

Original research article

AN INVESTIGATION INTO THE CORRELATION BETWEEN DIABETIC FOOT AND PERIPHERAL ARTERY DISEASE

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Abstract

Background and Objectives: The term "diabetic foot" refers to a wide range of foot problems caused by diabetes or its consequences. Patients with diabetes have a diminished quality of life due to ulceration and amputation. Peripheral vascular disease (PAD) prevalence estimates have been inconsistent and challenging to obtain. Here at our hospital, we wanted to find out how often peripheral vascular disease occurs among diabetic patients who come in with foot difficulties.

Methods: The present clinical investigation was carried out at department of general surgery, Gandhi Medical College, Secunderabad. This study was done between the June 2022 to June 2023. 100 participants were included in this study. The study included all individuals with diabetes who met the specified criteria for inclusion and exclusion.

Results: A prevalence rate of 38% was observed for peripheral vascular disease among those diagnosed with Diabetes Mellitus. Numerous patients have no symptoms, and the prevalence of this condition is elevated within poorer socioeconomic groups. Males exhibit a greater inclination compared to females. Incidence rises as individuals become older. The femoro-popliteal section is the most prevalent level of arterial occlusion, followed by the tibial segment. Peripheral arterial disease has a substantial impact on the outcome of diabetic foot ulcers, leading to a higher proportion of amputations in these individuals. The prevalence of coronary artery disease and cerebrovascular disease is notably elevated in individuals with diabetes and peripheral artery disease. Consequently, PAD serves as an indicator of systemic vascular illness that affects both coronary and cerebral vessels, including myocardial infarction, stroke, and mortality.

Conclusion: The necessity and value of clinically palpating peripheral pulses and the ankle brachial index in the investigation of peripheral vascular disease in diabetics has been demonstrated time and time again by this and other studies.

Keywords: Ankle brachial index, diabetic foot, and peripheral vascular disease

Introduction

Diabetes mellitus is a prevalent global ailment, and its prevalence is continuously rising in India. Despite advancements in treatment choices for those with diabetes, a significant number of individuals still experience a range of complications associated with the condition. Diabetic foot complications are a common occurrence, often leading to severe outcomes such as the need for extremity amputations ^[1, 2].

Throughout the history of medicine, there have been numerous indications of foot disorders associated with diabetes and their historical therapy. A recently unearthed ancient Egyptian mummy was found with a missing toe, necessitating the usage of a leather toe prosthetic. The mummies of Ramses II provide evidence of the presence of calcific atherosclerosis in the leg veins circa 1200 BC ^[3, 4]. Hippocrates' book provides proof of treatment, including the removal of mortified parts for gangrene foot. The Book of Kings in the Bible contains a mention of King Asa, who experienced foot sickness and sought refuge with his forefathers. This event has been interpreted by many scholars as the earliest documented instance of diabetic foot gangrene in individuals with inadequately managed Type II diabetes ^[3-5].

The aetiology of atherosclerosis in individuals with diabetes is complex and involves multiple factors, such as inflammatory pathways, dysregulation of arterial wall cellular components, facilitation of coagulation, and suppression of fibrinolysis. These two variables contribute to the heightened vulnerability of the vasculature to atherosclerosis, as well as the decreased stability that renders plaque more susceptible to rupture and thrombosis. Therefore, it is imperative to employ a multidisciplinary methodology in order to enhance the clinical outcomes within this specific group of patients ^[6, 7]. The presence of diabetes is primarily linked to blockage in the femoro-popliteal and tibial regions, namely below the knee. Conversely, smoking and hypertension are related with illness in the aorto-ilio-femoral arteries, which are located closer to the knee. The early diagnosis of peripheral artery disease (PAD) is of utmost importance due to its potential to mitigate functional impairment and limb loss. Furthermore, it has the capability to detect a patient who is highly susceptible to experiencing a myocardial infarction or stroke. Intermittent claudication is the most prevalent sign of PAD without sensory neuropathy. However, it can also manifest later with rest pain, foot ulcers, and gangrene in the toe, foot, or entire leg ^[7, 9].

