Original Research Article

Prevalence of peripheral artery disease in diabetic patients of a tertiary care hospital

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ABSTRACT

Background: Peripheral Arterial disease (PAD) is a major microvascular complication of diabetic mellitus. Patients with diabetes have an increased prevalence of PAD. The Ankle branchial Index (ABI) is an easy, noninvasive and often underutilized tool for diagnosis of PAD. The aim of this study is to detect the prevalence of PAD in diabetic patients using Ankle Brachial Index (ABI). Since most of the patients with PAD are asymptomatic, routine screening for the same is necessary to avoid lower limb ulcerations and amputation.

Methods: In this cross-sectional study, 200 diabetic patients attending a tertiary care hospital in the Kancheepuram district of Tamilnadu were screened for the prevalence of PAD using ABI and to find out risk factors associated with it.

Results: Among the 200 diabetic patients who underwent ABI measurements using handheld Doppler, 19.5% were found to be having PAD. Most of them were symptomatic. Age more than 50 years and female gender were considered as statistically significant (P<0.05) determinants of PAD.

Conclusions: PAD is relatively common in elderly diabetics. ABI measurement is a valid tool in early detection of PAD and therefore regular follow up will decrease disabilities in the diabetic population.

Keywords: Ankle brachial index, Claudication symptom, Peripheral arterial disease, Peripheral Arterial disease patient

INTRODUCTION

Diabetes a condition caused by the body's inability to regulate Insulin levels is the fastest growing disease burden over 16 years to 2018. India currently represents 49% of World's diabetes burden, with an estimated 72 million cases in 2017, a figure expected to almost double to 134 million by 2025.[1] DM associated atherosclerosis can lead to complications in all major vascular beds, including coronary arteries, carotid vessels, and lower extremity arteries. The Prevalence of PAD worldwide has been estimated at between 4.5 and 29%.[2] Peripheral arterial disease (PAD) is a known complication of type 2 diabetes mellitus.[3] Studies have shown that prevalence of the peripheral arterial disease in diabetic patients is affected by host factors including age, duration of diabetes, level of glycemic control and presence of peripheral neuropathy.[4] PAD is associated with increased risk of lower extremity amputation, and is also a marker for atherothrombosis in cardiovascular, cerebrovascular and renovascular beds.[5] Patients with PAD, therefore, have an increased risk of MI, stroke, and death.

Additionally, PAD causes significant long-term disability in diabetic patients. In may be asymptomatic or may manifest as symptoms of compromised blood flow with exercise (mainly intermittent claudication) or in severe cases, at rest.[6] More than 50% of diabetics have obvious atherosclerotic cardiovascular disease within 15 years of the onset of diabetes and are 20 times more likely to have significantly lower extremity arterial disease than nondiabetics.[7]

METHODS

This is a cross-sectional study. It was conducted over a period of 3 months that is from June 2018 to August 2018 at Karpaga Vinayaga Institute of Medical Sciences, Tamilnadu after getting the Institutional ethical committee clearance. Assuring the prevalence of Peripheral Arterial disease as 14.5% with a power of 80% an absolute precision of 5% and a confidence level of 95% sample size was around 200. The study participants were selected based on convenient sampling. About 200 diabetic patients aged between 30-70 who were willing to participate in the study were included.

Those who had limb amputation or ulceration proximal to head of metatarsal of one or both lower limbs and amputation proximal to the wrist of one or both arms were excluded. Patients with prior bypass surgeries to lower limb arteries and those who had acute limb ischemia on cuff inflation were also excluded. The diagnostic criteria for PAD based on the ABI are interpreted as follows:[1,3,7]

- Normal if 0.91–1.30
- Mild obstruction if 0.70–0.90
- Moderate obstruction if 0.40–0.69
- Severe obstruction if <0.40
- Poorly compressible if >1.30

An ABI value >1.3 suggests poorly compressible arteries at the ankle level due to the presence of medial arterial calcification. This renders the diagnosis of PAD by ABI alone less reliable. Due to the high estimated prevalence of PAD in patients with diabetes, a screening ABI should be performed in patients >50 years of age who have diabetes. If normal, the test should be repeated every 5 years. A screening ABI should be considered in diabetic patients <50 years of age who have other PAD risk factors (e.g., smoking, hypertension, hyperlipidemia, or duration of diabetes >10 years). A diagnostic ABI should be performed in any patient with symptoms of PAD. It should be noted that in the evaluation of the individual patient there may be errors and that the reliability of any diagnostic test is dependent on the prior probability of disease (Bayes' Theorem).

