ORIGINAL ARTICLE

Prevalence of Peripheral Arterial Disease in Patients with Diabetes Mellitus in a Primary Care Setting

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SUMMARY

The aims of the study were to determine the prevalence of peripheral arterial disease (PAD) in diabetic patients and in different ethnic groups at a primary care setting, and to evaluate risk factors associated with PAD in these diabetic patients. A cross sectional study of 200 diabetic patients over 18 years old who attended a primary care clinic at a teaching hospital in Kuala Lumpur, Malaysia was carried out. Face-to-face interviews were conducted using structured questionnaires for demographic characteristics and risk factors evaluation. Blood pressure measurements, assessment of peripheral neuropathy and ankle brachial pressures were performed. PAD was diagnosed by an ankle brachial pressure index (ABPI) of <0.9 on either leg. The overall prevalence of PAD was 16% in this diabetic population. The prevalence of PAD was 5.8% in Malays, 19.4% in Chinese and 19.8% in Indians. The prevalence of peripheral neuropathy was 41%, foot ulcer 9.5%, and gangrene 3.0%. The presence of foot ulcer was weakly associated with PAD (P=0.052). No significant relationships were found between age, gender, smoking status, duration of diabetes mellitus, hypertension, dyslipidaemia, and PAD. PAD is common in the diabetic population of this study.

KEY WORDS:
Peripheral arterial disease, Ankle brachial pressure, Diabetes mellitus, Peripheral neuropathy, Ethnic groups

INTRODUCTION

Peripheral arterial disease (PAD) is a vascular disease caused by an occlusion of a peripheral arterial vessel that results in ischaemia[1,2]. Clinically it may manifest as intermittent claudication and rest pain[3]. It progresses more rapidly and is more diffuse in patients with diabetes mellitus (DM)[4]. Patients with Type 2 DM are 20 times more likely to develop PAD of the lower extremities[5]. The risk of lower extremity amputation and mortality are also higher in diabetics compared to non-diabetics[6]. The American Diabetic Association has estimated that 40-50% of the diabetic related amputations are preventable[5]. Therefore early detection of PAD in the diabetic population is very important.

The prevalence of PAD among patients with DM is found to vary between 10-42%[7-9]. However, no data is available on the association of ethnicity and PAD in the diabetic population. In the general population, Indians are found to have a higher prevalence rate of PAD than other ethnic groups[10]. Possible risk factors for PAD in patients with DM include increasing age, duration of DM, smoking, hypertension, hyperlipidaemia and increased waist to hip ratio[7-9].

Ankle brachial pressure (ABPI) is an effective method used to detect PAD[11]. The sensitivity of ABPI is 90% and the specificity is 98% for an angiographically defined stenosis of 50% or more in a major leg artery[7]. However, in patients with DM, the detection of PAD may be complicated by the presence of peripheral neuropathy, as ischemic symptoms are usually not felt due to reduced sensation, and the presence of calcification of medial arteries[12].

As no local data was found on the prevalence of PAD among patients with DM in Malaysia, this study was undertaken to determine the magnitude of the problem in patients with DM of different ethnic groups, and to evaluate possible risk factors of PAD in these patients.

MATERIALS AND METHODS

This was a cross sectional study on previously diagnosed diabetic patients over 18 years of age who attended a primary care clinic at a teaching hospital in Malaysia between March and April 2004. Approval was obtained from the hospital ethics committee.

All patients with DM who attended the clinic during the study period were approached. Of the 202 patients approached, 200 agreed to participate giving a response rate of 99%. Participants were interviewed face to face using structured questionnaires that included demographic characteristics (age, gender, and ethnic group), risk factors assessment, type and duration of DM, presence or absence of diabetic foot lesions (ulcer, callus, foot deformity, gangrene, amputation), history of smoking, hypertension, and dyslipidaemia. The results of HbA1C and lipid profile within the previous 6 to 12 months were recorded.

