



## Medicine for Managers

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# Peripheral Vascular Disease

**Peripheral Vascular Disease (PVD) is a slow, progressive circulatory disorder associated with narrowing or blockage of arteries most commonly in the leg muscles, but also in the brain or heart. It is also known as Peripheral Arterial Disease or hardening of the arteries. The most common cause is atherosclerosis, which is a build-up of a hard deposit on the inside of the arterial wall.**

To understand the disease process with PVD, it is important to appreciate the anatomy of the artery and the pathological changes which compromise the arterial passage of blood.

Arteries carry blood **away** from the heart (as opposed to veins which carry back **towards** the heart).

Blood is expelled from the heart under pressure in order to drive it round the body through the vascular system. When the heart contracts, the blood pressure rises and, in a healthy person, might be around 120 millimetres of mercury.

This is called the **systolic blood pressure**. As the heart relaxes between beats, the pressure falls and, in someone healthy, is commonly around

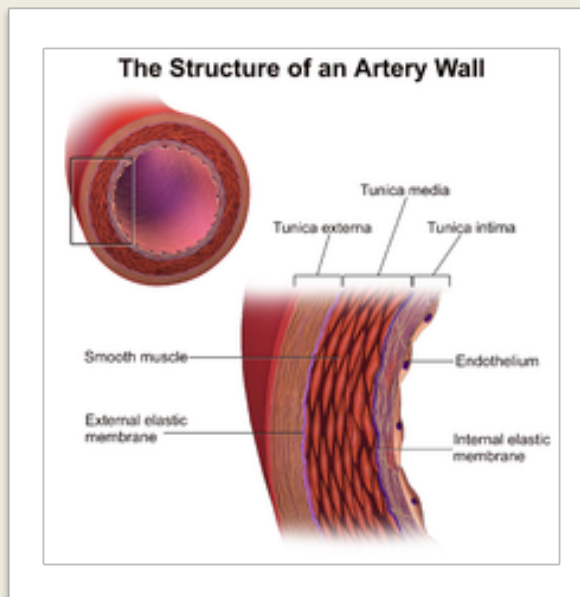
80 millimetres of mercury and is called the **diastolic blood pressure**.

When the doctor records the blood pressure, he therefore measures these two blood pressures:  
Systolic Pressure 120  
Diastolic Pressure 80

Under normal circumstances, with mechanical pumps, if the pump is pushing a fluid down a tube, the pressure is produced by the pumping action but drops to zero if the pump is switched off.

With the heart and vascular system this is not the case.

When the heart rests in between beats, the systolic pressure falls to the diastolic level but does not fall to zero.



Thus the blood continues to circulate. In large part this is because many arteries contain elastic fibres.

When the heart pumps, these arteries stretch because they are elastic and effectively accommodate a reservoir of blood. When the heart rests, the elastic fibres recoil and so push the blood reserve onwards in the circulation preventing the blood pressure falling too far. In this way the peaks and troughs of blood pressure which would otherwise occur, are partially flattened out.

The arteries going to the brain, heart and the periphery of the body have several layers as illustrated.

The inner layer is called the **tunica intima** which consists of cells called **endothelial cells** which line the artery and are soft and smooth so that flow is unimpeded.

The middle layer is called the **tunica media**.

It is the thickest layer and is made up of **smooth muscle cells** and **elastic fibres**. There are more elastic fibres in the arteries near the heart because the blood pressure is higher and the ability to distend is important.

Further from the heart, the blood vessels have more muscle cells, needed to push the blood along the vessels.

The outer layer is the **tunica externa**, made up of a mixture of **elastic** and **collagen** fibres. The

external layer provides structure, protection and support.

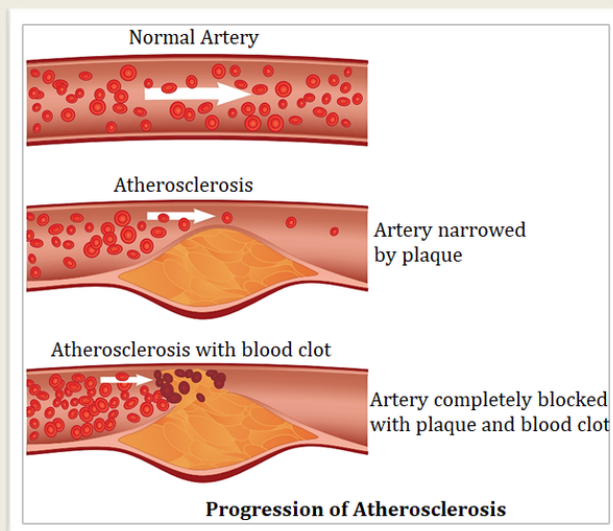
Peripheral arterial disease is caused by a build-up of fatty deposits in the walls of the arteries. These deposits, called **atheroma**, reduce the diameter of the arteries and the disease is called **atherosclerosis**.

The atheroma itself is composed of a mixture of fats (lipids) formed of cholesterol, with blood cells, calcium and fibrous tissue.

The result of the accumulation of the atheroma, is that the ability of the arteries to supply oxygen and nutrients to the tissues and to

eliminate waste products is compromised.

The plaques of atheroma steadily enlarge and the roughened surfaces provide a focus on which blood clot can form. The clot may produce increasing narrowing and ultimately obstruction of an artery impairing or preventing blood flow.



