Peripheral arterial disease – high prevalence in rural black South Africans

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Background. The prevalence of peripheral arterial disease (PAD) worldwide has been estimated at between 4.5% and 29%. PAD has been associated with male gender, advanced age, diabetes, hypertension, hypercholesterolaemia and smoking. Clinical experience with amputations at Mthatha General Hospital, a district hospital in the Eastern Cape, suggests that PAD is common, but the actual prevalence has not been determined. The Eastern Cape is a rural area and patients attending the hospital are mostly Xhosa-speakers.

Objectives. To assess the prevalence of PAD and associated risk factors among patients attending the hospital.

Methods. Five hundred and forty-two patients over 50 years of age attending the outpatient department were systematically selected. Gender, body mass index (BMI), blood pressure, capillary blood glucose and smoking status were determined. The ankle-brachial pressure index (ABPI) was measured by Doppler ultrasound, and PAD was defined as a ratio less than 0.9.

Results. Of 542 patients (315 females, 227 males), 159 (29.3%) had an ABPI of less than 0.9. The mean age was 62.4 years and the range 50 - 95 years. In a stepwise logistical regression analysis smoking had a significant adjusted odds ratio for PAD of 4.29 (2.68 - 6.95), diabetes 1.72 (1.11 - 2.69) and male sex 1.69 (1.06 - 2.68). Obesity as measured by BMI and hypertension were not associated with PAD.

Conclusion and recommendations. Prevalence of PAD was relatively high in this sample of rural black patients when compared with findings from other countries. Preventive interventions should focus on control of diabetes and smoking cessation. Surprisingly, the prevalence was higher in those with a normal BMI and without hypertension, and risk factors in this community should be studied further. Physicians in this setting should be more aware of the possibility of undetected PAD.

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Peripheral arterial disease (PAD) is a condition in which the arteries that carry blood to the arms and legs become narrowed or clogged.[1] Most clinicians diagnose PAD from symptoms such as intermittent claudication and rest pain, and signs such as diminished peripheral pulses, ischaemic ulceration and gangrene.[2] The clinical diagnosis and assessment of intermittent claudication are not always reliable and physician awareness of the diagnosis is low.[3] The general population and patients have poor knowledge of symptoms, risk factors and treatment options for PAD.[4]

In most cases PAD can be confirmed by measuring the ankle-brachial pressure index (ABPI).[1,2,5-7] ABPI is the ratio of the tibial systolic artery pressure to brachial systolic artery pressure. The measurements are commonly taken with a Doppler ultrasound device; this process is non-invasive and painless and can be performed by any clinician. An ABPI of less than 0.9 is diagnostic of PAD. The normal range is between 0.9 and 1.1. When greater than 1.1 it is mostly because of calcified arteries. The range between 0.7 and 0.89 is consistent with mild-to-moderate PAD (asymptomatic or with intermittent claudication). Less than 0.7 is consistent with moderate to severe PAD with intermittent claudication or rest pain.[2]

The validity of ABPI as a diagnostic marker of subclinical arterial disease is confirmed by its adverse prognostic significance for coronary and cerebrovascular events.[2,5-8] ABPI has been found to be an independent predictor even when the effects of advanced age, hypertension, diabetes mellitus, and pre-existing cardiovascular disease have been taken into account using multivariate analysis.[9] In a study performed in Los Angeles, USA,[10] using ankle Doppler testing, a sensitivity of 89%, specificity of 99%, positive predictive value of 90%, negative predictive value of 99%, and overall accuracy of 98% were calculated for the test. These results indicate that the majority of patients with PAD can be detected using a hand-held Doppler flow meter.

Internationally, reported PAD prevalence among those over 50 years of age is between 4.5% and 29%.[2,3,8] The disease affects everyone, although men are more likely than women to have PAD. Those at higher risk are smokers, diabetics, hypertensives, hyperlipidaemics, the obese and people over 50 years of age.[2,5-8,11,12] In South Africa, hospital prevalence studies[13] have established that atherosclerosis is the predominant pathology in all population groups with PAD, but large-vessel arteritis is also a significant cause in black

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patients. White patients appear to have a higher prevalence of aneurysmal disease and extracranial cerebrovascular disease than blacks.[13] PAD was found to be more common in males across all population groups, but this association was particularly strong in black patients.[13] Black patients appear to have a lower incidence of cardiac ischaemia, hypertension and cigarette smoking than other groups.[13] No significant differences were found in the lipid profiles of the various groups.[13] Black patients have tended to present with more serious ischaemia involving gangrene, rather than with earlier symptoms such as claudication.[13] African-Americans have also been found to have a higher risk.[14]

