CASE TWO

Short case number: 3_27_2
Category: Cardiovascular
Discipline: Surgery
Setting: General Practice
Topic: Lower Limb Arterial disease

Case

Doug McCutcheon is a 69 year old who has recently moved into the self care units at the aged care facility that you attend. He is presenting today because of worsening pain in his legs. Since moving to the facility he has been enjoying daily walks however he has found that he is unable to walk all the way up the hill to the bus stop because of the pain in his calves.

Questions

1. In your assessment of Doug for lower limb ischaemia. What are the key features of your history and examination and why?
2. What are the possible differential diagnoses of claudication pain and how would you differentiate these on history and examination?
3. You explain to Doug that the pain in his legs may be due to blood vessel disease, explain the vascular anatomy of the lower limb and the pathophysiology of claudication pain.
4. What are the common sites of thrombosis in the lower limb arteries and outline the possible sites for the lodgement of emboli.
5. How is the ankle:brachial pressure index measured and what measurements are found in patients with no arterial disease compared with patients with intermittent claudication and chronic limb ischaemia?
6. You explain to Doug that if the vascular disease worsens he is at risk of critical limb ischaemia – what is critical limb ischaemia? Explain the clinical features on history and examination.
7. In a management plan detail the medical and surgical management of chronic Lower limb ischaemia. Including the indications, contraindications and risks of surgical management.

Suggested reading:

- Garden OJ, Bradbury AW, Forsythe JLR, Parks RW, editors. Davidson's Principles and Practice of Surgery. 6th edition. Philadelphia: Churchill Livingstone Elsevier; 2012.
- Henry MM, Thompson JN, editors. Clinical Surgery. 3rd edition. Edinburgh: Saunders; 2012.
- Douglas et al: Macleod's Clinical Examination 12th Edition. Elsevier Churchill Livingstone, 2009.
- Everett Stephen. Peripheral Vascular Disease. http://emedicine.medscape.com/article/761556-overview

ANSWERS

1. In your assessment of Doug for lower limb ischaemia. What are the key features of your history and examination and why?

   Clinical features of an ischemic limb:
   - pulseless
   - pain
   - pallor
   - 'perishing' cold
   - paralysis
   - paraesthesia.

   Faced with the acutely ischaemic limb, the following questions must be addressed: Is the limb salvageable? Is the limb threatened?

   <u>The non-viable limb</u>
   Features that indicate the limb is no longer salvageable include:
   - fixed staining of tissues
   - lack of blanching on pressure
   - anaesthesia with rigid muscles-rigor mortis.

   <u>The threatened limb</u>
   Features of an ischaemic limb that is likely, in the absence of revascularisation, to become non-viable include:
   - loss of sensation
   - loss of active movement
   - pain on passive movement and when the calf muscles are squeezed.

   When these features are present, there is a maximum of 6 hours in which to re-establish normal flow to avoid irreversible nerve and muscle injury.

2. What are the possible differential diagnoses of claudication pain and how would you differentiate these on history and examination?

   Intermittent claudication (IC)
   IC is pain felt in the legs on walking due to arterial insufficiency. It is the most common symptom of peripheral arterial disease. The pain typically occurs in the calf secondary to femoropopliteal disease but may be felt in the thigh and/or buttock if proximal (aorto-iliac) obstruction to blood flow is present. Patients describe a tightness or 'cramp-like' pain which develops after a relatively constant distance, which is shorter if walking uphill. The pain disappears completely within a few minutes of rest but recurs on walking. The claudication distance is how far patients say they can walk before pain starts.

   Neurogenic claudication
   This is leg pain on walking due to neurological and musculoskeletal disorders of the lumbar spine.

