

## Original Research Article

# Prevalence of peripheral artery disease in diabetes mellitus: research article

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### ABSTRACT

**Background:** Peripheral artery disease is a major macrovascular complication of diabetes mellitus. Patients with diabetes mellitus have an increased prevalence of PAD. The ankle brachial pressure index is an easy, non invasive and often under utilised tool for diagnosis of PAD.

**Methods:** In the present study, 100 patients from Western Uttar Pradesh with diabetes mellitus were enrolled to find out prevalence of peripheral vascular disease using ankle brachial pressure index and study the associated risk factors.

**Results:** 59 percent of the subjects were female and 41 percent were male. Ankle-brachial index (ABI) examination of patients indicated Abnormal (ABI= <0.9), in 40 cases.

**Conclusions:** it can be concluded that peripheral vascular disease in Diabetes Mellitus is more commonly associated than is generally believed.

**Keywords:** Ankle brachial pressure index (ABPI), Diabetes, PVD

### INTRODUCTION

Peripheral artery disease (PAD) is defined as atherosclerotic occlusive disease of lower extremities. PAD is associated with increased risk of lower extremity amputation and is also a marker for atherothrombosis in cardiovascular, cerebrovascular and renovascular beds. Patients with PAD therefore have an increased risk of MI, stroke and death.<sup>1</sup> Additionally, PAD causes significant long-term disability in diabetic patients. PAD can be clinically identified by intermittent claudication and/or absence of peripheral pulsations in the lower extremities.<sup>2</sup> With the use of doppler technology and ankle brachial pressure index measurement, peripheral artery disease can be identified non invasively before clinical manifestations.

Peripheral vascular disease is a major macrovascular complication of diabetes mellitus. Because of the unique

involvement of distal pattern of vessels and invariable association with neuropathy, peripheral arterial disease in diabetics presents late, having already developed limb threatening ischaemia.<sup>3</sup> In the present study, 100 patients with diabetes mellitus were enrolled to find out prevalence of peripheral vascular disease using ankle brachial pressure index and study the associated risk factors.

### METHODS

This prospective observational study was carried out at the Department of Medicine at Subharti Medical College, Swami Vivekanand Subharti University, Meerut, India. Patients of all age group presented with Diabetes Mellitus in the department of medicine and admitted to the hospital were studied during the study period from June 2015 to May 2017.

The sample size was estimated on the basis of a single proportion design. The target population from which we randomly selected our sample was considered 20,000. We assumed that the confidence interval of 9.8% and confidence level of 95%. The sample size actually obtained for this study was 100 patients. The study population was drawn from patients who presented to Department of Medicine at Subharti Medical College, Swami Vivekanand Subharti University, Meerut. There were 100 patients, who were diagnosed and admitted in the department of medicine in the hospital with diabetes mellitus. The research procedure followed was in accordance with the approved ethical standards of Subharti Medical College, Swami Vivekanand Subharti University, Meerut, Ethics Committee.

All patients diagnosed with Diabetes Mellitus by ADA 2014 criteria were included in the study.<sup>4</sup> Patients with Limb amputation proximal to head of metatarsal of one or both lower limb and amputation proximal to wrist of one or both arms, with limb wounds or ulcerations proximal to metatarsal head in the lower limb, with prior bypass surgery to the lower limb arteries, patients with acute limb ischemia on cuff inflation and patients not consenting to participate in the study were excluded.

A written consent was taken from all potentially eligible subjects and excluded from the study if they were not matched with inclusion criteria of the study. Detailed history and physical examination was performed and recorded on predesigned proforma from each patient. Patient's personal history, physical examination findings like the blood pressure (BP), age, height (cms), weight (kg), BMI (kg/m<sup>2</sup>), presence and quality of the lower limb pulses on palpation, presence of ulcers/gangrene on inspection, calculated ABI, patients clinical history (age at initial diagnosis of DM, duration of DM, family history of diabetics, current medical therapy, history of hypertension (HT) and history of symptoms of intermittent claudication), associated symptoms, , Occupation, smoking history, duration of hypertension, alcoholic habit, blood sugar level, developmental history and laboratory measurement (HbA1c) were recorded.

