

## Original Research Article

# Prevalence of peripheral neuropathy and peripheral artery disease in diabetic patients attending a tertiary care hospital

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### ABSTRACT

**Background:** Foot complications are one of the most devastating complications among diabetes all over the world. Both Diabetic Peripheral Neuropathy (DPN) and Peripheral Artery Disease (PAD) are responsible for diabetic foot complications. Aim of this study is to screen diabetic patients for both DPN and PAD.

**Methods:** This is a cross-sectional study covering 200 diabetic patients attending a Teaching Hospital. Prevalence of DPN was assessed using Biothesiometer and PAD by measuring the Ankle Brachial Index using handheld Doppler.

**Results:** 49.5% had DPN and 19.5% had PAD. 13% had both PAD and DPN. Most of the subjects were in 51-60 years age group constituting 36.5%. 61.5% were females. 69.5% had diabetes for more than 10 years. 88% had their HbA1C of more than 6.5%.

**Conclusions:** The prevalence of PVD is multi-fold higher in patients with diabetes with smoking, hyperglycemia, hypertension, dyslipidemia, as major risk factors. Ankle, brachial pressure index, is useful in identifying PVD and it needs further evaluation by an arterial color Doppler and digital subtraction angiography.

**Keywords:** Biothesiometer, Diabetic peripheral neuropathy, Diabetes mellitus, Doppler evaluation, Peripheral artery disease

### INTRODUCTION

Diabetes mellitus is a global health emergency. As of 2016, 422 million people had diabetes worldwide, up from an estimated 382 million in 2013 and 108 million in 1980.<sup>1</sup> Diabetes currently affects more than 62 million Indians, which is more than 7.1% of the adult population. Nearly 1 million Indians die due to diabetes every year.<sup>2</sup> According to Indian Heart Association, India is projected to be home to 109 million individuals with diabetes by 2035.<sup>3</sup> Diabetic Peripheral Neuropathy (DPN) is the major causal factors in the development of foot ulceration among diabetic subjects. They have a seven-fold increased risk of foot ulcerations.<sup>4</sup> The diabetic foot at risk is one that has developed any of the features of neuropathy or Peripheral arterial disease before

ulceration. Given the inconsistencies associated with the symptoms of PAD, the measure of ABI (Ankle Brachial Pressure Index) is an objective relatively simple, noninvasive and inexpensive technique employed in the evaluation of PAD.<sup>5</sup> As We know that both PAD and DPN are causes for foot morbidities in diabetics, our aim in this study was to assess the prevalence of both PAD and DPN in diabetic population.

### METHODS

The study was conducted over a period of 3 months from June 2018 till August 2018. About 200 diabetic patients attending a Tertiary Care Hospital in Kancheepuram district of Tamilnadu, were included. Institutional ethical committee clearance was made. The demographic data of

the patient who met the inclusion criteria were recorded using a questionnaire. Height and weight of the patient were measured using a stadiometer and weighing machine respectively. Blood pressure was measured using Diamond Mercury Sphygmomanometer.

**Inclusion criteria**

Diabetic patients between the age of 25-75years, who were willing to participate in the study were included.

**Exclusion criteria**

- Critically ill patients.
- Neuropathy due to other diseases like environmental toxins, nerve root compression, CVA, Hypothyroidism, Leprosy, Guillain Barre syndrome, chronic alcoholism, nutritional deficiencies and side effects of certain medications.
- Patients with limb amputation proximal to head of metatarsal of one or both lower limbs and amputation proximal to the wrist of one or both arms.
- Patients with limb wounds or ulceration proximal to metatarsal head in the lower limb.
- Prior bypass surgeries to lower limb arteries.
- Patients with acute limb ischemia on cuff inflation.

**Vibration perception threshold**

Presence of DPN in a patient was assessed using Biothesiometer which measured the vibration Perception Threshold. It consists of a handheld unit with a rubber tractor that vibrates at 100Hz. The voltage range of the machine is 0-50 volts. The stylus was kept on the tip of the great toe, perpendicular to the surface. The voltage was gradually increased or decreased and the optimum voltage which patient-perceived was recorded. A mean of three readings in each foot was used. Biothesiometer values of more than 15 volts in either of both of the lower limbs were defined as having peripheral neuropathy.

**ABI (Ankle Brachial Pressure Index)**

Handheld life Doppler from Wallach Surgical Brand, Diabetic foot care was used to measure ABI.

The ABI was performed measuring the systolic blood pressure form both brachial arteries and from both dorsal pedis and posterior tibial arteries after the patient has been at rest in the supine position for 10 minutes.

ABI was then calculated in each leg, using the formula,

$$\text{Right AB} = \frac{\text{Highest pressure in Right Foot.}}{\text{Highest pressure in both arms.}}$$

Normal ABI ranges from 1.0-1.4. Values above 1.4 suggest noncompressible calcified vessel. A normal below 0.9 was considered diagnostic of PAD.

**Statistical analysis**

Using SPSS version 16 the data was analyzed in terms of descriptive statistics as well as bivariate analysis (Chi-Square test). Independent sample students t-test was used to compare quantitative data. X<sup>2</sup> was used to test for differences in proportions. P<0.05 was considered evidence of the statically significant difference between predictive and outcome variables. Odds ratio (ORs) and corresponding 95% confidence intervals (CIs) were reported.

**RESULTS**

Table 1 shows the study population was at the age of 25-75 years. Among them 36.5% were in the age group of 51-60 followed by 27% of 41-50 years age group, 22.5% of 61-70 years age group and 8.5% of 31-40 years age group.61.5% of the study population were females.69.5% had less than 10 years of diabetes duration.

Most of them were not having good glycemic control. 88% had HbA1C >6.5% 51.5% were obese and 24.5% were overweight depending upon their Body Mass Index.