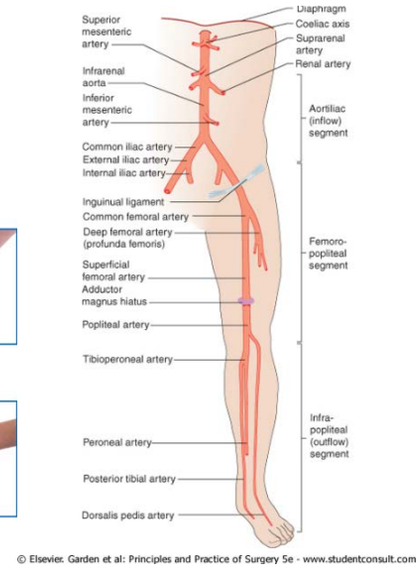
   Venous claudication
   This is pain due to venous outflow obstruction from the leg following extensive deep vein thrombosis. Neurogenic and venous claudication is much less common than arterial claudication, and can be distinguished on history and examination

The clinical features of arterial, neurogenic and venous claudication

	Arterial	Neurogenic	Venous
Pathology	Stenosis or occlusion of major lower limb arteries	Lumbar nerve root or cauda equina compression (spinal stenosis)	Obstruction to the venous outflow of the leg due to iliofemoral venous occlusion
Site of pain	Muscles, usually the calf but may involve thigh and buttocks	Ill-defined. Whole leg. May be associated with numbness and tingling	Whole leg. 'Bursting' in nature
Laterality	Unilateral if femoropopliteal, and bilateral if aorto-iliac disease	Often bilateral	Nearly always unilateral
Onset	Gradual after walking the 'claudication distance'	Often immediate on walking or standing up	Gradual, from the moment walking starts
Relieving features	On stopping walking, the pain disappears completely in 1-2 minutes	Bending forwards and stopping walking. May sit down for full relief	Leg elevation
Colour	Normal or pale	Normal	Cyanosed. Often visible varicose veins
Temperature	Normal or cool	Normal	Normal or increased
Oedema	Absent	Absent	Always present
Pulses	Reduced or absent	Normal	Present but may be difficult to feel owing to oedema
Straight leg raising	Normal	May be limited	Normal

3. You explain to Doug that the pain in his legs may be due to blood vessel disease, explain the vascular anatomy of the lower limb and the pathophysiology of claudication pain.

   Arterial insufficiency causes ischaemic muscle pain on walking: At rest, the blood requirement is met by the collateral circulation through the profunda femoris system which joins the popliteal artery below the blockage usually just above the knee. However, exercise produces a demand which cannot be met, and the calf muscles become ischaemic. Because the thigh muscles still have a normal blood supply, the pain is usually felt only in the calf. If stenosis is more proximal (aorto-iliac), then pain is felt in the whole leg and even the buttock if the blood flow to the internal iliac artery is compromised.



4. What are the common sites of thrombosis in the lower limb arteries and outline the possible sites for the lodgement of emboli.

   The most common site for atherosclerotic narrowing/occlusion are the superficial femoral artery, aorto-iliac and femoropopliteal segments.

   Emboli, usually are of cardiac origin (80%); they also can originate from proximal atheroma, tumor, or foreign objects. Emboli tend to lodge at artery bifurcations or in areas where vessels abruptly narrow. The femoral artery bifurcation is the most common site (43%), followed by the iliac arteries (18%), the aorta (15%), and the popliteal arteries (15%).

5. How is the ankle:brachial pressure index measured and what measurements are found in patients with no arterial disease compared with patients with intermittent claudication and chronic limb ischaemia?

