

Acute and chronic limb ischaemia

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Acute Lower Limb Ischaemia




- Definition:
 - Any sudden decrease in limb perfusion causing a potential threat to limb viability
- Presentation less than 2 weeks duration
- Overlap with chronic critical leg ischaemia
- Incidence: 1 per 6000 population per year

ALI

- Subcritical ischaemia (viable leg):
 - no neurological deficit and audible arterial doppler at ankle
- Critical acute ischaemia (threatened leg):
 - partial neurological deficit, no audible doppler signal
- Irreversible acute ischaemia:
 - complete neurological deficit, tense muscles, absent capillary return, no arterial or venous doppler signal



Livedo reticularis

0-6 hours	6-12 hours	over 12 hours
		
<p>Painful, marble white foot Neurosensory deficit</p>	<p>Mottled appearance due to capillary pooling Blanches on digital pressure</p>	<p>Fixed staining: mottled areas coalesce and no longer blanch to pressure Anterior compartment red and tender</p>
<p>Reversible</p>	<p>Partly reversible</p>	<p>Irreversible</p>

Aetiology

- Thrombosis
 - Atherosclerosis
 - Popliteal aneurysm
 - Bypass graft occlusion
 - Thrombotic conditions
- Embolism
 - AF
 - Mural thrombosis
 - Vegetations
 - Proximal aneurysms
 - Atherosclerotic plaque
- Rare causes
 - