ORIGINAL ARTICLE

Peripheral Artery Disease in Type II Diabetes

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ABSTRACT

Objective: To determine the frequency of peripheral arterial disease (PAD) in type 2 diabetic patients.

Study Design: Cross-sectional observational study.

Place and Duration of Study: Diabetes Clinic, Medical Unit III, Jinnah Postgraduate Medical Centre, Karachi, from January to June 2010.

Methodology: Three hundred and eighty seven (387) type II diabetic patients of either gender and any age were included in the study. Patients with a previous history of trauma to the arterial vasculature, pregnancy and those who underwent arterial graft procedures were excluded. Non-purposive convenient sampling technique was used to enroll patients in the study. PAD was diagnosed when ankle-brachial index (ABI) was less than 0.9. A p-value of less than 0.05 was considered statistically significant.

Results: Out of 387 studied patients, 128 were males (33.1%) and 259 were females (66.9%). Mean age was 52.22 ± 9.671 (22 – 76) years in the entire cohort. Mean duration of diabetes was 9.38 ± 6.39 years. PAD was detected in 152 (39.28%) of the total study subjects. Thirty-one of 128 male patients (24.22%) had PAD disease while 121 out of 259 female patients (46.71%) had evidence of PAD (p = 0.001). Hypertension was a significantly associated factor (p = 0.002).

Conclusion: A high frequency of PAD was observed in the diabetic population particularly with hypertension and more prevalent in females.

Key words: *Diabetes. Peripheral artery disease. Ankle brachial index. Hypertension. Female gender.*

INTRODUCTION

According to WHO estimates, Pakistan currently has more than eleven million diabetics and the number is estimated to escalate over 16 million by the year 2030.[1] The country currently ranks 6th according to the number of diabetics and is expected to jump to 4th position by the year 2030 if no preventive measures are taken.[1] Diabetes comprise host of metabolic abnormalities which can lead to many long-term macro-and micro-vascular complications. Macro-vascular complications are due to atherosclerosis of the blood vessels. It clinically manifests as cerebro-vascular accident (CVA), coronary artery disease (CAD) and/ or peripheral arterial disease (PAD). In Pakistan, 15% of diabetics suffer from complications involving foot.[2] PAD is not an uncommon complication of diabetes; it can lead to development of diabetic foot complications. PAD is four times more prevalent in diabetics than in non-diabetics and can lead to foot ulcers and amputations.[3]

Patients with diabetes have unique problems with PAD as the disease appears to affect distal blood vessels and pain is often not prominent due to concomitant neuropathy, and this places them at risk of seeking medical attention only in advanced stages.[4] Symptom of intermittent cluadication (IC) and examination of peripheral pulses have poor correlation with presence of PAD or its severity. This in turn leads to the advancement of disease, hospitalization for ulcers, re-vascularization, amputation and need for rehabilitation. It results in considerable loss of employability among patients with diabetes. A good and organized foot care program in diabetic patients can prevent upto 25% limbs lost due to diabetic foot complications.[5]

Ankle brachial index (ABI) is a useful initial screening test for arterial disease of the lower extremities,[6] which is the ratio of systolic blood pressure recorded at ankle arteries to the brachial artery. The ABI is a simple, reliable and reproducible test for the diagnosis of PAD. In clinical practice, an ABI of < 0.9 has been shown to be 95-96% sensitive and 94 – 100% specific in detecting angiogram positive PAD and it takes 10-15 minutes and can be performed in an outpatient department (OPD) or clinic with the 4 – 8 MHz hand-held Doppler and a sphygmomanometer.[7,8]

The aim of this study was to determine the frequency of PAD and to see the relationship with various risk factors in type II diabetic patients.

METHODOLOGY

This cross-sectional observational study was conducted from 1st January 2010 to 30th June 2010 at the Diabetes Clinic of Medical Unit III, Jinnah Postgraduate Medical Centre, Karachi. A total of 387 adult patients having diabetes mellitus (DM) type II were enrolled using non-purposive convenient sampling technique. Patients of

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either gender, any age and duration of DM, with or without signs of peripheral vascular insufficiency, complaints of numbness and/or discoloration of periphery or ulceration, were included in the study. Patients with a previous history of trauma to the arterial vasculature, pregnancy and those who had undergone arterial graft procedures were excluded.

After obtaining an informed consent, a detailed history regarding diabetes, hypertension (HTN), CVA, smoking and other tobacco exposure was taken. An interviewer asked all patients for symptoms of PAD based on Edinburgh questionnaire. Physical examination was carried out by a research associate and basic anthropometric data; height, weight, body mass index (BMI), blood pressure, peripheral pulses and ankle-brachial index (ABI) was calculated. On the basis of WHO recommended Asian cut off values for BMI in kg/m^2; patients were divided into five groups; normal (18.5 – 22.99), overweight (23 – 24.99), mild obesity (class I, 25 – 26.99), moderate obesity (class II, 27 – 29.99) and severe obesity (class III, ≥ 30).

The ABI was calculated by measuring the systolic blood pressure from both brachial arteries at arms and from both the dorsalis pedis and posterior tibial arteries of both feet, after the patient had been at rest in the supine position for 5 minutes. Recordings were obtained with blood pressure cuffs applied to the patient's arm and lower calf (immediately above the cubital fossa and ankle). Systolic pressures were recorded with a handheld 8-MHz Sonotrex Doppler instrument. Both arm pressures were recorded and the higher blood pressure was used for ABI calculation, while for both the ankle pressures (posterior tibial and dorsalis pedis) the higher pressure was used to calculate the ABI of respective side. PAD was diagnosed if any of ABI value (right or left) was < 0.90.

Data was collected and recorded on a pre-designed proforma and analyzed by Statistical Package for Social Sciences (SPSS) version 16. Categorical variables such as gender, age groups, BMI groups, HTN, smoking, hyperlipidemia and ABI were expressed as frequencies and proportions. Mean values with standard deviations were calculated for continuous variables such as age, duration of diabetes, BMI, duration of HTN and dyslipidemia. For categorical variables, differences between patients were tested using the chi-square test. P-value of ≤ 0.05 was considered significant.

RESULTS

Out of 387 studied patients who met the inclusion criteria, 128 were males (33.1%) and 259 females (66.9%). Mean age was 52.22 ± 9.671 (22 – 76) years in the entire group, while it was 55.09 ± 10.115 years (range: 24 – 76) for men and 50.80 ± 9.135 years (range 22 – 71) for women. Mean duration of diabetes was 9.38 ± 6.39 (range 0.5- 35) years. Descriptive variables of studied patients are given in Table I. PAD was found in 152 subjects (39.28%). Amongst these, ABI proved 41 (28.2%) PAD patients were symptomatic while 111 (71.8%) were asymptomatic. On the other hand, 68 patients (28.9%) having no PAD were clinically symptomatic based on Edinburgh questionnaire. Of patients who had detectable PAD, 121/152 (80%, p = 0.0001) were female. PAD was seen in 121/256 (46.7%) of female subjects, and in 31/128 (24.2%) of male subjects. HTN was present in 97/152 (64%) of PAD patients, and 131/152 (86%) were obese or overweight. Amongst the patients giving the history of CAD 28/70 (40%) had PAD. Female gender (p = 0.001) and HTN (p = 0.002) were statistically significant as shown in Table II. Regarding other risk factors; 9 subjects (2.3%) had history of cerebrovascular accident and 39 (10%) had tobacco chewing, but these did not prove statistically significant.

Table I: Descriptive variables.

Variables	N	Min	Max	Mean	Std dev
Age (years)	387	22.0	76.0	52.220	9.671
Duration of DM	386	0.5	35.0	9.387	6.3998
Duration of dyslipidemia	56	0.2	15.0	4.373	3.7230
Duration of HTN	197	0.2	27.0	7.856	6.4156
BMI	387	17.36	55.43	28.0226	5.31882

Table II: Characteristics of patients.

Variables	n (%)	PAD (ABI < 0.9) (n = 152)	No PAD (ABI ≥ 0.9) (n = 235)	p-value
Gender				
Male	128 (33.1)	31 (20.4)	97 (41.3)	0.0001
Female	259 (66.9)	121 (79.6)	138 (58.7)	
Age (years)				
< 50	164 (42.4)	68 (44.7)	96 (40.9)	0.324
50 – 60	137 (35.4)	47 (30.9)	90 (38.3)	
> 60	86 (22.2)	37 (24.3)	49 (20.9)	
BMI (kg/m^2)				
Underweight	03 (0.8)	00	03 (1.3)	0.491
Normal	59 (15.2)	21 (13.8)	38 (16.2)	
Overweight	44 (11.4)	16 (10.5)	28 (11.9)	
Obese class I	163 (42.1)	70 (46.1)	93 (39.6)	
Obese class II	118 (30.5)	45 (29.6)	73 (31.1)	
Duration of DM (years)				
< 5	104 (26.9)	45 (29.6)	59 (25.1)	0.40
5 – 9	130 (33.6)	53 (34.9)	77 (32.8)	
> 9	153 (39.5)	54 (35.5)	99 (42.1)	
Hypertension				
Yes	210 (54.3)	97 (63.8)	113 (48.1)	0.002
No	177 (45.7)	55 (36.2)	122 (51.9)	

DISCUSSION

Peripheral artery disease in patients with diabetes has become an increasingly significant public health concern in both the developed and developing world. Epidemiologic evidence suggests a strong association

between diabetes and an increased prevalence of PAD. Individuals with diabetes have a two-to-fourfold increase in PAD rates.[9] It has been estimated that PAD is present in 15% of patients with diabetes 10 years after the initial diagnosis and in 45% of patients 20 years after diagnosis.[10] The true prevalence of PAD in people with diabetes has been difficult to determine, as most patients are asymptomatic and many do not report their symptoms,[11] as in this study where 70% of the patients with PAD did not have any symptom.

