there is a need for evaluation of peripheral vascular disease in all diabetics, especially those with diabetic foot by formulating effective management protocols, thereby limiting the morbidity, mortality and social costs associated with the disease.

Materials and Methods: This is a prospective, observational study involving 100 patients aged 18 or more years, presenting with diabetic foot in the Department of General Surgery, Jawaharlal Nehru Hospital and Research Center, Bhilai (C.G.) over a period of 18 months (September 2022 to February 2024).

Results: out of a total 100 patients with diabetic foot infection the prevalence of peripheral vascular disease in the entire population is 27%. The mean age was 51-60yrs with male preponderance and majority of them were smokers with or without other co-morbidities.

Conclusion: A strong suspicion of Peripheral vascular Diseases should be sought in patients with high risk factors associated with PVD, such as male gender, age >40 years, foot ulcer, duration of the diabetes and habitual smoking.

Keywords: Diabetic Foot, Peripheral Vascular Disease, Ankle Brachial Index, Colour Duplex Ultrasonography.

Introduction

The importance of diabetes mellitus as a cause of lower extremity disease was recognized well before the discovery of insulin. The surgical literature of the 19th century admonished that "gangrene occurring from trivial causes in persons presenting the appearance of usual health and in whom there is no evidence of atheromatous degeneration.

PAD is manifestation of atherosclerosis characterized by atherosclerotic occlusive disease of the lower extremities. The prevalence of peripheral vascular disease has been difficult to estimate and is around 13-45% in various studies. Framingham heart study revealed that 20% of symptomatic patients with PAD had diabetes but this probably underestimates the prevalence as most people with PAD are asymptomatic.[1] Diabetes, smoking, hypertension, advanced age, hyperlipidemia, elevated C-reactive protein, apolipoprotein, lipoprotein (a), fibrinogen and plasma viscosity are the risk factors for PAD.[2]

The mechanisms by which diabetes induces atherosclerosis are multifactorial and include inflammatory processes, derangements of various cell types within the vascular wall, promotion of coagulation, and inhibition of fibrinolysis. These factors both increase the susceptibility of the vasculature to atherosclerosis, as well as the instability that makes plaque prone to rupture and thrombosis. Thus, it is important to use a multidisciplinary approach to improve the clinical outcomes in this patient population. Diabetes is most strongly associated with femoro-popliteal and tibial occlusion i.e., below the knee PAD whereas smoking and hypertension are associated with more proximal disease in the aorto-ilio-femoral vessels. Diagnosing PAD early is very crucial, because it can reduce the functional disability and limb loss.

Also, very importantly it can identify a patient who is at high risk of developing a myocardial infarction or stroke.[3] Though the most common symptom

of PAD without sensory neuropathy is intermittent claudication, it can also present late with rest pain, ulcer in foot and gangrene of toe, foot or the entire leg. Critical limb ischemia (CLI) is a collective term including chronic ischemic rest pain, ulcers or gangrene attributable to objectively proven arterial occlusive disease.[4] On the other hand, patients with peripheral neuropathy will elicit subtle symptoms of slow walking velocity and easy leg fatigability which they usually attribute to getting older. Hence most of these diabetics experience worst kind of lower limb dysfunction at a later date as they are prone to develop sudden ischaemia of their lower limb due to arterial thrombosis. [4,5]

Aim:

To study the prevalence of peripheral vascular disease in the patient of diabetic foot ulcer. To study the prevalence of peripheral vascular disease in patients with diabetic foot infections and to see its effects on management outcomes. .To determine the prevalence of peripheral vascular disease by Duplex study of lower limb vessels, ABPI, pulse oximetry in patients with diabetic foot infections. To study the duration of hospital stay, healing rate, management outcomes in patients with diabetic foot infection.

Materials and Methods

This is a prospective, observational single centre study which was performed over a period of 18 months i.e., from SEPTEMBER 2022 to FEBRUARY 2024 in the Department of General Surgery, Jawaharlal Nehru Hospital and Research Center, Bhilai, Chhattisgarh. A total of 100 patients presenting with pain, swelling, ulcer and blackish discoloration of lower limbs were initially screened for the study eligibility and were explained the study procedure in their native language. Patients willing to participate and signed the informed consent document (patients or relatives for patients aged < 18 years) were enrolled in the study. Following enrollment, detailed history was obtained, physical examination was performed, and blood samples were withdrawn for performing laboratory and radiological investigations.