Patients with PAD alone have the same relative risk of death from cardiovascular causes as those with coronary artery disease, and are four times more likely to die within 10 years than patients without the disease.[2,7,9,10] Therefore it may be prudent to diagnose PAD early in order to prevent complications like intermittent claudication, ulceration and gangrene of the legs and cardiovascular disease. The rationale for early detection of asymptomatic PAD is that risk-factor modification might lower subsequent morbidity and mortality and systemic atherosclerotic disease.[5] There has been no research to examine whether the detection and treatment of asymptomatic persons with PAD reduces the morbidity or mortality observed in symptomatic patients. There is evidence, however, that smoking cessation, adequate control of diabetes and hypertension, maintenance of a normal body mass index (BMI) and regular exercise are beneficial in symptomatic persons through improvement in symptoms and reduced overall cardiovascular mortality.[11,12] However, underdiagnosis of PAD in primary care practice may be a barrier to effective secondary prevention of the high ischaemic cardiovascular risk associated with PAD.[3]

This study was conducted at Mthatha General Hospital, a district hospital in a rural and low socio-economic area of South Africa that serves a population of 112 000. Patients attending the hospital are mostly black Xhosa-speakers. Although the study was hospital-based, the sample was derived from outpatients who were mostly self-referred and visited the hospital for both medical and administrative reasons.

Methods

The sample size of 542 was based on the population in the drainage area, and an expected PAD prevalence rate of 15%; 95% confidence intervals (CIs) were calculated using EpiInfo version 6.

On weekdays two research assistants systematically selected patients from the reception area of the outpatient division. Patients had to be over 50 years of age and without known PAD. Those who met the inclusion criteria and gave consent were invited to participate – the first two patients from the left end of each of the six benches in the waiting room were selected.

Selected patients were interviewed to assess their risk profile (age, sex, history of hypertension, diabetes and smoking status) and had their BMI calculated from weight and height measurements. After resting for 5 minutes the blood pressure in the right arm was measured using a Dinamap (Critikon, USA), and the systolic pressures in the right brachial and posterior tibial arteries were measured using the Huntleigh Diagnostics ultrasonic diabetic foot kit, both in the supine position. Those who had a blood pressure of 140/90 mmHg or more after 2 consecutive readings 30 minutes apart were considered hypertensive, and those who had a capillary blood sugar levels were more than 11 mmol/l were considered diabetic. Random blood sugar levels were recorded using an Accu-Chek Active (Roche, Mannheim, Germany) glucometer. Data were analysed using Statistica version 7.

Results

There were 315 female (58%) and 227 male (42%) patients, with a mean age of 62 years and an age-sex distribution as shown in Fig. 1. Overall, 159 patients were identified as having PAD, giving a prevalence rate of 29.3%. Of the 159 patients, 9% had no risk factors, 32% had 1, 36% 2, and 23% more than 2 risk factors. Females were significantly more likely to be diabetic, hypertensive and obese than the men, while there was a significantly higher prevalence of smoking among men (Table I). Males and females also differed significantly in the number of risk factors, with 53% of men versus 63% of women having 2 or more risk factors (Table I). The unadjusted odds ratios (ORs) for PAD in association with the risk factors are shown in Table II. The unadjusted ORs for male sex, smoking, BMI and hypertension with PAD were all statistically significant. However PAD was significantly less common in those with a BMI ≥ 30 kg/m^2 and a normal blood pressure.

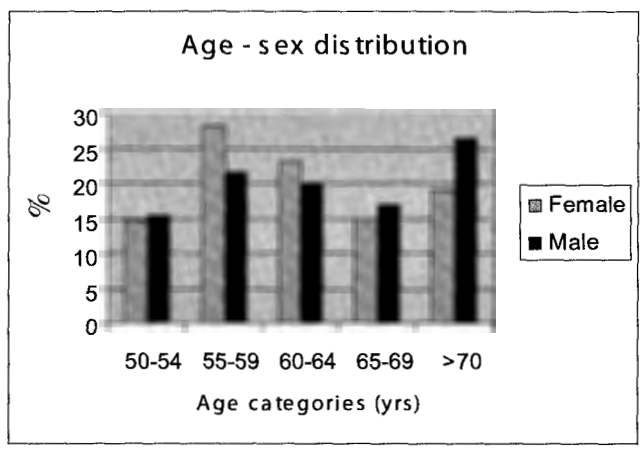

Fig. 1. Age and sex distribution of study participants (p = 0.16 for age categories versus sex).

Table I. Profile of male (N = 227) and female (N = 315) study participants ($p < 0.05$ in all categories)

Category	Male N (%)	Female N (%)	All N (%)
Diabetic	52 (22.9)	112 (35.6)	164 (30.2)
Smokers	135 (59.5)	33 (10.5)	168 (30.9)
BMI > 30 kg/m^2	47 (20.7)	157 (50)	204 (37.7)
High blood pressure	155 (68.3)	252 (80)	407 (75.1)
No risk factor	13 (5.7)	38 (12.1)	51 (9.4)
One risk factor	93 (41)	79 (25.1)	172 (31.7)
Two risk factors	73 (32.2)	121 (38.4)	194 (35.8)
Three risk factors	42 (18.5)	75 (23.8)	117 (21.6)
Four risk factors	6 (2.6)	2 (0.6)	8 (1.5)

