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## Peripheral vascular disease

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### Aims and intended learning outcomes

The aim of this article is to provide an overview of peripheral vascular disease (PVD) and highlight the associated risk factors. Patient assessment and subsequent medical treatments will be reviewed. The role of the nurse will concentrate on health promotion and reduction in risk factors. After reading this article, you should be able to:

- Define peripheral vascular disease and briefly outline the disease process.
- List the essential components of patient assessment.
- Outline the various treatment options.
- Identify the associated risk factors that predispose people to peripheral vascular disease.
- Indicate the essential components of a risk factor modification programme.

evaluated at age 40 already had signs of significant calcification in the arteries in their legs. For those people who are exposed to lifelong atherosclerosis risk factors, it is this early arterial damage that often progresses to severe arterial narrowing (PECSVN 1998). Finally, the Basle study in Switzerland of limb arterial atherosclerosis showed a PVD prevalence of 18 per cent in men aged over 65 (Dormandy *et al* 1989).

The very nature of PVD involves lengthy and repeated hospital admission for many sufferers. Treatment can be tedious and painful, and the healing process is often slow. This obviously has major financial and social cost implications, and it is therefore vital that healthcare professionals have understanding and respect for PVD and its risk factors, so that improvements in quality of life and survival of this patient group are achieved.

### in brief

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#### Summary

This article discusses peripheral vascular disease and its associated risk factors. It outlines clinical patient assessment, medical interventions and the role of the nurse in secondary prevention.

#### Keywords

- Cardiovascular disorders
- Cardiovascular disorders: prevention
- Vascular disorders

These key words are based on the subject headings from the British Nursing Index. This article has been subject to double-blind review.

### Introduction

All forms of circulation or vascular disease, such as heart disease, stroke and peripheral vascular disease, are common in the Western world and some evidence of vascular disease will be present in most people by the time they reach late middle age (Mera 1997).

PVD typically begins its progression in mid-life (for men at approximately 45 years of age and for women 55-60 years) (PECSVN 1993). It is estimated that some 50,000 people per annum are admitted to hospital in England and Wales with PVD (Fowkes 1988). In the US, up to 1.3 million people, every two years over the next 50 years, can expect to develop disabling PVD (Gardner and Poehlman 1995). An American study of older patients with systolic hypertension showed that PVD occurred in approximately 25.5 per cent of that population (Newman *et al* 1993). A European study (Reunanen *et al* 1982) reported that 10 per cent of men

### TIME OUT 1

Think about how you would explain the nature of PVD to a patient. Consider the terminology you would use. Compare your notes with the following text.



### Pathology

A thorough understanding of arterial anatomy and physiology is required for clinical investigation, patient education, and in order to select an appropriate management programme for patients.

Generally, arteries have smooth linings, allowing unimpeded blood flow. Arteriosclerosis is a degenerative arterial disease and one of the chief causes of death in the UK (Reed 1985). It refers to 'hardening of the arteries', whereby muscle and elastic tissue are replaced with fibrous tissue and calcification might occur. Atherosclerosis is the most



common type of arteriosclerosis, characterised by the formation of atheromatous plaques, which are deposits of fatty material in the lining of medium and large-sized arteries. These arteries then become narrowed and rough as more fat is deposited. Blood clots form more easily due to their roughness, further narrowing the artery, and thus potentially limiting blood flow. A reduction of blood supply to the organs and tissues means that they are unable to perform as well, and the plaques are very liable to break down and form ulcers. Thromboses may then develop as a result of the roughening and ulceration of the inner coat of the arteries.

**Signs and symptoms** Arteriosclerosis causes:

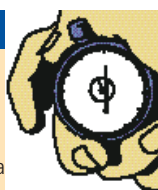
- The narrowing of small arteries which reduces the blood supply to various organs and tissues.
- Any thrombosis which occurs in the diseased arteries.

In many arteries, arteriosclerosis might have little effect, but it does produce well-recognised diseases. In the coronary arteries it leads to angina pectoris and coronary thrombosis. In the cerebral arteries it leads to cerebral thrombosis (one form of 'stroke') and in the leg arteries results in intermittent claudication and peripheral thrombosis with gangrene of the limb.