Inclusion Criteria: Patients aged 18 or more years, patients of either gender, patients with diabetic foot infections were included in this study.

Exclusion Criteria: Patients aged < 18 years, patients with previous history of peripheral arterial disease, patients with prior surgeries for arterial occlusive disease, patients with severe sepsis, ketoacidosis, and severely ill patients were excluded in this study.

Results

Age:

Table 1: Age

Age group	N (=100)	%
≤30	1	1%
31 – 40	4	4%
41 – 50	9	9%
51 – 60	31	31%
61 – 70	30	30%
71 – 80	25	25%

In our study the majority of the patients were in the age group of 51-60 years about 31 patients which was statistically insignificant (p value = 0.54)

Sex: In our study the male to female ratio is 1.5:1 which is statistically insignificant (p value= 0.45)

Table 2: Sex

Gender	N (=100)	%
Male	60	60%
female	40	40%

Presenting symptoms: In our study majority of the patients were presented with the complaints of abscess (36 patients) followed by swelling (35 patients) followed by gangrene (29 patients) which is statistically insignificant (p value= 0.13)

Table 3: Presenting symptoms

Presenting symptoms	N (=100)	%
Swelling	35	35%
Abscess	36	36%
Gangrene	29	29%

Years with diabetes: In our study maximum patients with diabetes were between 10 to 20 years (47) followed by less than 10 years (31) followed by 20-30 years (22) which is statistically insignificant.

Table 4: Years with diabetes

No of years with diabetes	N (=100)	%
0 – 10	31	31%
10 – 20	47	47%
20 – 30	22	22%

Addiction: In our study maximum of male patients were smokers (37) followed by tobacco chewers (17) whereas females were more of tobacco chewers (27) and non-smokers (0)

Table 5: Addiction

Bad habits	Male	Female
Smoking	37	0
Tobacco	17	27

USG findings and diagnosis: Out of 100 patients only 27 patients were having peripheral vascular disease rest were out of any vascular disease (73).

Table 6: USG findings and diagnosis

Ultrasound diagnosis	N (=100)	%
Presence of peripheral vascular disease	27	27%
absence of peripheral vascular disease	73	73%

ABPI: In this study there were more number of patients with ABPI >1 (44%) followed by patients with ABPI 0.8 – 1 (32%) followed by ABPI 0.5-0.8 (15%) followed by ABPI of 0-0.5 (9%).

Table 7: ABPI

ABPI	N (=100)	%
0 – 0.5	9	9 %
0.5 – 0.8	15	15 %
0.8 – 1	32	32 %
>1	44	44 %

Discussion

In this study we tried to evaluate the prevalence of peripheral vascular disease in patients presenting with symptoms of diabetic foot.

Age: The majority of belonged to age group of 51-60 years (30%) followed by 61-70 years (28%) followed by 71-80 years (23%) followed by 41-50 years (11%) followed by 31-40 years (4%) followed by 21-30 years (3%). The number of patients in our study was found to be above 50 years of age. This can also be explained by the fact that age-related atherosclerotic changes independent of diabetic status worsen with advancing age. Also the problem of late diagnosis of diabetes status seen in our region could explain the late diagnosis in elderly patients. Morbach et al [6] compared foot disease in Germany, India and Tanzania and found that German patients were significantly older (70.5 years) compared with those from Tanzania (51.4 years) and India (56.4 years). These studies were conducted in different centers that offer diabetes care of different qualities. This comparable mean age may suggest certain time-dependent risk factors in the evolution and course of diabetic foot ulcer disease which are common to diabetes in whatever environment. Age of onset of diabetes is also different in continents.

Sex: The majority were male (57%) and that of females were (43%). This is because peripheral vascular disease is more common in smokers. Male patients are more exposed to cigarette smoking while women were not exposed to cigarette smoking. While comparing with other studies, the result of my study is comparable to rest with higher incidence in males than in females.[7]

Presenting symptoms: The majority were presented with swelling and pain (41%) followed by presence of abscess foot (34%) and the least percentage presented with gangrene (25%). The reason why diabetic paatinets are involved are pathogenic process like abnormal biomechanics of foot , poor wound healing , peripheral neuropathy, repeated traumas mild pr severe. Sensory disorders cause abnormal weight bearing while walking leading to repeated calluses and ulcer. Motor and sensory neuropathy leads to abnormal mechanics of foot muscles and structural alterations (hammer toe, claw foot, and Charcot foot). Peripheral vascular disease are unnoticed in patients and these presenting symptoms leads to its diagnosis.