All patients had standard anthropometric measurements of height in metres (m) and weight in kilograms (kg) for calculation of BMI using the formula:

$$\text{BMI} = \text{weight in kg} / \text{height in m}^2$$

Normal BMI, overweight and obesity were defined as BMI of 18–24.9, 25–29.9 and  $\geq 30$  kg/m<sup>2</sup> respectively.

A detailed physical examination of the peripheral lower limb was also performed (palpation for quality of foot pulses and clinical inspection for any skin colour, hair and nail changes, temperature variations and for presence of ulcerations and gangrene). A resting ABI of each lower limb was then determined in supine position using a portable Doppler machine with a 5-8MHz probe for

peripheral vessels. Blood pressure cuffs were placed bilaterally on the upper arm (brachial pressure) and at the ankle just above the medial malleoli.

An ultrasound transducer was used to locate the arterial Doppler signals distal to the blood pressure cuffs. The Doppler signal from the brachial artery was used to obtain the arm pressure while that from the dorsalis pedis and posterior tibial arteries was used to obtain the ankle pressure. The higher systolic pressure of the anterior dorsalis pedis or posterior tibial measurement for each foot was divided by the highest brachial systolic pressure to obtain the ABI for each limb.

**Statistical analysis**

Data was analyzed using Statistical Package for Social Sciences, version 20 (SPSS Inc., Chicago, IL). Results for continuous variables are presented as mean±standard deviation, whereas results for categorical variables are presented as number (percentage). Statistic Sensitivity, Specificity (Positive and Negative Predictive) was calculated on 95% CI. The level P <0.05 was considered as the cutoff value or significance.

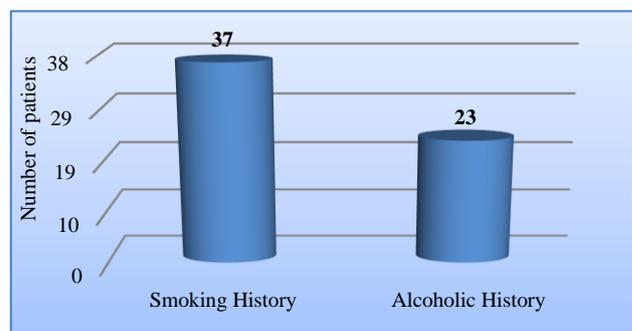
**RESULTS**

Demographic profile of the 100 patient enrolled for study was mentioned in the table.

**Table 1: Demographic characteristics.**

Demographic	Mean±SD (N=100)
Age (year)	58.21±9.81
Height (cm)	164.30±5.5
Weight (kg)	68.59±10.3
BMI (Kg/M <sup>2</sup> )	25.45±3.9
Waist circumference (cm)	102.96±5.54
Gender	Male 41 (41.0)
	Female 59 (59.0)

Mean age of patients was 58.21±9.81 (year), mean height was 164.30±5.5 (cm), mean weight was 68.59±10.3 (kg), mean BMI was 25.45±3.9 (Kg/m<sup>2</sup>) and mean Waist Circumference was 102.96±5.54 cm. The male and female ratio was 41: 59 (Table 1).