**Intermittent claudication** Patients suffering reduced blood supply to the lower limbs often experience effort-related cramp in the calves, thighs and buttocks, which disappears when they rest. This is known as intermittent claudication. The site of claudication indicates the most likely site of the narrowing or blockage and when severe, claudication can become debilitating, limit mobility and is sometimes associated with a worsened quality of life and loss of functional independence. Pain can occur at more regular intervals as the disease process continues to its end stage – critical limb ischaemia – until it finally occurs when the patient is at rest (rest pain). At this stage, rest pain is usually worse when the legs are elevated and during sleep, with the patient gaining relief by hanging the foot over the side of the bed. The development of non-healing wounds or gangrene (tissue death) could occur at this stage. Revascularisation is usually required to avoid amputation. This disease process can lead to loss of limb and life, therefore investigation and early diagnosis are important for successful patient management.

### TIME OUT 2

Imagine a patient presents at a vascular clinic with suspected peripheral vascular disease. Make notes on what the vascular team would need to consider to ensure a comprehensive patient assessment.



**Assessment** Individual patient care begins with a thorough assessment. There are three essential components of assessment for identifying patients with PVD (Box 1). The patient who presents with typical, reproducible, exertional discomfort in the buttocks, thighs, or calves, that disappears with rest, is likely to have claudication and symptomatic PVD.

### The ankle brachial pressure index

The ABPI is an inexpensive, non-invasive diagnostic test that is both highly sensitive and specific for PVD, and this test can quantitatively clarify the severity of PVD in nearly all affected individuals, whether symptomatic or not. The ABPI is also an accurate predictor of mortality, with a low ABPI indicating a very poor prognosis. Patients with an ABPI value of 0.90 or less are diagnosed to have PVD. It is important to note that an ABPI can be difficult to achieve in patients with long-standing diabetes or other older patients with calcified calf arteries, not compressible by the blood pressure cuff.

**How to record the ABPI** Rest the patient in a supine position. Measure the systolic blood pressure in both arms. Measure the ankle systolic blood pressure from the left and right dorsalis pedis (DP) and posterior tibial (PT) arteries. The value of one ankle is taken from the higher of the DP and PT readings.

The ABPI is calculated by dividing the highest ankle pressure by the highest brachial pressure (McKenna *et al* 1991). Once the assessment criterion is completed, the vascular team summarises the findings and devises a treatment plan for the patient. Box 2 outlines how to interpret the ABPI.

### Medical interventions

Most people with mild PVD will not require surgical treatment. Their condition can be treated simply through lifestyle modification by avoiding cigarettes, taking regular exercise and reducing weight where necessary. Therefore, the sequence of subsequent investigations is very much dependent on the patients' symptoms. To assess whether further medical intervention is required, the following procedures can be undertaken.

Usually performed by a vascular technologist, a Doppler records the blood flow at various points of the patient's leg and detects the severity and location of vessel disease. Doppler ultrasound works on the principle that the frequency of sound reflected by a moving object (the red blood cells) is shifted in proportion to its velocity.

To determine the size and blood flow of a vessel, a Duplex scan is undertaken, whereby ultrasound waves monitor the amount of blood flow through

### Box 1. Stages of assessment for PVD

**Stage 1 – Vascular history of symptoms including relevant health problems such as cardiac history, surgical history, description of pain, and lifestyle (to identify risks)**

**Stage 2 – Physical assessment for signs of:**

- Ischaemia
- Absent pulses
- Poor skin nutrition
- Low skin temperature and loss of hair
- Cool temperature of the leg/foot due to deficient blood supply
- Paleness of the leg/foot when elevated, due to a diminished blood supply
- Redness – instead of a normal rosy pink, the leg or foot might be red or reddish-blue, due to the injury of the superficial capillaries which causes them to remain dilated
- Cyanosis indicates less than normal levels of oxygen in the blood. It implies very slow circulation in that area
- Reduced ability to spread the toes and move the foot

**Stage 3 – Blood pressure measurement, using Doppler ultrasound on the ankle arteries. This is called the ankle brachial pressure index (ABPI)**



### Box 2. ABPI interpretation

MEASUREMENT	INTERPRETATION
Above 0.90	Normal
0.71 - 0.90	Mild obstruction
0.41 - 0.70	Moderate obstruction
0.00 - 0.40	Severe obstruction

### Box 3. Medical interventions

- Drugs (aspirin, peripheral dilators, anti-hypertensives)
- Doppler and Duplex scans
- Arteriogram
- Angioplasty
- By-pass surgery
- Amputation

### Box 4. Risk factors

- Increased all-cause mortality – the risk of death for individuals with PVD can be as high as for many common cancers. Patients with an ABPI of <math><0.40</math> have a five-year probability of survival of only 44 per cent (McKenna *et al* 1991)
- Increased cardiovascular mortality – claudication is associated with a two-to-fourfold increase in the risk of cardiovascular mortality, as highlighted in the Framington Study (Murabito *et al* 1997)
- Non-fatal cardiovascular events – people with PVD are at increased risk of heart attack, stroke, transient ischaemic attack (TIA), angina and congestive heart failure

the blood vessels. Doppler and Duplex scanning are referred to as non-invasive tests.