Blood pressure (BP) was measured in a resting position with a mercury sphygmomanometer by auscultatory method. Peripheral neuropathy was determined by assessing pain (using a 5.07 Semmes Weinstein monofilament), vibration sense, proprioception and light touch. Ankle brachial pressure was measured in a supine position with a 12-cm occluding cuff placed above the ankle and a portable Doppler device was used as the distal sensor at the dorsalis pedis and posterior tibial arteries. The brachial systolic BP was

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measured in both arms. Ankle brachial pressure index (ABPI) was calculated by dividing the higher reading of the ankle pressures at the dorsalis pedis or posterior tibial artery, by the brachial systolic pressure of the same side[4]. PAD was defined as ABPI < 0.9, while ABPI > 0.9 denotes absence of the disease. ABPI > 1.3 suggests partial incompressibility of arteries, which is likely to be due to medial arterial calcification.

The data was analysed using SPSS version 11.5 for windows. Chi square test was used to look for associations between categorical variables and student's t test was used for continuous variable. The level of significance was set at $p<0.05$.

RESULTS

Two hundred patients with DM were enlisted. Their demographic characteristics are presented in Table I. There were more women (60.5%) than men in this population. One hundred and ninety-nine (99.5%) had type 2 DM. Twelve (6.0%) patients were current smokers. Three quarter of the patients had concurrent hypertension and more than half had dyslipidaemia. The prevalence of PAD was 16% (n=32, ABPI < 0.9). Out of the 168 patients that had ABPI > 0.9, 15 (8.9%) had ABPI ≥ 1.3, signifying the presence of medial arterial calcification. The prevalence of PAD among Malays was 5.8%, Chinese 19.4%, and Indians 19.8%. The prevalence of peripheral neuropathy was 41%.

Table II shows the association between possible risk factors and PAD in diabetic patients. There was no significant association found between age, gender, ethnic groups, duration of DM, HbA1C levels, gangrene, smoking, hypertension, dyslipidaemia, and PAD in these diabetic patients. However, the presence of foot ulcer was weakly associated with PAD (p=0.052).

DISCUSSION

We found the prevalence of PAD in patients with DM in this primary care setting to be 16%. This is comparable to findings of other studies, which varies from 10-15%[7,8].

Although the prevalence of PAD was lower in Malays than Chinese and Indians, this was not statistically significant. No data is available to compare the prevalence of PAD in different ethnic groups amongst diabetic population, although in the general population, Chao *et al* found a higher prevalence of PAD in Indians as compared to Chinese and Malays[10]. Another study found the prevalence of PAD to be higher in African American compared to Whites and Hispanics[13].

The mean age of patients with PAD was 62±9.7 years. There was no significant relationship between age and PAD. Other studies that found age as a risk factor for PAD were of older population[7-9]. Tseng showed that in Taiwanese Type 2

Table I: Demographics and Prevalence of different conditions

Parameters (n=200)	
Mean age of total studied population (years)	61.10 ± 9.82
Mean age of male (years)	61.90 ± 9.79
Mean age of female (years)	60.58 ± 9.85
Gender	
Male	79 (39.5%)
Female	121 (60.5%)
Ethnic group	
Malay	52 (26.0%)
Chinese	62 (31.0%)
Indian	86 (43.0%)
Diabetes Mellitus	
Duration (years)	10.72 ± 7.56
HbA1C within last 6-12 months (%)	8.38 ± 8.12
Smoking	
Current smoker	12 (6.0%)
Ex-smoker	36 (18.0%)
Never smoke	152 (76.0%)
Prevalence of foot Lesion	28 (14.0%)
Foot Ulcer	19 (9.5%)
Gangrene	6 (3.0%)
Others (fungal infection)	3 (1.5%)
Prevalence of hypertension	150 (75.0%)
Prevalence of dyslipidemia	112 (56.0%)
Lipid Profile	
Mean total cholesterol (mmol /L)	5.247 ± 1.02
Mean HDL-Cholesterol (mmol /L)	1.228 ± 0.27
Mean LDL-Cholesterol (mmol /L)	3.227 ± 0.85
Mean Triglyceride (mmol /L)	1.739 ± 0.90