**Figure 1: Smoking and alcoholic habits of patients.**

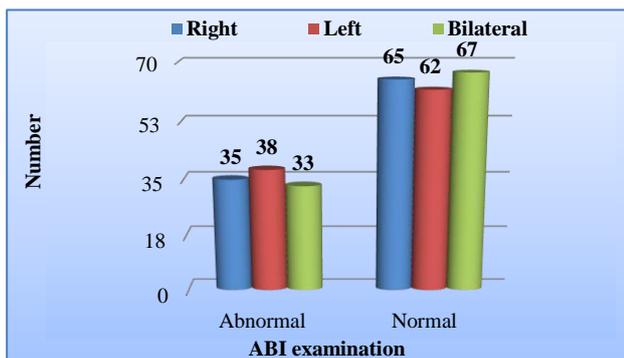
Among 100 Patients enrolled for study, 37 were smokers and 23 others had Alcoholic history as recorded in the table (Figure 1).

**Table 2: Lower limb examination findings.**

Lower Limb examination	Number of patients (%) (N=100)
Intermittent claudication	41(41.0)
Diminished foot pulses	19 (19.0)
Thickened nails	16 (16.0)
Cold feet	12 (12.0)
Atrophy of subcutaneous fat	8 (8.0)
Loss of hair	8 (8.0)
Shiny skin	6 (6.0)
Rest pain	2 (2.0)
Nocturnal pain	1 (1.0)

Lower limb examination revealed, Intermittent claudication in 41 (41.0%) cases, Diminished foot pulses in 19 (19.0%) cases, Thickened nails in 14 (14.0%) cases, Cold feet in 9 (9.0%) cases, Atrophy of subcutaneous fat in 8 (8.0%) cases, Shiny skin in 3 (3.0%) cases, Loss of hair in 2 (2.0%) cases, Rest pain in 2 (2.0%) cases, Nocturnal pain in 1 (1.0%) cases and Ulcers and gangrene in 1 (1.0%) cases (Table 2).

Ankle-brachial index (ABI) examination of patients indicated Abnormal (ABI= <0.9), in 40 cases. Right side Abnormal was in 35 cases, Left side Abnormal was in 38 cases and Bilaterally Abnormal was in 33 cases. As for normal (ABI= >0.9) cases Right side Normal were in 65 cases, Left side Normal were in 62 cases, and Bilaterally Normal was in 67 cases. Total normal ABI cases were 60 only (Figure 2).



**Figure 2: Distribution of ABI of studied patients.**

While 40 (40%) patients were afflicted with Peripheral vascular disease (PVD), 60 percent were free from such an ailment.

**DISCUSSION**

Cardiovascular diseases (CVD) are a major cause of morbidity and mortality in adult patients with diabetes mellitus (DM). Macro vascular complications like stroke,

myocardial infarction and PAD tend to occur earlier in diabetics compared to non diabetics.<sup>5</sup>

PAD is a manifestation of widespread systemic atherosclerosis characterized by atherosclerotic occlusive disease of the lower extremities and is one of the macro vascular complications highly prevalent in adult diabetic patients. The majority of diabetic patients with PAD have concomitant coronary artery disease and a significant burden of morbidity and mortality in these patients is intimately associated with myocardial infarction, ischemic stroke or sudden cardiovascular death.<sup>6-8</sup> Epidemiologic data has shown a strong association between PAD and DM. Other notable traditional risk factors of PAD include smoking, increasing age, hypertension and hyperlipidemia and ethnicity.<sup>9</sup> This implies that a significant proportion of diabetic patients remain undiagnosed and are at risk of foot complications like foot ulceration and gangrene and CVD.

The noninvasive techniques like Ankle Brachial Pressure Index (ABPI) and Duplex ultrasonography are coming to the forefront for early diagnosis of PVD. ABI is the ratio of the peak systolic pressure in the ankle and brachial artery. It is a quick, reliable and sensitive method to detect subclinical disease.<sup>10</sup>

Screening for PAD by measuring the ABI, which is the ratio of the tibial systolic artery pressure to brachial systolic artery pressure is preferred to clinical inspection of lower limbs and palpation of the feet pulses. ABI measurement is a non-invasive procedure performed using a Doppler ultra sound device and has a 95% sensitivity and 100% specificity for diagnosing PAD compared to the gold standard angiography. An ABI of less than 0.9 is diagnostic of PAD. The normal range is between 0.9 and 1.1 while values  $\geq 1.3$  signify non compressible or calcified peripheral arteries.<sup>11</sup>