Arteriogram and angioplasty are invasive procedures, requiring a short hospital stay.

**The arteriogram** An arteriogram is an X-ray procedure enabling diagnosis of a blockage or malfunction in the arteries. It provides the vascular team with knowledge of the extent and location of any arterial disease. A needle and small catheter is inserted into the artery at the groin. Contrast (dye) is injected down the catheter and X-rays taken as the solution passes along the arteries. These X-rays can be used to determine patients' treatment plans.

**Angioplasty** This is a procedure in which a balloon is passed into the artery on the end of a catheter, then inflated to treat a narrowed or blocked artery. The inflated balloon breaks the plaque, pushes it back against the artery wall, stretches the artery and subsequently increases the blood flow. The catheter is then removed once the balloon has been deflated. If the artery has been sufficiently stretched (determined by injecting contrast dye), it means that the need for surgery is avoided (albeit temporarily in some cases).

However, avoidance of surgical intervention is not always possible when a patient has more severe occlusive arterial disease. In this situation, one of the following procedures can be undertaken:

- An endarterectomy – removes plaque from a diseased artery.
- A thrombectomy/embolectomy – removes blood clots from a blocked artery
- A bypass – required when angioplasty has either failed or is insufficient to improve the circulation. This operation bypasses the blocked arteries in the leg, to improve the blood supply.

Where the arteries are furred up and blocked, infection is present, or the muscles and tissues are too badly damaged, and surgical reconstruction is not possible, the limb might require amputation. Box 3 summarises the medical interventions.

#### TIME OUT 3

Imagine you are asked to conduct a risk factor assessment of a patient with known PVD. Indicate what you think the key risks are and how you might conduct your assessment.



#### Risk factors

The atherosclerosis risk profile of individuals with PVD is similar, but not identical, to the risk profile of individuals with other forms of atherosclerosis.

PVD leads to tangible risks of other vascular ischaemic events and deaths (Box 4).

The typical PVD patient is likely to have cardiovascular problems, such as ischaemic heart disease and congestive heart failure. In addition smoking, hypertension, elevated cholesterol and diabetes, are commonly associated with PVD. It is therefore essential to reduce such risk factors. The vascular team must attempt, where appropriate, to modify blood cholesterol levels via dietary and medical interventions. Exercise should be prescribed for symptomatic individuals, and smoking cessation initiatives established. Anti-platelet and antithrombotic medication (such as aspirin 75mg or warfarin) should be administered or considered appropriate, as should peripheral dilators.

**Smoking** The risk of atherosclerosis increases in accordance with the quantity of cigarettes smoked by a person (Mera 1997). Nicotine is thought to increase platelet adhesion, and carbon monoxide might increase the permeability of the arterial wall lining, thus enhancing plaque formation. Smokers also have higher fibrinogen levels and a higher blood viscosity, both of which exacerbate atherosclerosis (Mera 1997). Regarding PVD, smoking cessation has a greater influence on patient outcome than drug therapy (Ball 1981).

**Cholesterol** Studies, such as the Scandinavian Simvastatin Survival Study (1994) – known as the 4S study – show a positive relationship between raised blood cholesterol levels and the incidence of atherosclerosis, especially when associated with coronary heart disease (CHD). Elevated cholesterol levels can be the result of endogenous (metabolic disease, for example, diabetes) or genetic factors, or those that are exogenous (high fat, especially saturated fats and high cholesterol diet).

**Exercise** In much of the world, obesity is epidemic and the combination of physical inactivity and excessive calorie intake lead to metabolic abnormalities toxic to arteries. A meta-analysis of exercise programmes for improving claudication pain distances in patients with PVD, recommends a standard six month minimum exercise programme using intermittent walking to near-maximal pain (Gardner and Poehlman 1995).

**Hypertension** The most common causes of death in the UK older population are associated with hypertension, whereby increased circulatory pressure creates stress on the heart and blood vessels (Mera 1997). Current recommendations for educating hypertensive patients are to stop smoking, lose excessive weight, reduce saturated fat intake, avoid excessive alcohol, reduce salt intake and take regular exercise.