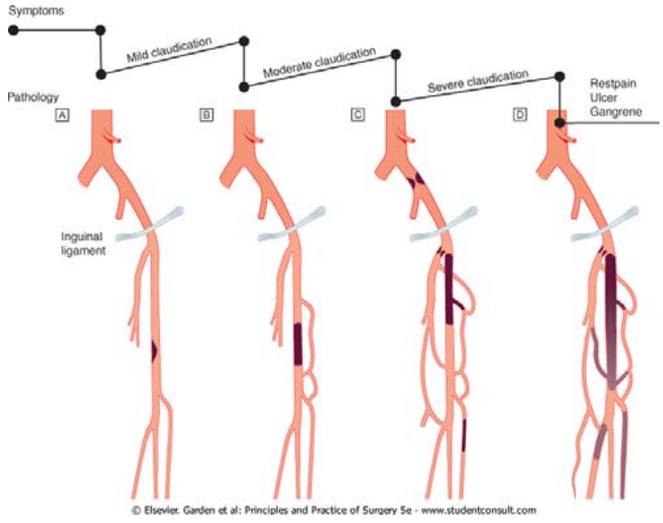
   <u>Ankle:brachial pressure index</u>
   The severity of ischaemia can be estimated by determining the ratio between the ankle and brachial blood pressures. The latter is recorded in the normal way, the former using a cuff and a hand-held Doppler device.

   Normal: should be at least 1 (the pressure at the ankle at least as high as that in the arm)
   Intermittent Claudication: usually 0.5-0.9
   Chronic limb ischaemia: usually less than 0.5.

6. You explain to Doug that if the vascular disease worsens he is at risk of critical limb ischaemia – what is the critical limb ischaemia? Explain the clinical features on history and examination.

   Critical Limb Ischaemia (CLI) is usually caused by multiple lesions affecting different arterial segments. These patients have tissue loss (ulceration or gangrene), with or without rest pain, and, by definition, have an ankle blood pressure of less than 50 mmHg. Without revascularization, such patients will usually lose their limb-and often their life-in a matter of weeks or months.
   Subcritical limb ischaemia (SCLI) describes patients who have night and/or rest pain, but not tissue loss. They are in an intermediate group between IC and CLI, and share features of both. A proportion of these patients may respond to BMT, thereby obviating the need for arterial reconstruction to save the limb.
   Severe limb ischaemia (SLI) describes all patients with chronic limb ischaemia that is more severe than

IC: that is, CLI and SCLI.



13. In a management plan detail the medical and surgical management of chronic Lower limb ischaemia. Including the indications, contraindications and risks of surgical management.

Medical therapy:

- Immediate, absolute and permanent cessation from smoking
- Control of hypertension
- Control of hypercholesterolaemia. It is increasingly apparent that, whatever a patient's baseline cholesterol, if there is any manifestation of atherosclerosis, then that level of cholesterol is too high for the individual patient and should be lowered. While dietary advice is important, virtually all patients will require drug therapy, usually with statins, to obtain the necessary fall in total cholesterol. There is increasing evidence that statins, as well as having cholesterol-lowering properties, also stabilize atheromatous plaques and prevent the development and progression of aneurysmal disease through as yet incompletely understood anti-inflammatory mechanisms.
- Prescription of an antiplatelet agent. This is normally aspirin (100 mg daily), but in the significant proportion of patients who state they are unable to tolerate this, clopidogrel (75 mg daily) is an equally effective alternative.
- Regular exercise (if possible).
- Control of obesity. (improving blood pressure, cholesterol and exercise tolerance)
- Active treatment of patients with diabetes, including foot care

Active intervention, by either endovascular or open surgery, should not normally be considered until the patient has been compliant with BMT for at least 6 months.

Surgical management:

<u>Endovascular management</u>

Percutaneous transluminal (balloon) angioplasty (PTA) has been used successfully in the iliac, femoral, popliteal and tibial arteries. PTA is performed under local anaesthesia. The lesion is identified on duplex ultrasound or arteriography and crossed with a wire. A balloon catheter is introduced over the wire and the balloon inflated. This ruptures the atheromatous plaque, thereby enlarging the lumen. In supra-inguinal (aorto-iliac) occlusions and complex disease, metal stents may be deployed across the lesion to improve patency and reduce distal embolic complications.

In Intermittent claudication:

- relatively expensive
- associated with a 1-2% morbidity rate
- possible lack of durability in femoro-popliteal segment
- Such patients tend to be younger, so that their symptoms have a greater impact on their quality

of life and livelihood.

