2 Assessment of Peripheral Vascular Disease

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2.1 Introduction

As radiologists we are very familiar with the use of sometimes very expensive investigations to solve clinical problems. However, it is important that, as interventionalists, we recognise the need for a thorough clinical assessment of our patients before recourse to expensive and possibly unnecessary investigations. Lower limb ischaemia is much more common than in the upper limb. It may be acute or chronic, with the latter manifesting itself either as intermittent claudication or critical limb ischaemia.

Thus, it is crucial to take a thorough history and examination. After this, investigations may be required to assess the severity and location of the arterial disease. It is also necessary to assess the general health of the patient, for example by identifying risk factors. This will not be covered in detail in this chapter.

2.2 History

The definitions of many of the terms used in the description of vascular disease are symptom based, meaning that the history is all important. Thus, acute limb ischaemia is defined as “any sudden decrease or worsening in limb perfusion causing a potential threat to extremity viability” (TASC 2000). Intermittent claudication describes leg pain that is brought on by exercise, is of sufficient severity to cause the patient to stop and is relieved by rest. Finally, critical limb ischaemia is usually readily identified clinically, but defies precise definition. Nonetheless, these patients have a chronic history featuring rest pain, possibly associated with ulceration or gangrene.

2.3 Examination

On examination the limb may appear normal in claudication, may be pale and cold in acute limb ischaemia or may show hair loss, atrophy of the subcutaneous tissues, ulceration or gangrene in critical limb ischaemia. It is attractive and logical to think that palpation of the limb pulses may indicate the likely site of the vascular stenosis or occlusion responsible for the symptoms. However, the presence or absence of peripheral pulses is, in fact, an unreliable guide (CRIQUI et al. 1985). For example, assessment of the strength of the femoral pulse is an unreliable indicator of the presence of aortoiliac disease (CAMPBELL et al. 1984), although the presence of a bruit on the symptomatic side is of value. Similarly the popli-
teal artery can be very difficult to detect even when normal, and assessment of the dorsalis pedis artery can be difficult because of variable anatomy.

2.4 Investigations

There are two issues which need to be addressed in the further assessment of peripheral vascular disease. The first is the severity of the ischaemia and the second is the location of the arterial disease causing it.

2.4.1 Severity of Ischaemia

The mainstay for assessment of the severity of ischaemia is the measurement of Doppler ankle pressures. Exercise testing can be a useful supplement to this. Other investigations such as plethysmography and transcutaneous oximetry are used less commonly.

2.4.1.1 Doppler Ankle Pressures

A continuous wave (CW) probe is used to detect flow in impalpable arteries. A sphygmomanometer cuff is then used to measure the systolic blood pressure. The cuff is placed around the ankle, inflated to greater than systolic pressure, then slowly deflated. The pressure at which the return of blood flow detected by Doppler occurs is the systolic blood pressure. The brachial systolic pressure is also measured. The ratio of the ankle pressure to the brachial pressure is then calculated to give the ankle brachial index (ABI). Use of ABIs allows patients to be compared, and also change within individual patients to be detected. Thus, a normal ABI is 1.0, and claudicants usually have an ABI of less than 0.9. A European Consensus Document has defined critical limb ischaemia (CLI) as persistent rest pain for more than 2 weeks, with or without ulceration or gangrene, with an ankle systolic pressure of less than 50 mmHg (EWGCLI 1992).

Ankle pressures can become quite inaccurate in the presence of vascular calcification, the classic example being in peripheral vascular disease secondary to diabetes. The vessels become relatively incompressible leading to falsely elevated pressure readings. Toe arteries rarely calcify, so the measurement of toe pressures is often recommended in these patients (Ubbink et al. 1997)

2.4.1.2 Exercise Testing

Exercise testing is generally performed using a treadmill, and is of value in patients who have a convincing history of claudication with normal Doppler ankle pressures at rest. Conventionally the speed is set at 3.5 kph at a gradient of 10°. The duration of exercise may be standardised to 1 min (Laing and Greenhalgh 1980) or may be continued until the patient experiences pain. The increase in muscle blood flow brought about by exercise will cause a fall in ankle pressures if there is significant arterial disease (Berglund and Eklund 1980).

2.4.1.3 Plethysmography

Plethysmography, sometimes called pulse volume recording (PVR), describes the measurement of limb volume. Short term alterations in limb volume can largely be ascribed to changes in the amount of blood contained within it (Brodie and Russell 1905). Completely accurate limb volume measurements require the use of very cumbersome equipment. Simpler equipment employing cuffs over segments of the limb allows volume changes to be measured using a pulse volume recorder. Other available measurements include limb diameter using a mercury strain gauge, blood skin volume measured by infrared photoplethysmography or skin blood flux by laser Doppler.

The difficulty with all of these measurements is that they are more complex and expensive than Doppler ankle pressures. Their main role is therefore in the assessment of venous disease and as research tools (Ruckly 1988). The role of plethysmography in clinical practice may change with the advent of digital photoplethysmographic sphygmomanometers, which are cheaper and require less expertise than Doppler pressures.

2.4.1.4 Other Techniques

Transcutaneous oximetry is time consuming, requires the skin to be heated and produces inac-