This study focused on detecting PAD in diabetic patients and found 39.28% had PAD. It was higher than the 12.3% (38/309) reported from Taiwan and 20.0% from USA, while being lower than the 61.4% frequency reported from Saudi Arabia.[12-14] Different methods of sampling, different sample size and different distributions of risk factors can be responsible for the reported variations of overall prevalence. It is also possible that the PAD development in diabetic individuals varies in different ethnic groups or gender background. Javed *et al*. carried out a multicentre study at eight centres throughout Pakistan and included 830 patients out of which 262 (31.6%) had PAD, ABI < 0.9.[15] Rehan *et al*.[16] studied 350 cases of acute coronary syndrome out of whom 62 (17.7%) had PAD; moreover diabetes was found in 34.0% patients of that study population and PAD was significantly higher 24.16% in the diabetics compared to 14.3% in the non-diabetics. Shoaib *et al*. studied 67 diabetic foot patients, out of whom 30 (44.77%) had evidence of PAD.[17] Again the variation in frequency in the disease detection is because of different sample techniques, samples size and different risk factors. Furthermore, studies by Shoaib *et al*. and Rehan *et al*. were carried out at tertiary care hospitals in high risk subjects, while Javed *et al*. studied at referral clinic. The difference might reflect the increasing prevalence of PAD in diabetic patients due to changes of lifestyle such as eating habits and the decrease in physical activity seen in recent decades. It may also be explained by the difference in the diagnostic methods. Studies using the ankle-brachial index (ABI), which is the preferred screening technique, found the prevalence of PAD (defined as an ABI < 0.90) in diabetic individuals ranging from 20 to 30%.[11,18] Early studies generally relied on absent foot pulses or the presence of IC to identify individuals with PAD. Recently, the role of ABI in the detection of PAD has been well established.

In this study, females had a significant higher frequency of PAD than males in both younger (≤ 40 years) and older (> 40 years) age groups (p = 0.04 and p = 0.001 respectively). It was in consistence with other published studies,[20] although a higher frequency is often reported among men.[9,21] Some studies have reported no significant differences in the prevalence of PAD between males and females in diabetic subjects.[19] This disagreement might be due to a difference in other predisposing factors of PAD between females and males; females had higher BMI as compared to male subjects (mean 29.00 vs. 26.03) and duration of diabetes was longer for females (mean 9.15 vs. 5.99 years) in this study. Hypertension is associated with lower extremity PAD, although the association is generally weaker than that with cerebrovascular and coronary artery disease.[22,23] Hypertension increased the risk of developing lower extremity PAD in some studies but not in others.[13] This study revealed a statistically significant association between hypertension and PAD (p = 0.002). Moreover, hypertension was more prevalent in female subjects in this cohort.

Smoking is one of the highest risk factors for vascular atherosclerosis, including PAD.[24] However, in this study, a history of smoking was not significantly associated with PAD, probably because our definition of smoking history did not differentiate current or ex-smokers and the number of smokers were very small (13%) amongst the study population. Moreover, increasing age, obesity, and duration of diabetes are important risk factors for PAD but in this study this association was not statistically significant for these variables. As the population is ageing, the incidence of diabetes is rising and as the subjects with diabetes are living longer, it is anticipated that the burden of PAD will also increase.

PAD is underdiagnosed and poorly managed at primary care level in Pakistan and many other developing countries. Given the very high prevalence of PAD found in diabetic patients, and the morbidity and mortality associated with PAD, it is assumed that better public and health professional awareness would help to reduce the devastating effects of PAD. Although the efficacy of interventions to prevent PAD is not well known, yet effective treatment of diabetes, hyperlipidemia and hypertension along with exercise training, cessation of smoking, may each be effective counter strategies. They may also reduce associated cardiovascular morbidity and mortality.

This was a limited study having enrolled a single centre hospital based subjects. It is also known that an ABI of 1.3 or greater suggests non-compressible or partially non-compressible vessels which may give false negative results.

CONCLUSION

A relatively high frequency (39%) of PAD was detected in the studied diabetic patients with a statistically significant relation with HTN (p = 0.002). There was a significantly high proportion of female subjects (80%, p = 0.001) amongst the diseased population.

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