In the present study, mean age of patients was  $58.21 \pm 9.81$  (year) and male female ratio was 41:59. Similarly, Mwebaze RM et al conducted a study and they found  $53.9/12.4$  years age (mean age/ standard deviation) of the study participants with the youngest and oldest being 30 years and 81 years respectively. Eighty seven (59.6%) participants were  $\geq 50$  years.<sup>12</sup> An Indian study done by Premalatha, G et al reported mean age of the study group was  $59.5 \pm 10.1$  years and the mean duration of diabetes was  $11.7 \pm 8.1$  years which was similar to present study.

Few studies findings were reported by various researchers in India regarding female preponderance in Indian diabetics similar to present study as reported by Ramaiya et al, Ramachandran et al and Lipscombe LL et al.<sup>13-15</sup> The response rate among men was relatively less compared to that among women because of lower participation rate of young and middle aged men, who represent the major workforce in the community. This lower participation of men compounds the gender ratio of participants further in favour of females, from an already

female -favourable ratio in the population. The higher proportion of elderly men among respondents may be an artifact due to relatively less participation of young and middle aged men.

Peripheral vascular disease is common in diabetic patients and is responsible for a substantial proportion of morbidity in Diabetes. The purpose of this study was to study the clinical features of PVD in patients with DM and then to investigate the association of ABI and CDU in those patients presenting with DM in Subharti medical college, Meerut. Present study shows prevalence of Peripheral vascular disease (PVD) was 40 (40%) in diabetic patients using ABI measurement.

Similarly, Mwebaze RM et al reported a prevalence of PAD of 39% in the study population.<sup>12</sup> Majority of the study participants had symptomatic PAD (59.6%) and mild obstruction (99.3%) according to the ABI measurement. Asymptomatic PAD was noted in 41.4% of the study participants. The presence of symptoms of intermittent claudication and microalbuminuria were significantly associated with PAD.

This documented prevalence is higher than what is reported from other regions of India and other developing countries. Data from the Framingham Heart study revealed a prevalence of symptomatic PAD of 20% in adult diabetic patients.<sup>16</sup> In the Bypass Angioplasty Revascularization Investigation 2 Diabetes (BARI 2D) Trial another large study to examine the magnitude of ABI abnormalities in 2,240 diabetic patients with coronary artery disease, low ABI was found in 19% of the patients.<sup>17</sup>

An Indian study done by Bembi V et al reported 24% prevalence of PAD in diabetics.<sup>18</sup> Using ABI to identify PAD, the prevalence of PAD in people with DM over 40 years of age has been estimated to be 20% as reported by Elhadd TA et al.<sup>19</sup> This prevalence increases to 29% in patients with DM over 50 years of age. The severity and duration of DM are important predictors of both the incidence and the extent of PAD, as observed in United Kingdom Prospective Diabetes Study, where each 1% increase in glycosylated hemoglobin was correlated with a 28% increase in incidence of PAD, and higher rates of death, microvascular complications and major amputation as reported by Selvin E et al and Jude EB et al.<sup>20,21</sup>

Dick F et al reported the prevalence of concomitant PAD and DM is especially high in those patients who have critical lower limb ischemia, with more than 50% of patients with critical limb ischemia (CLI) also having DM.<sup>22</sup>

## CONCLUSION

From the present study it can be concluded that peripheral vascular disease in Diabetes Mellitus is more commonly associated than is generally believed.

Atherosclerosis of the peripheral vessels is also associated with generalized atherosclerotic changes in the coronary and vascular beds. It is also associated with significant mortality and morbidity. Hence early detection of peripheral vascular diseases should be attempted to evaluate a proper treatment guideline for patients with diabetes.

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