Peripheral arterial disease: Its recognition and treatment

James DiResta

Introduction

This article outlines a US-based three-phase study to improve the rate of diagnosis and treatment of peripheral arterial disease, an independent risk factor for cardiovascular events. The preliminary results, from phase one, on ankle–brachial index screening in a community population are presented herein. The second phase of the study will include a state-wide initiative with a podiatric physician at its centre. The proposed third phase will move the initiative alongside hypertension screening in the primary care setting.

Peripheral arterial disease (PAD) has long been recognised as a risk factor in the development of non-healing foot ulcers and lower extremity amputations in people with diabetes (Singh et al, 2005). More recently, PAD has been identified as a risk marker for coronary heart disease, stroke, diabetes and hypertension (Hooi et al, 2002; Hankey et al, 2006); many healthcare professionals are now advocating the measuring of ankle–brachial index (ABI) in order to identify PAD (Mohler, 2003). The American Diabetes Association (ADA), in a consensus statement (ADA, 2003), has called for PAD screening in all people over the age of 50 years who have diabetes. It has also called for PAD screening in people under the age of 50 years with diabetes, who have other associated risk factors such as hypertension, hypercholesterolaemia, a smoking habit, or diabetes duration of 10 years or more.

The ABI value is the ratio between Doppler-measured systolic blood pressure in the lower and upper limb extremities. An ABI value of <0.9 diagnoses PAD (Norman et al, 2006). The Clopidogrel versus Aspirin in Patients at Risk of Ischaemic Events (CAPRIE) study showed a 10% reduction in survival for every 0.1 point reduction in ABI score (CAPRIE Steering Committee, 1996).

It has been estimated that 60% of patients with PAD are asymptomatic but are at significant risk of developing cardiovascular and cerebrovascular complications (Jarvis and Simpson, 2000). Prescription of aspirin with anticoagulant therapy can be life-saving in this group (Gey et al, 2004). Murabito and colleagues (2002) demonstrated that a low ABI score is significantly associated with an elevated risk of stroke and ischaemic heart attack. This study also demonstrated an interaction between hypertension and gender on the association of hypertension and lower extremity disease.

Sacks and colleagues (2003), in identifying PAD as a risk marker for diabetes, coronary heart disease, stroke, hypertension and other vascular diseases, have recommended that all patients being screened for PAD should have their ABI measured. However, it has been reported that ABI values are not specific enough for determining severe ischaemia (Dorros et al, 2001); therefore, ABI values would be better utilised for patients with risk factors who are asymptomatic or presenting with minimal symptoms.

Mehler and colleagues (2003) report that intensive blood pressure control in people with PAD resulted in a marked reduction in cardiovascular events. Their study demonstrated that, in people with diabetes who have normal blood pressure, the inverse relationship between ABI and cardiovascular events was abolished with intensive blood pressure-lowering therapy (Moser, 1999;

ARTICLE POINTS

1 There is a need to screen for peripheral arterial disease (PAD) among people with diabetes.

2 The ankle–brachial index (ABI) is a reliable method of assessing PAD.

3 In order for ABI to become widely used, practice behaviour among podiatrists in the US must change.

4 In the author's view, ABI screening can reduce the risk factors of the population with diabetes.

5 The author recommends that people with diabetes should be screened for ABI scores on a routine basis.

KEY WORDS

- **Peripheral arterial disease**
- **Ankle–brachial index**
- **Screening**

James J DiResta DPM MPH is a Podiatrist at Anna Jaques Hospital, Newburyport, Massachusetts, USA.

PAGE POINTS

1 Peripheral arterial disease (PAD) is often unrecognised and left under-treated by primary care clinicians.

2 The primary aim of this study is to improve the quality of care provided by podiatric and primary care physicians in the treatment of the population with diabetes as it relates to PAD.

Moser, 2003). According to another study, PAD should be viewed as an independent predictor of cardiovascular events, as should heart attack and stroke (Dawson et al, 2002).

PAD is often unrecognised and left under-treated by primary care physicians (Hiatt, 2002). The addition of aspirin to antiplatelet therapy can effectively improve outcomes and morbidity among PAD patients (Antiplatelet Trialists' Collaboration, 1994). In light of this evidence, a future change in the present process, in the US, of PAD screening in the podiatrist office and in the primary care setting to include PAD screening alongside hypertension screening is envisioned.

Study aims

The primary aim of this study is to improve the quality of care provided by podiatric and primary care physicians in the treatment of the population with diabetes as it relates to PAD. The results of our first phase of study, presented herein, lay the ground work for the next two phases. We set out to capture the incidence of PAD in the general population over 50 years of age and then tease out groups where our improvement goals could be reached.

Materials and methods

PAD screening was conducted monthly by experienced vascular technicians using a sphygmomanometer and Doppler ultrasound in the presence of specialist physicians (interventional cardiologists and podiatrists). The resultant ABI scores were interpreted by one of two cardiovascular physicians. The ratio of the systolic pressure at the ankle over the systolic pressure at the arm was then calculated for both the left and right limb extremities. A positive diagnosis of PAD was made when either extremity revealed a ratio of <0.9. *Table 1* illustrates ABI values and their meanings. This non-invasive and objective diagnostic tool has been shown to have 95% sensitivity and 100% specificity (Feigelson et al, 1994).

Table 1. Ankle brachial index (ABI) scores and their meanings.

ABI score	Level of peripheral arterial disease
>0.9	None
0.75–0.9	Mild
0.4–0.75	Moderate
<0.4	Severe

The demographics of the population screened were obtained and included people with diabetes and those without, and people over age 50; the study population had more females than males. Individuals who underwent screening sessions completed an intake survey answering demographic-related questions as well as questions related to lower extremity symptoms at rest or with activity, their present level of physical activity, history of diabetes, history of hypertension and smoking status.

The collected screening data were then further separated and matched to age, sex, symptoms, smoking status, history of hypertension and history of diabetes. The data were placed and organised into spreadsheets and analysed using STATA statistical software (StataCorp LP, Texas). People with low ABI scores were referred for further study.

Results and discussion

ABI values were obtained from both the left and right limbs for each participant. A total of 234 patients were seen in the monthly screening sessions that took place over a 7-month period. Of this population group, 205 patients fulfilled the study criteria (participants were excluded if they did not accurately record the requested demographic information or the results of their screening were not fully completed) and were included in the data analysis. In addition to the ABI recordings, other demographics and associated comorbidities were obtained.

The most significant statistical finding in correlating PAD with any of the demographics obtained, which was greater than that of smoking status or history of concurrent hypertension treatment, was a history of diabetes.

Analysis of these results revealed an

increase in abnormal ABI readings (<0.9) in those with diabetes when compared with those without the condition (odds ratio 2.40; 95% confidence interval 0.89–6.11; $P<0.05$).

The results were also somewhat surprising in that, in the prevalence of PAD, there was no significant difference between smokers and non-smokers. However, as the screening criteria lacked a qualitative value, as the captured group included anyone who has ever smoked, the reality being that most older people have smoked at some point in their lives; this left too small a comparison group of non-smokers.

No significant differences in comparison of the group with no symptoms and those with symptoms were observed. The symptomatic group included those who gave positive responses to the series of three questions in *Table 2*.

Early diagnosis of PAD presents a real opportunity for treatment before more invasive and aggressive procedures might become necessary or, unfortunately, when no treatment is possible. Early treatment would involve the implementing of lifestyle changes, such as diet and exercise, as well as the prescription of aspirin when appropriate.

The relative protective effect of exercise was demonstrated in those that responded that they lead an active lifestyle. An odds ratio of 0.50 for this result demonstrates that those who led an active lifestyle were only half as likely to develop PAD, and supports lifestyle changes in our focused population group (95% confidence interval 0.24–1.06; $P<0.05$).

The results of this screening form the basis for the second phase of our study, which will bring the podiatrist office into a central role of diagnosing PAD using the ABI test among the local population with diabetes over the age of 50 and contrast this with the present standard of practice among podiatrists. A group of podiatric physicians using ABI as a diagnostic tool and a control group using the present standard of care in assessing peripheral circulation by observation of trophic changes and the palpation for absence or presence of pedal pulses will be compared and outcomes measured. This will provide the implementation of our main aim of improving present quality of care by improving physician awareness and changing practice behavior. This change in practice will also include the implementation of recommendations for changes in lifestyle, medical treatment and appropriate vascular referrals for podiatrists to employ in patients with abnormal ABI scores. This again will be compared with a similar patient group in the control practices for recommendations and treatment.

The third phase of our study will then bring the ABI tool to the primary physician office to be used alongside hypertension screening.

Study limitations

The first phase study results, reported herein, have some limitations. There was no randomisation within the patients screened as this was a community outreach initiative.

There is also a limitation to our screening tool. The ABI test, with a 95% sensitivity, will fail to find a group of patients who have calcific, and therefore non-compressible, vessels in the ABI screen and will comprise a 'false negative' group. This fact needs to be emphasised to the appropriate screening practitioners so they are educated about other means of assessment (e.g. trophic changes such as colour and temperature), especially if they are suspicious in spite of normal ABI results, particularly in the population with diabetes where calcific vessels are more likely to occur.