Table II. Unadjusted odds ratios for different risk factors in relation to PAD

Risk factor	Category	N	Prevalence of PAD N (%)	Odds ratio	95% CI
Sex	Male	227	98 (43.2)	3.16	2.16 - 4.66
	Female	315	61 (19.4)		
Age (yrs)	50 - 59	218	64 (29.4)	0.99	0.68 - 1.44
	≥ 60	323	94 (29.1)		
Diabetes	Yes	164	52 (31.7)	1.18	0.79 - 1.75
	No	378	107 (28.3)		
Smokers	Yes	168	90 (53.6)	5.10	3.43 - 7.64
	No	374	69 (18.5)		
Hypertension	Yes	407	107 (26.3)	0.57	0.38 - 0.86
	No	135	52 (38.5)		
BMI	≥ 30 kg/m^2	204	47 (23.0)	0.60	0.40 - 0.89
	< 30 kg/m^2	337	112 (33.2)		
Multiple risk factors	0 or 1	223	61 (27.4)	1.18	0.81 - 1.72
	2 or more	319	98 (30.7)		

A stepwise logistical regression analysis was then performed on all the recorded variables. Continuous variables defined as age, BMI, random blood glucose, and systolic and diastolic blood pressure were included as well as categorical variables defined as sex, diabetes, smoking, hypertension and the total number of risk factors. In this regression only 3 variables were significantly associated with PAD, as shown in Table III.

Table III. Adjusted odds ratios in logistical stepwise regression

Variable	Odds ratio	95% CI
Diabetes	1.72	1.11 - 2.69
Sex	1.69	1.06 - 2.68
Smoking	4.29	2.68 - 6.95

Discussion

This study shows that almost one-third of the over-50-year-old population attending Mthatha General Hospital was suffering from some degree of PAD, with 91% having one or more of the known risk factors. The 29% PAD prevalence in this rural black population was at the upper end of rates reported internationally.[2,3,8] The high prevalence confirms the anecdotal experience of the researchers, who have performed a large number of amputations for gangrenous lower limbs. The high prevalence also confirms that this may be a common asymptomatic problem that physicians should be more aware of in their clinical assessment of patients. Although routine screening for PAD cannot yet be justified, this study suggests that physicians should be more active in opportunistic disease prevention aimed at the modifiable risk factors.

The association of PAD with male sex, diabetes and smoking was not surprising, and in this sample 31% had a history of smoking and 30% of diabetes. Good glycaemic control has the potential to prevent, or at least delay, amputation in patients with diabetes.[2] A South African study[15] has shown that if both dorsalis pedis pulses are absent in diabetics, the ABPI is significantly diminished compared with when both pulses are present. Current smokers are at higher risk of PAD than ex-smokers or those who have never smoked.[2,13] The likelihood of claudication, amputation, stroke, abdominal aortic aneurysm and failure of vascular reconstruction is higher in smokers than non-smokers.[12] The association between smoking and PAD is about twice as strong as the association with coronary heart disease.[2] It is clear that smoking cessation in patients with intermittent claudication, which is the earliest

symptom of PAD, has certain beneficial effects such as marked improvement in symptoms and reduced overall cardiovascular morbidity and mortality.[11,12]

Fine *et al.* reported on the predictive power of cardiovascular risk factors for detecting PAD and listed the following hierarchy: hypertension, cardiovascular disease, hyperlipidaemia, diabetes, smoking, obesity and stroke.[7] The present study, in the Xhosa population of the Eastern Cape, only showed an association with diabetes and smoking. Hyperlipidaemia, cardiovascular disease and stroke were not measured. However hypertension and obesity were not associated with PAD, which warrants further investigation in this population. The lack of an association with obesity could be related to the use of BMI as there is growing evidence that this may not be the best measure of obesity for assessing cardiovascular risk.[16] Although diabetes, obesity and hypertension were more common in women and they had a higher number of recognised risk factors, men were still significantly more likely to have PAD. The strong association with men, independent of smoking as a risk factor, also raises questions as to whether this is genetically determined or due to an unmeasured confounding risk factor. This study suggests that preventive strategies should focus on control of diabetes and smoking cessation.

The catchment area of Mthatha General Hospital has a homogeneous population comprising rural Xhosa people. The study sample was derived from outpatient attendees, many of whom were self-referred, visiting the hospital for medical and administrative reasons. Nevertheless the study sample may not be wholly representative of the larger community in that they were derived from those seeking help for medical problems or perceived illness. Cholesterol levels were not measured because of financial constraints.

Conclusion

The 29% prevalence rate for PAD is relatively high in this sample of rural black patients compared with findings from other countries. Male sex, diabetes and smoking were associated with PAD, but surprisingly obesity and hypertension were not associated. The risk factors in this community should be studied further and physicians in this setting should be more aware of the possibility of undetected PAD and the potential for risk factor modification.

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