Study instrument

Height and Weight of the patient were measured using stadiometer and weighing machine respectively.

Diamond mercury sphygmomanometer was used to record blood pressure. Handheld life Doppler from Wallach surgical Brand from Diabetic foot care was used to measure ABI. Demographic data were collected using a Questionnaire.

ABI measurement

The ABI is performed by measuring the systolic blood pressure from both branchial arteries and from both the dorsal pedis and posterior tibial arteries after the patient has been at rest in the supine position for 10 minutes.[2,4,5]

ABI is then calculated in each leg, using the formula:

$$\text{Right ABI} = \frac{\text{Highest Pressure in Right foot}}{\text{Highest pressure in both arms}}$$

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

RESULTS

Among the sample population, 36.5% were in the age group of 51-60 years and the least was in the age of 31-40 years accounting for 8.5% Among them, 61.5% were females, 69% had diabetes more than 10 years. 88% had HbA1C>6.5% 51.5% were in the obesity range considering their BMI.

Table 1: Characteristics and diabetes pattern among sample population.

Demographic details	Categorization	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 1 shows, among the 200 persons, 39 had PAD accounting for a prevalence rate of 19.5%. The male were 38.5 %, females were 61.5% 0.139 patients were known diabetic for more than 10 years and 61 patients were diabetic less than 10 years. HbA1c level was <6.5% in 24 patients and >6.5% levels were observed in 176 patients.

In 200 patients, normal weights were 36 patients, overweight categories were 49 patients, obese were 103 patients and morbidly obese were 12 patients. In the present study, the prevalence of PAD was 19.5% in T2DM patients. The prevalence of PAD among diabetic patients as observed in different studies varies substantially. Using ABI as criteria its prevalence varies from as low as 3.5% in newly diagnosed diabetics to as high as 42.6% in a study population with median age 52.5 years whereas based on a combination of ABI and symptomatic criteria, its prevalence could be as high as 87.2%. There are studies that show a variability in ethnicity to be responsible for the prevalence of PAD

among the determinants, age>50years had a significant association (P<0.029) with prevalence of PAD. Female gender also had a significant association with PAD (*P*=0.052).

Table 2: Prevalence of peripheral arterial disease.

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

Table 3: Association between peripheral arterial disease and diabetes pattern.

Characteristics of patient		Peripheral arterial disease		OR (CI)	P value
		Present	Absent		
Age group	<50 Years	11.3	88.7	0.40(0.173-0.929)	<0.029
	>50 Years	24	76		
Sex	Male	13	87	0.484(0.221-0.601)	<0.052
	Female	23.6	76.4		
Duration of diabetes	<10 Years	17.3	82.7	0.640(0.308-1.386)	<0.229
	>10 Years	24.6	75.4		
HbA1C	HbA1C < 6.5	12.5	75	0.556(0.157-1.966	<0.85
	HbA1C>6.5	20.5	87.5		<0.355
BMI	BMI <23	11.1	88.9	0.461(0.153-1.30)	<0.61
	BMI >23	21.3	78.7		

Table 3 PAD symptoms were present in most of the patients who had PAD as per ABI measurement. Age, duration of diabetes, and peripheral neuropathy are associated with an increased risk of PAD in patients with pre-existing DM.

Using ABI to identify PAD, the prevalence of PAD in people with DM over 40 years of age has been estimated

to be 20%. 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 the United Kingdom Prospective Diabetes Study, where each 1% increase in glycosylated hemoglobin was correlated with a 28% increase in the incidence of PAD, and higher rates of death, microvascular complications and major amputation.

Table:4 Association between peripheral arterial disease and pad symptoms.