Table 2 Shows When considering the characteristics of patients who had both DPN and PAD, age more than 50, female sex, duration of diabetes more than 10 years, HbA1c more than 6.5% and BMI more than 23 were found to be associated with the defect.

**Table 1: Characteristics and diabetes pattern among sample population.**

		N	%
Age group	31-40	17	8.5
	41-50	54	27
	51-60	73	36.5
	61-70	45	22.5
	>70	11	5.5
Sex	Male	77	38.5
	Female	123	61.5
Duration of diabetes	<10 years	139	69.5
	>10 years	61	30.5
HBA1C	<6.5	24	12
	>6.5	176	88
Body mass index	Normal	36	18
	Overweight	49	24.5
	Obese	103	51.5
	Morbidly obese	12	6

**Table 2: Association between DPN and PAD with diabetes pattern.**

Characteristics of patient		PAD & PN		OR(CI)	Chi-square & p-value
		Present	Absent		
Age group	<50 Years	4	67	0.368 (0.119-1.124)	X <sup>2</sup> =3.437 P=0.035
	>50 Years	18	111		
Sex	Male	4	73	0.319 (0.103-0.983)	X <sup>2</sup> =4.310 P=0.018
	Female	18	105		
Duration of diabetes	<10 years	18	121	2.119 (0.686-6.550)	X <sup>2</sup> =1.769 P=0.094
	>10 years	4	57		
HbA1C	HbA1C < 6.5	0	22	0	X <sup>2</sup> =3.371 P=0.025
	HbA1C>6.5	24	154		
BMI	BMI <23	2	34	0.423 (0.094-1.89)	X <sup>2</sup> =1.329 P=0.131
	BMI >23	20	144		

**Table 3: Prevalence of peripheral neuropathy.**

Peripheral neuropathy	Frequency	Percentage
PN Present	83	41.5
PN Absent	117	58.5
Total	200	100

Table 3 shows that among the 200 study population whose vibration perception threshold was measured using biothesiometer, 41.5% had peripheral Neuropathy and 58.5% does not show signs of peripheral neuropathy which was found to be statistically more significant.

**Table 4: Prevalence of peripheral arterial disease.**

Peripheral arterial disease	Frequency	Percentage
Pad present	39	19.5
Pad absent	161	80.5
Total	200	100

Table 4 shows that among the 200 study participants, 19.5% of the patients had PAD as per their ABI measurements. Most of the PAD patients in this study were symptomatic (80.5%).

Table 5 shows Though individually DPN prevalence among the study group was 41.5% and PAD prevalence was 19.5%, the presence of both DPN and PAD was present in 13% of the study population.

**Table 5: Peripheral neuropathy and peripheral arterial disease.**

Peripheral neuropathy and peripheral arterial disease	Frequency	Percentage
Both present	26	13
Both absent	174	87
Total	200	100

## DISCUSSION

Diabetes causes a wide variety of acute, chronic, focal and diffuse neuropathy syndromes. By far, the most common is DPN, which accounts for 75% of diabetic neuropathy.<sup>6</sup> The other patterns of nerve injury include autonomic neuropathy, cranial neuropathy, mononeuritis multiplex, mononeuropathy, Radiculo Plexus neuropathy, diabetic neuropathic cachexia, and treatment-induced neuropathy.<sup>7</sup> DPN has been defined by the Toronto Consensus Panel on Diabetic Neuropathy as asymmetrical, length-dependent sensorimotor polyneuropathy attributable to metabolic and micro vessel alterations as a result of chronic hyperglycemia exposure and cardiovascular risk covariates.<sup>8</sup> The pathophysiological processes included in DPN are toxic adiposity, oxidative stress, mitochondrial dysfunction, activation of the polyol pathway, accumulation of advanced glycation end products and elevation of inflammatory markers.<sup>9</sup> The true prevalence of PAD in people with diabetes has been difficult to determine, as most patients are asymptomatic, many do not report their symptoms, screening modalities have not been uniformly agreed upon, and pain perception may be blinded by the presence of peripheral neuropathy.<sup>10</sup> PAD is atherosclerosis leading to narrowing of the major arteries distal to aortic arch. It can involve both upper and lower extremities. Progressive occlusion results in arterial stenosis, reduced blood flow and claudication, the most common presenting symptom. Only 10% of patients with PAD have classic claudication; others have atypical leg pain (50%) or are asymptomatic (40%).<sup>11</sup> In our present study, about 41.5% of diabetic patients had peripheral Neuropathy when measuring their vibration perception threshold using biothesiometer. A similar study concluded that the prevalence of peripheral neuropathy was 34.9% with VPT.<sup>12</sup> Many other studies prove the prevalence of Peripheral neuropathy as between 30-40% using biothesiometer.<sup>13</sup> Prevalence of PAD was 19.5% in our study group, as per the ABI measurement values.

Studies also come to a conclusion that prevalence of PAD in diabetics was around 20% and ABI measurement was a very useful tool in screening for PAD.<sup>14</sup> Prevalence of both PAD and DPN in our subjects was 13%. The prevalence of both DPN and PAD in diabetic patients are on the high and they need to be screened in all diabetic patients.<sup>15</sup> There was no statically significant association between various determinants like age, duration of diabetes, HbA1C levels, BMI and the prevalence of PAD and DPN among the study subjects.<sup>16,17</sup>

## CONCLUSION

The prevalence of diabetic peripheral Neuropathy and Peripheral Artery disease is significantly high among diabetic populations. By employing simple screening procedures like measuring vibration perception threshold using Biothesiometer and Ankle-brachial Index using Handheld Doppler, the lower limb morbidities in the diabetic population can be prevented and awareness among patients regarding foot care practices can be made.

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