In extrapolating this study and

PAGE POINTS

1 The relative protective effect of exercise was demonstrated in those that responded that they lead an active lifestyle.

2 The results of this screening form the basis for the second phase of our study, which will bring the podiatrist office into a central role of diagnosing peripheral arterial disease using the ankle–brachial index test among the local population with diabetes over the age of 50 and contrast this with the present standard of practice among podiatrists.

Table 2. Questions asked to enable classification into the symptomatic group.

- Do you have aching, cramping or other pain in your legs when you walk or exercise?
- Does the pain go away when you rest?
- Do you have pain in your toes or feet at night?

PAGE POINTS

1 In extrapolating this study and bringing it into the day-to-day work of podiatrists, in the US, there is the added cost of equipment and time.

2 However, should the ankle–brachial index (ABI) prove to be a useful tool in the diagnosis of peripheral arterial disease (PAD), it could become a standard practice guideline and treatment outcomes will outweigh cost.

3 A concern of this study, and that of population screening in general, is the risk of labelling a 'sick' population as even 'sicker' for perhaps a yet undetermined benefit in morbidity and mortality.

4 Although difficult to implement, lifestyle changes, particularly in asymptomatic patients with low ABI scores, may prove beneficial to the long-term progression of PAD much like in those with impaired glucose tolerance.

bringing it into the day-to-day work of podiatrists in the US, there is the added cost of equipment and time. However, should ABI prove to be a useful tool in the diagnosis of PAD, it could become a standard practice guideline and treatment outcomes will outweigh cost.

In bringing this test to the primary care physician the ABI will be of even greater value as physicians and nurses will not need to be as proficient in the assessment of pedal pulses and other trophic pedal changes in arriving at a diagnosis of PAD. It can prove to be quite efficient: it is less time consuming; it is easy to complete; and it can be done alongside blood pressure measurement (as half the test is already completed).

PAD can often be asymptomatic. Symptoms in the calf of the leg and the inability to exercise can be falsely attributed to other causes, such as ageing and arthritis, so PAD can go undiagnosed. A simple but significant tool will be the future practice of ABI scoring and dispensing of written recommendations and verbal instruction which reinforce the control of the risk factors mentioned earlier.

A concern of this study, and that of population screening in general, is the risk of labelling a 'sick' population (those with diabetes) as even 'sicker' (having diabetes and PAD) for perhaps a yet undetermined benefit in morbidity and mortality.

Future implications

Future planning to bring this care into everyday practice has implications for US podiatrists in the leadership role they can take in providing ABI screening and being at the forefront of the ADA's consensus panel recommendations (ADA, 2003).

Treatment algorithms, as modified from that described by Drummond (1997), for the treatment of PAD can be implemented as a practice guideline. Utilisation of lifestyle modifications with recommendations for exercise, smoking cessation and pharmacological treatment with antiplatelet therapies, control of hypertension, hyperlipidaemia and diabetes control will all be instrumental in assessing changes in physicians' practices.

Although difficult to implement, lifestyle changes, particularly in asymptomatic patients with low ABI scores, may prove beneficial to the long-term progression of PAD, much like in those with impaired glucose tolerance (Rao et al, 2004). Practice should include checking, or recommending the lowering, of HbA_{1c} levels to below 7% in people with diabetes, control of hypertension, lowering low-density lipoprotein-cholesterol to below 100 mg/dl (2.6 mmol/l), and initiating aspirin or other antiplatelet medicines, as well as referral to a vascular specialist or further non-invasive vascular testing, weight reduction planning and implementation of a walking or other exercise programme (ADA, 2003).

The American Podiatric Medical Association has a national initiative in place to increase patient walking activity in its campaign entitled Podiatrists Keep America Walking and its annual survey of the top-ten US 'walking cities'. This initiative to increase walking as a behavioural modification will improve upon the results of outcome measures.