Data are shown as no. of patients (%) or mean± SD

Table II: Association between Risk Factors and Peripheral Arterial Disease in patients with Diabetes Mellitus

Risk Factors	Prevalence of risk factors		p Value
	No PAD (n=168)	PAD (n=32)	
Age	60.91 ± 9.86	62.09 ± 9.71	NS
Gender			
Female	100 (59.5%)	21 (65.6%)	NS
Male	68 (40.5%)	11 (34.4%)	
Ethnic Group			
Malay	49 (29.2%)	3 (9.4%)	NS
Chinese	50 (29.8%)	12 (37.5%)	
Indian	69 (41.1%)	17 (53.1%)	
Duration of DM	10.56 ± 7.72	11.59 ± 6.74	NS
HbA1C %	8.236 ± 2.45	9.143 ± 2.52	NS
Foot Lesion			
Foot ulcer	13 (7.7%)	6 (18.8%)	0.052
Gangrene	5 (3.0%)	1 (3.1%)	NS
Smoking			
Current /Ex-smoker	38 (22.6%)	10 (31.3%)	NS
Non-smoker	130 (77.4%)	22 (68.8%)	
Hyperlipidemia	94 (56.0%)	18 (56.3%)	NS
Total cholesterol			
Normal (≤5.2)	21 (12.5%)	6 (18.8%)	NS
Abnormal (≥5.2)	147 (87.5%)	26 (81.3%)	
Triglyceride			
Normal (≤1.7)	54 (32.1%)	7 (21.9%)	NS
Abnormal (≥1.7)	114 (67.9%)	25(78.1%)	
HDL-C			
Normal (≥1.0)	138 (82.1%)	23 (71.9%)	NS
Abnormal (≤1.0)	30 (17.9%)	9 (28.1%)	
LDL-C			
Normal (≤2.6)	21 (12.5%)	3 (9.4%)	NS
Abnormal (≥2.6)	147 (87.5%)	29 (90.6%)	
Known Hypertensive	125 (74.4%)	25 (78.1%)	NS
Peripheral Neuropathy	65 (38.7%)	17(53.1%)	NS

NS: not significant
Data are shown as no. of patients (%) or mean± SD

diabetics, PAD was not common until the age of 65 years, and thereafter the prevalence dramatically escalated in those aged 75 years and above[7].

The influence of the duration of DM on the occurrence of diabetic macroangiopathy has been controversial[7-9]. We did not find any significant association between the duration of DM and PAD in this diabetic population. The United Kingdom of Prospective Trial (UKPDS) showed that 50% of their newly diagnosed type 2 diabetics had chronic complications at diagnosis[14].

Similarly the association between the control of DM and PAD has been controversial[8]. Again, we found no significant association between HbA1C level[5] and PAD, and this is in concordance with some studies[7,9,15]. We found no gender difference in the prevalence of PAD in patients with DM (male 13.9%, female 17.4%). This concurred with other studies[7-9]. However; we found a weak association between foot ulcer and PAD. Oyibo had demonstrated that the majority of diabetic patients with foot ulcers had clinical evidence of PAD and peripheral neuropathy[16].

Smoking is an important risk factor of PAD in the general population. We did not demonstrate any significant association between smoking and PAD, a finding also of some other students[7,9]. The high number of females recruited in this study could have contributed to the low prevalence of smoking (6%).

The prevalence of hypertension and dyslipidemia were high in both PAD and non-PAD groups in this study, suggesting high cardiovascular risks in this population. Some studies have shown a strong relationship between systolic hypertension and PAD[7,8] but others have found no significant association[9]. We did not find any significant association between hypertension or dyslipidaemia and PAD.