- More often short-segment disease that is amenable to PTA with or without a stent.
- They often have (relatively) normal infra-inguinal arteries
- They tend to be more symptomatic, with shorter walking distances and bilateral symptoms.
- They may not achieve a satisfactory increase in walking distance with BMT alone, because the ability of the body to collateralize around aorto-iliac disease is not as good as it is around femoro-popliteal disease.
- The long-term patency of PTA and stenting is optimal in high-flow, large-calibre vessels, leading to durable benefit in most patients.

In Critical limb ischaemia

- it may be safer, cheaper and quicker
- it may require less hospitalization
- it can be repeated; and, even if it is unsuccessful, it may not prejudice the chances of subsequently performing a successful arterial bypass
- tend to have complex multilevel disease, many are unsuitable for conventional PTA.
- Randomized controlled trials are currently under way.

Arterial reconstruction

In Intermittent claudication, most surgeons are reluctant to perform infra-inguinal bypass surgery because:

- The risk of limb loss is very low with medical therapy.
- Those patients who fail to comply with medical therapy are also those at greatest operative risk and those least likely to gain durable benefit from their bypass.
- Surgery is associated with a significant risk of mortality and major morbidity (exceeding 5% for infra-inguinal bypass and 10% for aorto-bifemoral bypass)
- As most patients have bilateral disease, even if they have unilateral symptoms, successful surgery on one side often reveals limiting symptoms on the other, requiring a second operation. (This is also a problem with unilateral PTA/stenting.)
- As soon as a bypass graft is inserted, collaterals circumventing the original lesion involute. For this reason, when the graft occludes, usually suddenly, the patient is normally returned to a worse level of ischaemia than before the operation. Secondary interventions are technically more difficult, are associated with higher risk and have a lower patency rate.

As with PTA and stenting, the balance of risks and benefits is different in patients with aorto-iliac disease. Although the risk of surgery is higher, the long-term patency rates of such grafts are excellent, and one operation deals with both legs.

Procedures of arterial reconstruction :

Endarterectomy

This involves the direct removal of atherosclerotic plaque and thrombus. With the advent of prosthetic large-calibre grafts and the successful endovascular treatment of focal disease, endarterectomy is a relatively uncommon operation in modern surgical practice, except at the carotid bifurcation.

Bypass grafting

For a surgical bypass operation to be successful in the long term, three conditions must be fulfilled:

- There must be high-flow, high-pressure blood entering the graft (inflow).
- The conduit must be suitable.
- The blood must have somewhere to go when it leaves the graft (outflow).

Two main types of conduit are available:

- autogenous material, most commonly the ipsilateral long saphenous vein
- prosthetic material (polytetrafluoroethylene or Dacron).

The main advantage of vein is that it is lined by endothelium that is actively antithrombotic and profibrinolytic, and more resistant to infection.

Extra-anatomic bypass

In most bypass operations, the new conduit more or less follows the course of the original artery-so-called anatomic bypass. Where this is not possible and/or desirable, a so-called extra-anatomic bypass can be inserted. For example, if only one iliac artery is blocked, and the patient is unfit for abdominal surgery and unsuitable for endoluminal treatment, a femoro-femoral crossover graft can be performed.

Complications of arterial reconstruction

In the early post-operative period (30 days), vascular patients are susceptible to all the general complications of major surgery. As such patients are usually elderly and unfit with widespread vascular disease, and the operations are lengthy and blood loss is often high, the morbidity of vascular surgery is considerably higher than for most other types of major surgery.

In the longer term, the major complications are graft occlusion and infection. (note the increasing prevalence of antibiotic-resistant organisms, including MRSA). Once a prosthetic graft is infected, it must be removed to rid the patient of sepsis and/or to prevent the anastomoses breakdown and potential life-threatening haemorrhage.