Collectively, the author feels that ABI screening will improve upon the level of practice of podiatrists and improve the overall health and well-being of people with diabetes, who constitute a significant portion of their daily patient load. It will strengthen the relationship between vascular and podiatric surgeons, who in their daily work strive to improve limb salvage rates and preserve as much of the integrity of the foot as possible. It will also improve upon the greater public health issues of decreased morbidity and mortality of this at-risk population group. If successful, the author feels this study may change podiatric physician practice and policy guidelines and serve as an impetus to a larger study that seeks to introduce ABI screening into primary care practice. It will engage podiatrists in more primary care roles for controlling diabetes, hypertension, smoking cessation, obesity and risk

factor modification. Bringing this practice in at an earlier point in the process of screening will identify at-risk patients earlier on in the process and hence lead to a greater chance for successful management and, when appropriate, vascular intervention. Present practice, in the US, is, in the author's opinion, too little too late. ■

American Diabetes Association (ADA; 2003) Peripheral arterial disease in people with diabetes. *Diabetes Care* **26**(12): 3333–41

Antiplatelet Trialists' Collaboration (1994) Collaborative overview of randomised trials of antiplatelet therapy-I: Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. *British Medical Journal* **308**(6921): 81–106. Erratum in: *British Medical Journal* (1994) **308**(6943): 1540

CAPRIE Steering Committee (1996) A randomised, blinded, trial of clopidogrel versus aspirin in patients at risk of ischaemic events (CAPRIE). *Lancet* **348**(9038): 1329–39

Dawson DL, Hiatt WR, Creager MA, Hirsch AT (2002) Peripheral arterial disease: medical care and prevention of complications. *Preventive Cardiology* **5**(3): 119–30

Dorros G, Jaff MR, Dorros AM, Mathiak LM, He T (2001) Tibioperoneal (outflow lesion) angioplasty can be used as primary treatment in 235 patients with critical limb ischemia: five-year follow-up. *Circulation* **104**(17): 2057–62

Drummond M (1997) Socioeconomic impact of peripheral vascular disease. *Atherosclerosis* **131**(Suppl): S33–4

Feigelson HS, Criqui MH, Fronek A, Langer RD, Molgaard CA (1994) Screening for peripheral arterial disease: the sensitivity, specificity, and predictive value of noninvasive tests in a defined population. *American Journal of Epidemiology* **140**(6): 526–34

Gey DC, Lesho EP, Manngold J (2004) Management of peripheral arterial disease. *American Family Physician* **69**(3): 525–32

Hankey GJ, Norman PE, Eikelboom JW (2006) Medical treatment of peripheral arterial disease. *Journal of the American Medical Association* **295**(5): 547–53

Hiatt WR (2002) Pharmacologic therapy for peripheral arterial disease and claudication. *Journal of Vascular Surgery* **36**(6): 1283–91

Hooi JD, Stoffers HE, Kester AD, van RJ, Knottnerus JA (2002) Peripheral arterial occlusive disease: prognostic value of signs, symptoms, and the ankle–brachial pressure index. *Medical Decision Making* **22**(2): 99–107

Jarvis B, Simpson K (2000) Clopidogrel: a review of its use in the prevention of atherothrombosis. *Drugs* **60**(2): 347–77. Erratum in: *Drugs* **61**(1): 52

Mehler PS, Coll JR, Estacio R, Esler A, Schrier RW, Hiatt WR (2003) Intensive blood pressure control reduces the risk of cardiovascular events in patients with peripheral arterial disease and type 2 diabetes. *Circulation* **107**(5): 753–6

Mohler ER 3rd (2003) Peripheral arterial disease: identification and implications. *Archives of Internal Medicine* **163**(19): 2306–14

Moser M (1999) Hypertension treatment and the prevention of coronary heart disease in the elderly. *American Family Physician* **59**(5): 1248–56

Moser M (2003) Outcomes trials underlying the JNC–7 guidelines. *Managed Care* **12**(8 Suppl Hypertension): 20–5

Murabito JM, Evans JC, Nieto K, Larson MG, Levy D, Wilson PW (2002) Prevalence and clinical correlates of peripheral arterial disease in the Framingham Offspring Study. *American Heart Journal* **143**(6): 961–5

Norman PE, Davis WA, Bruce DG, Davis TM (2006) Peripheral arterial disease and risk of cardiac death in type 2 diabetes: the fremantle diabetes study. *Diabetes Care* **29**(3): 575–80

Rao SS, Disraeli P, McGregor T (2004) Impaired glucose tolerance and impaired fasting glucose. *American Family Physician* **69**(8): 1961–8

Sacks D, Bakal CW, Beatty PT, Becker GJ, Cardella JF, Raabe RD et al (2003) Position statement on the use of the ankle brachial index in the evaluation of patients with peripheral vascular disease. *Journal of Vascular and Interventional Radiology* **14**(9 Pt 2): S389

Singh N, Armstrong DG, Lipsky BA (2005) Preventing foot ulcers in patients with diabetes. *Journal of the American Medical Association* **293**(2): 217–28

'Bringing [ABI measurement] in at an earlier point in the process of screening will identify at-risk patients earlier on in the process and hence lead to a greater chance for successful management and, when appropriate, vascular intervention.'