More than half of the patients (53.1%) with PAD were found to have concomitant peripheral neuropathy. The presence of PAD and peripheral neuropathy increases the risk of foot complications[5]. Therefore, early detection is important so that preventive measures can be instituted.

This study was limited by universal sampling and small sample size. The HbA1C level obtained from records was done within the preceding six months. This level would not give an accurate reflection of patients' diabetic control over the years, as control would fluctuate. However, it gave us an indication of the control over a shorter period of time. The study recruits were from a primary care clinic of a tertiary center. Therefore, the findings may not reflect those in the community and the results cannot be generalized to a Malaysian diabetic population. Nevertheless, these findings provide an insight into the magnitude of this problem locally.

CONCLUSION

The prevalence of PAD in this diabetic population was 16%. There was a higher prevalence of PAD in Chinese, Indians

than Malays but this was not significant. There was a weak association between foot ulcer and PAD.

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REFERENCES

1. Weiner SD, Reis ED, Kerstein MD. Peripheral Arterial Disease. Medical management in primary care practice. Geriatrics 2001; 56(4): 20-27.
2. Mohler ER. Peripheral arterial disease; identification and implications. Archives of Internal Medicine 2003; 163: 2306-14.
3. Novo S. Classification, epidemiology, risk factors and natural history of Peripheral Arterial Disease. Diabetes, Obes Metab 2002; 4 (supp 2): S1-S6.
4. American Diabetes Association. Consensus Statements. Peripheral Arterial Disease in people with diabetes. Diabetes Care 2003; 26(12): 3333-41
5. Umeh L, Wallhagen M, Nicoloff N. Identifying diabetic patients at high risk for amputation. Nurse Pract 1999; 24(8): 56-62.
6. Bild DE, Selby JV, Sinnock P, Browner WS, Braveman P, Showstack JA. Lower extremity amputation in people with diabetes. Epidemiology and prevention. Diabetes Care 1989; 12(1): 24-30.
7. Tseng CH. Prevalence and risk factors of peripheral arterial obstructive disease in Taiwanese type 2 diabetic patients. Angiology 2003; 54 (3): 331-8.
8. Janka HU, Standl E, Mehnert H. Peripheral Vascular Disease in Diabetes Mellitus and its relation to cardiovascular risk factors, screening with the Doppler Ultrasonic Technique. Diabetes Care 1980; 3(2): 207-13.
9. Katsilambros NL, Tsapogas PC, Arvanitis MP, Tritos NA, Alexiou ZP, Rigas KL. Risk factors for lower extremity arterial disease in non-insulin dependent diabetic persons. Diab Med 1996; 13: 243-46.
10. Chao A, Koh W. Prevalence of peripheral arterial disease in Asians. A population screening study. ANZ J Surg 2003; 73(supp1): A120.
11. McDermott MM, Criqui MH, Liu K, Guralnik JM, Greenland P, Martin GJ, Pearce W. Lower ankle/brachial index as calculated by averaging the dorsalis pedis and posterior tibial arterial pressures, and association with leg functioning in PAD. J Vasc Surg 2000; 32(6): 1164-71.
12. Hittel N, Donnelly R. Treating Peripheral arterial disease in patients with diabetes. Diabetes Obes Metab 2002; 4 (supp.2): S26-S31.
13. Collins, Tracie C, Peterson, Nancy J, Suarez-Almazor, Maria, Ashton, Carol M. The prevalence of PAD in a racially diverse population. Archives of Internal Medicine 2003; 163: 1464-74.
14. International Diabetic Federation, Brussels. Guidelines for type 2 Diabetes Mellitus. Diab Med 1999.
15. UK Prospective Diabetes Study Group: Intensive blood glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet 1998; 352: 837-53.
16. Oyibo SO, Jude EB, Voyatzouglou D, Boulton AJM. Clinical characteristic of patients with diabetic foot problems, changing pattern of foot ulcer presentation. Practical Diabetes Int 2002; 19: 10-12.