There are a number of risks which can increase the chances of developing the disease. Risk factors which cannot be changed include:

- Age (above 50)
- History of heart disease
- Being male
- Being a postmenopausal woman
- A family history of high cholesterol, high blood pressure or PVD

Factors which can be changed, influenced or treated include:

- Smoking
- Diabetes
- Raised cholesterol
- High blood pressure
- Failure to exercise
- Obesity

Diabetic smokers are the group at most risk of peripheral vascular disease and its complications.

Atheroma can affect arteries throughout the body but the arteries in the legs are the most commonly affected. The classic symptom is the development of pain associated with exercise.

The condition is called ***intermittent claudication*** (from the Latin word *claudicare* meaning to limp). The symptom normally subsides when the individual stops although, in severe cases, it may persist at rest.

The pain is usually located in the calf muscles but, in severe cases, it can affect the thigh muscles and can vary in intensity. Most commonly, when someone suffers leg pain, it will subside in 5-10 minutes.

Other features of PVD in the legs include:

- Weak or absent pulses in the legs
- Leg numbness and weakness
- Gangrene, especially of toes due to lack of blood flow
- Hair loss
- Wounds or ulceration over pressure points such as the heels
- Reddish discolouration of the legs
- Thick, opaque toenails

If the disease affects related pelvic vessels, the sufferer may experience impotence and more generalised lower muscular pain.

PVD may also affect the arteries in the brain and heart resulting in an increased risk of heart attack and stroke.

The disease is estimated to affect about one person in forty under the age of sixty, about one in twelve by age 70 and about one in six over the age of seventy.

**NICE data suggests that about 20% of the UK population between the ages of 55 and 75 have evidence of lower extremity peripheral vascular disease, equating to a prevalence of 850,000 people, 5% of whom have symptoms.**

Therefore a practice with 10,000 patients should expect 20 newly diagnosed cases a year, equating to 0.2%. The likelihood of acquiring the condition should be declining as smoking rates are reduced, blood pressure and cholesterol levels are better monitored and other lifestyle issues are addressed.

Patients with symptoms from the list above should attend a doctor and examination will raise the suspicion of PVD. These days, there are a variety of investigations to assist in the diagnosis and assessment of the severity of the condition. They may include:

1. **Angiogram.** The injection of a radio-opaque dye into a leg artery and X-raying the vessel to assess the degree of atheromatous change.
2. **Treadmill Test.** The subject walks on a treadmill whilst the blood flow is assessed.
3. **Doppler Ultrasound.** A technique using high frequency sound waves to measure and assess blood flow.

4. **Magnetic Resonance Angiography** using MRI technology to show detailed images of the vasculature, enhanced by the use of a dye.
5. Other tests involving blood flow assessment and mapping the extent of the arterial involvement.

The **treatment** of peripheral vascular disease depends on the severity of the disease and whether there are localised areas of severe narrowing or more generalised arterial restriction.

Peripheral arterial changes cannot be reversed medically and the production of symptoms is a warning of potentially serious medical problems. Medical interventions are undertaken to:

- Reduce the symptoms
- Reduce the risk of more disabling complications
- Lower the risk of heart attack or stroke

First and foremost must be key lifestyle changes to control the risk factors. These include:

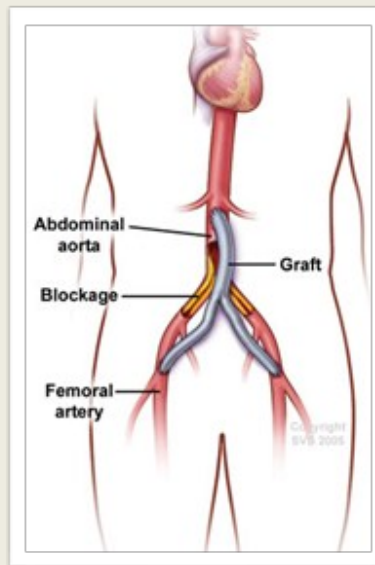
- Stopping smoking, including presence in areas where passive smoking may occur
- Increased regular exercise of at least thirty minutes a day
- Good nutrition with attention to reduced fat, avoidance of sugar and carbohydrates and increased consumption of fruit, vegetables and lean meat.
- Weight loss
- Reduction or cessation of alcohol intake

There should be vigorous medical treatment of any other medical disorders which might aggravate the vascular disease including:

- Management and good control of diabetes
- Reduction of high cholesterol
- Reduction of raised blood pressure

Medication can be employed to improve blood flow by:

- 'Thinning' the blood by the use of drugs such as anticoagulants and those that make the blood platelets less 'sticky'



- Dilating blood vessels by relaxation of the vessel walls

Vascular surgery may ease or resolve specific symptoms:

- **Angioplasty.** Insertion of a fine tube into the artery which may have

- A balloon to dilate the vessel
- A laser to destroy plaques
- A tiny coil or **stent** which is expanded within the artery to keep it open.

**Bypass surgery.** A graft fabricated from a vessel from another part of the body or a synthetic tube is placed near the blockage to divert blood.

The diagram shows the use of a graft to divert blood past a blockage where the aorta divides into the branches which supply the legs.

***Complications and adverse effects*** of peripheral vascular disease are relatively common in established cases and are normally the result of diminished or absent blood flow.

- Pain or severe pain
- Reduced mobility limited by symptoms
- Poor wound healing
- Amputation of ischaemic (insufficient blood flow) limbs

***In summary***, peripheral vascular disease remains a serious condition but modern therapy is reducing the incidence.

It causes restricted blood flow because of vessel narrowing.

Legs are most commonly affected. Improvement of blood flow is the key objective of medical or surgical treatment.

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