Diabetic people have a lifetime risk of developing foot ulcers ranging from 20% to 30%. Numerous studies have demonstrated that around 80% of lower limb amputations are preceded by the occurrence of foot ulcers. The risk of foot ulcers and amputations increases by a factor of 3 to 4 as the age and duration of diabetes increase. With the rising prevalence of diabetes, it is anticipated that there will be a growing number of lower extremity amputations in the future. The prompt identification of peripheral artery disease in individuals who do not exhibit symptoms significantly contributes to the mitigation of significant lower limb amputations and mortality. Therefore, it is imperative to assess peripheral vascular disease in individuals with diabetes, particularly those with diabetic foot, through the development of efficient management strategies ^[8-10].

This will help mitigate the adverse health outcomes, including morbidity, mortality, and societal burdens, associated with this condition. To investigate the frequency of

Peripheral Arterial Disease in the foot of individuals with diabetes. To investigate the mean age at which patient-acquired diabetes manifests. The objective is to examine the frequency of Coronary artery disease and Cerebrovascular accidents in diabetic patients with peripheral artery disease.

Materials and Methods

The present clinical investigation was carried out at department of general surgery, Gandhi Medical College, Secunderabad. This study was done between the June 2022 to June 2023. 100 participants were included in this study. The study included all individuals with diabetes who met the specified criteria for inclusion and exclusion. After documenting the relevant data according to the protocol, patients underwent a lower limb arterial Doppler scan and the results were recorded.

Inclusion Criteria

- All individuals with diabetes who have ulcerations on their feet.
- All individuals with gangrene toe.
- Diabetics who have abnormalities on their feet.

Exclusion Criteria

- Diabetics receiving corticosteroids.
- Non-diabetic ulcers.
- Diabetic ulcers concurrent with varicose veins.

Results

The study included a total of 100 patients that met the specified inclusion criteria. Among a cohort of 100 patients, 76 individuals exhibited foot ulcers, whereas 34 individuals experienced gangrene in either the toe or foot.

Table 1: The incidence of pad usage in relation to the length of diabetes

Sr. No.	Duration of diabetes (Yrs.)	Patients	%
1.	<1	2	2.0
2.	1 -10	25	25.0
3.	11 -20	23	23.0
4.	21 -30	35	35.0
5.	>30	15	15.0

The prevalence of peripheral artery disease (PAD) is highest among individuals with diabetes who have been diagnosed for 1-10 years, with a prevalence rate of 25% (25 cases out of 100). This is closely followed by a prevalence rate of 23% (23 cases out of 100) among those with diabetes who have been diagnosed for 11-20 years.

Table 2: Sex distribution

Sr. No.	Sex	Number	%
1.	Male	53	53%
2.	Female	47	47%

The study found that males with diabetic foot had a higher prevalence of PAD, with an incidence of 53%, compared to females who had an incidence of 47%.

Table 3: Peripheral artery disease distribution

Sr. No.	Site	Number	%
1.	Aorto - iliac	5	5.0
2.	Iliac	4	4.0
3.	Femoral	11	11.0
4.	Femoro - popliteal	50	50.0
5.	Popliteal	16	16.0
6.	Tibial	14	14.0

The most frequent occlusions occur in the femoro-popliteal segment, followed by the tibial segment of the arterial tree, in diabetic foot associated with peripheral arterial disease (PAD).

Table 4: Surgical interventions performed

Sr. No.	Procedures	Number	%
1.	Debridement	21	36.84
2.	Amputation / Disarticulation	58	49.12
3.	Revascularisation	7	12.28

Approximately 58 individuals with diabetes foot who had peripheral artery disease (PAD) had amputation, as contrast to diabetic foot patients without PAD. Diabetic foot patients with PAD exhibited a higher incidence of amputation. Diabetic foot patients with PAD experience a notable rise in CAD and CVA. Out of 57 diabetic foot patients with PAD, 11 patients were found to have concomitant CVA/CAD. In diabetic foot patients with PAD, the occurrence of related CVA/CAD was 19.29%, whereas in diabetic foot patients without PAD, it was 7.52%.

Discussion

The prevalence of diabetes mellitus in India has led to a steady increase in diabetic foot-related complications. India ranks second globally in terms of prevalence, with a figure of 65.1 million individuals, accounting for almost 7.1% of the adult population. The figure presented above illustrates the challenges associated with estimating the

frequency of peripheral artery disease (PAD) in individuals with diabetes. This difficulty arises from the diverse range of presentations observed, which encompass numbness resulting from neuropathy, claudicating pain, ulceration, and gangrene. The prevalence of our study is 38%, which is higher than the prevalence of 33% and 44% reported in previous studies. Exactly 57 out of 100 individuals exhibited peripheral arterial disease (PAD) in relation to diabetic foot. Underestimation of the high prevalence of PAD is a common occurrence. The occurrence of subclinical PAD is frequently overlooked due to the presence of asymptomatic patients in the study. In our investigation, the ankle brachial index and doppler were employed to detect even subclinical cases ^[8-10].