Characteristics of patient		Peripheral arterial disease		OR(CI)	Chi-square and *P* value
		Present	Absent		
PAD symptoms	Present	41.7	58.3	8.537 (1.466-8.941)	X^2 =8.375 P<0.003
	Absent	16.5	83.5		

Table 4 PAD is associated with significant morbidity and mortality. A low ABI (<0.90) has been associated with an increased risk of all-cause mortality (relative risk (RR) 1.60; 95% confidence interval (CI) 1.32-1.95); cardiovascular mortality (RR 1.96; 95% CI 1.46-2.64); fatal and non-fatal coronary heart disease (RR 1.45;95% CI 1.08-1.93); and fatal and non-fatal stroke (RR 1.35;

95% CI 1.10-1.65).[11] In a cross-sectional study that evaluated both walking impairment and quality of life among individuals with both PAD and other cardiovascular diseases, the impact of PAD on functional status was equal to or worse than that of individuals of comparable age with coronary and other cardiovascular diseases

DISCUSSION

Diabetes and smoking are the strongest risk factors for PAD. Other well-known risk factors are advanced age, hypertension, and hyperlipidemia (3). Potential risk factors for PAD include elevated levels of C-reactive protein (CRP), fibrinogen, homocysteine, apolipoprotein B, lipoprotein(a), and plasma viscosity. An inverse relationship has been suggested between PAD and alcohol consumption.[8] In people with diabetes, the risk of PAD is increased by age, duration of diabetes, and presence of peripheral neuropathy. African Americans and Hispanics with diabetes have a higher prevalence of PAD than non-Hispanic whites, even after adjustment for other known risk factors and the excess prevalence of diabetes.[9] For these reasons, a patient with diabetes and PAD may be more likely to present with an ischemic ulcer or gangrene than a patient without diabetes.[10] While amputation has been used by some as a measure for PAD prevalence, medical care and local indications for amputation versus revascularization of the patient with critical limb ischemia widely vary. PAD is a manifestation of atherosclerosis characterized by atherosclerosis occlusive disease of the lower extremities and is a marker for atherothrombotic disease in other vascular beds.[11] The most common symptom of PAD is intermittent claudication, defined as pain, cramping or aching in the calves thighs or buttocks that appears reproducibly with walking exercise and is relieved by rest.[12] Multiple metabolic aberrations in DM, such as advanced glycation end products, low-density lipoprotein cholesterol and abnormal oxidative stress have been shown to worsen PAD . When the imbalance between the needs of the peripheral tissues and the blood supply is produced more or less abruptly (high risk plaque) we are faced with a situation of acute ischemia of thrombotic origin.[13] The clinical manifestation of PAD depends decisively on the number of territories affected. Persons with a sedentary lifestyle and arterial involvement in just 1 zone are often asymptomatic or oligosymptomatic. The other end of the spectrum is formed by persons who have the disease at various sites, in whom critical ischemia is frequent.[14] In this study, patients in the age group of 51-60 had a higher incidence of PAD compared with others. This has been acknowledged by many studies. In this study, female patients had a higher incidence of PAD (P=0.052). This may be because, among the 200 tested, 61.5% were females. Most of the studies shows that males have a higher incidence of PAD because of other risk factors like smoking. In this study, most of the patients who had PAD also had PAD symptoms. (P<0.003) which was contraindicatory to many of the studies where most of the PAD patient were asymptomatic.[15]

The limitations in this study was that we could not perform treadmill tests to capture the severity of the narrowed arteries during walking the confirmatory tests to diagnose PAD are invasive tests like catheter Angiography and noninvasive advancements like Magnetic Resonance Angiography (MRA) or computerized tomography Angiography (CTA), which cannot be used for screening OPD patients.

CONCLUSION

Clinical manifestations of rest pain, ulceration, or gangrene in the foot of a person with diabetes portends limb loss and requires urgent treatment. The frequent presence of neuropathy strongly influences the clinical presentation. The presence of neuropathy blunts pain perception, allowing a later presentation with more severe lesions than in the nondiabetic patient. In a vicious cycle, the presence of PAD increases nerve ischemia, resulting in worsened neuropathy. In addition, such arterial lesions may progress undetected for long intervals due to the distal distribution, making the severity of the underlying PAD often underestimated. Accordingly, diabetic patients with PAD are more likely to present with advanced disease compared with nondiabetic patients. The prevalence of PAD among diabetic patients, both symptomatic and asymptomatic was higher, about 19.5% ABI is a simple and effective method detecting PAD in all diabetic patients. Earlier detection will help prevent lower limb ulcer and cardiovascular morbidities and create awareness to pursue preventive measures.

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