**Diabetes** Although diabetes as a single condition is an independent risk factor for atherosclerosis, the increased risks of obesity, hypertension and hyperlipidaemia which can be associated with diabetes, further increase risk of PVD (Mera 1997). For those patients with diabetes, atheroma



develops at a younger age and with increased severity. Box 5 summarises these risk factors.

### Patient education

It is commonly agreed that the associations between the diagnosis of PVD and its accompanying risks remain relatively unknown and often patients might not receive intensive medical interventions until severe symptoms or limb-threatening gangrene are observed. This is compounded by the fact that many people have trouble associating leg pains with a serious risk of heart disease or stroke and assume that claudication is merely a sign of 'growing old'. This is demonstrated when treatment attitudes toward patients with PVD versus patients with coronary artery disease (CAD) were compared. McDermott *et al* (1997) noted that patients with PVD were less likely to take cholesterol-lowering drugs or antiplatelet agents, or to follow a low-fat diet. Additionally, 74 per cent CAD patients recalled medical advice to exercise, compared to only 47 per cent PVD patients (McDermott *et al* 1997). On this basis, healthcare professionals need to be aware that any change in attitudes, skills or knowledge, might diminish over time if they are not reinforced over the long term. Ley's (1990) findings that patients forget about 40 per cent of provided information would appear to reinforce this view. However, lack of commitment on the patient's part can also affect ability to recall information.

This sets a huge challenge for all professionals caring for patients with vascular disease, to promote understanding of the disease process and its risk factors (Box 6).

It is imperative that in our drive to promote awareness of the risk factors and implement structures to reduce them, that we also remember patient empowerment and choice.

### TIME OUT 4

Reflect on why empowerment and choice is of importance when educating a patient with vascular disease on lifestyle changes.



### Empowerment and choice

Influencing individual health choices is a major function of health education. However, rather than manipulating and forcing people with vascular disease to comply with advice, the role of the nurse in this situation should emphasise (French 1990):

- Support.
- Empowerment.
- Facilitating choice.
- Promoting self-esteem.

Vascular nurses and doctors who try to persuade patients to do what they think they should do might constitute a subtle form of coercion, rather than education. Individual freedom should therefore be seen as paramount, along with the consequent acceptance that 'educated' people must be free to choose 'unhealthy' lifestyles and run the risk of exacerbating vascular disease if they so wish.

### The change process

Should patients with PVD choose to modify their lifestyle in some way, the following 'stage of change' model of behaviour (Prochaska *et al* 1993) forms an essential element of the process:

- Pre-contemplation – many people who attend a vascular out-patient clinic might not be at all interested in changing their 'risky' lifestyle, whether it includes smoking, high fat diet, inactivity, high alcohol intake or overeating. They might never have considered change, or, as previously mentioned, have been made aware of the risks they are running.
- Contemplation – once patients have been made aware of the need to change their lifestyle, through education on arteriosclerosis, and its associated risk factors, they weigh up the costs and benefits of change. For many, this can involve the choice between change of lifestyle or loss of a limb.
- Preparing to change – when perceived benefits outweigh the costs, and the patient believes change is worthwhile, he or she prepares to change.
- Making changes – positive decisions are required at this stage, requiring a clear goal, realistic plan, and support of the vascular team.
- Maintaining change – once habits are broken, the person has to settle into the new way of behaving. This will require the ongoing motivation and support of the vascular team.

It is important for individuals to pass through the 'stage of change' model of human behaviour, for those who leap over stages without adequate contemplation or preparation are at high risk of relapse.

### TIME OUT 5

You have been asked to set up a secondary prevention clinic for peripheral vascular disease. Brainstorm the factors that could influence the success of the clinic.