The maximal duration of PAD, as determined by the length of diabetes, is within the range of 1 to 10 years. The prevalence of the condition is 16%, with a prevalence of 14% seen within a timeframe of 11-20 years. In contrast, multiple studies have demonstrated a consistent and substantial increase in the prevalence of peripheral artery disease (PAD) as the duration of diabetes increases (36). This phenomenon can be ascribed to the limited sample size of 73 individuals, consisting of 100 instances. The number of cases reported within the 11-20 year period and 21-30 year duration was found to be 19 and 17, respectively. The duration of diabetes between 1 and 10 years is 0 to 45. The study group consisted of 73 tiny instances, with 100 cases reported over a length of 11-20 years and 17 cases reported over a duration of 21-30 years ^[11-13].

Upon examining the occurrence of peripheral arterial disease (PAD) in diabetic foot patients based on gender, my research indicates that it is more prevalent in males compared to females. In contrast to previous research, the findings of my study demonstrate a similar pattern, indicating a higher prevalence of the condition in males compared to females (36). This finding is consistent with the available evidence, which indicates a higher prevalence of peripheral arterial disease (PAD) in diabetic foot among males ^[14-16].

Upon conducting an analysis of the data, it is evident that amputations in our institution surpass revascularizations, a finding that aligns with the findings of the Zagreb study. In contrast to the research conducted by Zagreb *et al.*, the observed percentages of amputations exhibit a higher magnitude. Several patients who underwent amputations had stage 4 peripheral venous disease (PVD) and had an additional infection. Furthermore, due to the predominantly low socioeconomic class of our patients, encompassing individuals from the lower middle, higher lower, and lower socioeconomic strata, their understanding of the disease was limited, resulting in delayed presentation ^[17-19].

The majority of amputations are minor, namely affecting the toe and foot. This is comparable to the findings of the Zagreb study, but with a slightly larger percentage. This is because our analysis indicates that the level of occlusion is highest in the femoro-popliteal and tibial vessels. Our institution exhibits a much greater rate of above knee amputations in comparison to the study conducted in Zagreb. The prevalence of peripheral artery disease (PAD) varies according on socioeconomic position, with lower socioeconomic groups exhibiting higher rates. This finding can be supported by the observation that risk factors such as smoking and diabetes are more prevalent among individuals in lower socioeconomic groups. The prevalence of PAD is higher in lower socioeconomic categories, as indicated by a population-based study

conducted by Knut Kroger *et al.* and the Goteborg MONICA project. Furthermore, behavioural risk factors such as health awareness and treatment adherence can be linked to the higher occurrence of peripheral artery disease (PAD) in diabetic foot [20-22].

Conclusion

According to this study, 38% of patients with diabetic foot also have peripheral vascular disease. It is important to thoroughly examine all patients, even if they do not exhibit any symptoms or visible indicators of PVD. Peripheral vascular disease is more common in men than in women. The likelihood of peripheral vascular impairment increases with age. In diabetics, PAD often manifests between the ages of 40 and 60. The tibial segment and the femoro-popliteal segment are the most common levels of arterial occlusion in diabetic feet associated with PAD. A greater rate of amputations is observed in patients with PAD, suggesting that PAD considerably affects the outcome of diabetic foot ulcers. PAD is an indication of systemic vascular disease affecting coronary and cerebral vessels, such as myocardial infarction, stroke, and death, because the risk of CAD and CVA is substantially higher in diabetic foot patients with PAD. People from lower socioeconomic backgrounds are more likely to suffer from PAD. The necessity and value of clinically palpating peripheral pulses and the ankle brachial index in the investigation of peripheral vascular disease in diabetics has been demonstrated time and time again by this and other studies. In order to properly evaluate and manage these individuals, Arterial Doppler in conjunction with clinical approaches might be extremely helpful.

Funding

None.

Conflict of Interest

None.

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