Years with diabetes: The majority were having diabetes for 11-20 years (47%) followed by <10 years with diabetes (31%) followed by 21-30 years (22%) with diabetes. Oyibo had demonstrated that the majority of diabetic patients with foot ulcers had clinical evidence of PAD and peripheral neuropathy. But in comparison, various studies have

shown steady and a significant rise in prevalence of PAD with duration of diabetes. [8] Diabetics are more likely to suffer from atherosclerotic vessels, which affect blood supply and tissue perfusion of any given area and hence in periphery, can result in ulcer formation.[9]

Addictions: In our study 37 males were individual smoker and 17 patients had a history of tobacco chewing. 27 female patients were also grouped under tobacco chewing category. Smoking is implicated in the etiology of peripheral vascular disease and is also seen to accelerate changes in diabetic individuals. Some studies [10] have found a stronger association between tobacco abuse and PAD than between tobacco abuse and ischemic heart disease. The cessation of smoking is accompanied by a reduction in the risk for PAD [11] and, although the risk for PAD in ex-smokers is 7 times greater than in non-smokers, the risk in active smokers is 16 times greater.[12]

Diagnosis based on USG: The patients diagnosed with peripheral vascular disease were 27% whereas the others didn't have any vascular compromise (73%). PAD is defined as clinical disorder where there is stenosis or occlusion of lower limbs arteries. Atherosclerosis is the main cause of PAD in people over 40. The risk of atherosclerosis increases notably in diabetics, and epidemiological studies have confirmed a link between diabetes and rise in PAD prevalence. Diabetes is associated with a two to fourfold increase in PAD incidence compared to non-diabetic individuals. PAD is an important predictor of ulceration of the foot in diabetic patients. Therefore, the surgeon who examines a patient with diabetes and foot ulcer should always assess the vascular status of lower limbs and specifically search for signs of ischemia. Nevertheless, PAD detection and the assessment of its severity is a clinical challenge in diabetic patients with foot disease, due to altered clinical presentation of PAD and limitations of the diagnostic procedures. Moreover, the healing of the wound in these patients is influenced not only by presence of PAD but also by factors like infection and presence of comorbidities. Previous epidemiological studies have demonstrated a higher incidence of peripheral arterial disease and poorer prognosis in diabetic patients compared with nondiabetic patients. [13,14] In a population-based study in KSA, PAD contributed to 30% of diabetic foot ulceration (DFU).[15]

ABPI index: In our study majority of the patients were with ABPI >1 (44) followed by 32 patients with ABPI 0.8 -1 followed by 15 patients with ABPI 0.5-0.8 and least number of patients were in group of ABPI 0-0.5 (9). In non-diabetic patients, measurement of the ABPI is the cornerstone of the evaluation of PAD.[16] However, in diabetic patients, non-compressibility of the lower leg arteries can occur as a result of media calcification

(Mönckeberg's sclerosis), which produces a falsely elevated ABPI.

Conclusions

In the present study we conclude that

- The prevalence of peripheral vascular disease in the patients admitted to our hospital preseted with syptoms such as swelling of the lower limb , abscess foot and ganrene were 27%. All the patients were diabetics with or without other co-morbidities.
- Males have a higher predilection for developing peripheral vascular disease than females.
- The older the individual, the higher are the chances of having peripheral vascular compromise. The average age of presentation of PAD in diabetics is 51-60 years.
- The longer the course of diabetes the more is the prevalence of patients developing peripheral vascular diseae.
- Assosciated factors include smoking and tobacco chewing.
- Diabetic foot ulceration constitutes a major source of morbidity and mortality among patients with diabetes.

This study and others in the past have consistently proved the benefits and need of investigating diabetics for peripheral vascular disease through clinical palpation for peripheral pulses and ankle brachial index. The use of Arterial Doppler along with clinical methods can be of great significance in the proper evaluation and appropriate management of these individuals. A multidisciplinary team approach targeting at good glycaemic control, education on foot care and appropriate footware, control of infection and early surgical intervention is required in order to reduce the morbidity and mortality associated with diabetic foot ulcers .

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