### Secondary prevention clinics

Secondary prevention in PVD is the attempt to prevent furthering the disease process after it has manifested itself. Health promotion represents placing the absence of disease in the forefront of

### Box 5. Arteriosclerosis risk factors

- Sex – death rate is greater in males than females
- Age
- Emotional tension
- Elevated serum lipids
- Hypertension
- Cigarette smoking
- Obesity
- Impaired glucose intolerance (diabetes mellitus)
- Physical inactivity

### Box 6. Patients should be educated in these areas

- The need for regular exercise, preferably in a supervised setting, to improve claudication symptoms
- Follow dietary and medicinal interventions, to ensure control of blood cholesterol levels and diabetic blood glucose
- Foot care – foot injuries can lead to amputation, and these can be avoided by wearing well-fitting and protective footwear
- To participate in a vigorous programme to promote smoking cessation, to reduce the risk of critical limb ischaemia, heart attack, stroke and death
- To undergo monitoring of systolic and diastolic blood pressures, control of blood sugar and antiplatelet medications



### Box 7. Assessment of need

- To prioritise improvements in health care (to reduce the incidence of peripheral vascular disease)
- To identify priority groups/communities to receive health care (those people with multiple risk factors: smokers, hyperlipidaemia, non-exercisers, and diabetics)
- To determine the most appropriate interventions (health education in nurse-led secondary prevention clinics)
- To aid effective resource allocation (a vascular specialist nurse)

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attention. However, it is important to consider that such an approach does not take into account differing lifestyles, environmental factors, nor the relationship between behaviour and social circumstance. The focus should not be merely on disease prevention but also, and more importantly, on promoting positive health. Failure to consider these factors might mean that a preventive clinical approach can result in victim blaming.

The challenge for the vascular team is finding an effective way of putting all available evidence into practice, as there are various problems and complexities associated with secondary prevention:

- Many patients with PVD are older and have additional medical problems.
- Secondary prevention needs to be tailored to suit the individual patient to be effective.
- None of the components of secondary prevention are likely to be quickly or simply achievable.
- Helping people to change their lifestyle is not easy to effect or attain.
- Monitoring cholesterol and blood pressure levels and assistance to quit smoking all require regular patient follow-up.

Compiling a comprehensive package of secondary prevention for a typical vascular patient takes time, regular review and updating. One solution is to bring all factors together into structured secondary prevention clinics.

Assessment of need is the first phase in health promotion planning at national, regional and local levels (Box 7). It should assess the learning readiness of the target group at a local level to give insight into local attitudes, levels of knowledge and existing health practices. In turn, a community profile, on which to derive appropriate strategies and methods necessary to translate programme objectives into practice, can then be developed.

Formal or informal training should be given to staff involved in the secondary prevention programme. Lack of knowledge will prohibit nurses from giving effective advice, therefore denying patients the chance to make informed choices about reducing their risk of PVD.

The patient and family constitute the most important members of the (MDT) and their involvement should include identifying needs, setting goals and discussing treatments and techniques.

#### Strategies

Having explored needs, priorities, aims and objectives, the vascular nurse needs to select a variety of strategies to achieve the clinic's aims. The appropriateness and effectiveness of implemented learning strategies should also be reviewed.

The motivation of the target group to learn new skills and absorb information should be assessed in the programme planning, in conjunction with


assessment of their existing levels of knowledge concerning PVD.

Environmental and social factors mitigating against take-up of the secondary prevention clinics should also be recognised.

It is clear that setting up a health promotion programme is not an easy or straightforward task. Thought, insight, time, money and skill need to be invested if the programme aims are to be awarded a realistic chance of success. It is also imperative to remember that health education is concerned with making 'healthier choices easier choices' (Webb 1994). Education alone cannot be the catalyst for autonomy in individual health choices, and professionals advocating lifestyle change must be aware that it is often the social structures in which people live that are predominant major influences in enabling rights and freedoms on health issues. As health can potentially be sustained or diminished by our working and living environments, it is essential that professionals involved in secondary prevention understand how health is affected by policies on, for example, employment, housing and transport. These factors will obviously have a major impact on how easy it is for people with vascular disease to stop smoking, take a low fat diet and exercise.

#### Conclusion

PVD is a marker of risk to life and limb. The cardiovascular prognosis, without appropriate clinical intervention, has remained poor for decades. The costs of PVD to the patient in terms of quality of life, as well as potential loss of employment, can be enormous. In addition, severe disease can lead to hospitalisation, surgical intervention, home health costs, and requirements for long-term rehabilitation. However, a combination of physician, nurse and patient awareness can help to reduce risks, lower medical cost, and save lives.

Early diagnosis obtained by a detailed history, clinical examination and ABPI screening are of paramount importance to implement an appropriate treatment plan. All patients should receive the appropriate education on the risk factors and subsequent help and support for lifestyle modification. With the support of all the vascular team, we can aim to improve cardiovascular mortality and quality of life for all those people with PVD 

#### TIME OUT 6

Now that you have completed the article, you might like to think about writing a practice profile. Guidelines to help you write and submit a profile are outlined on page 54.

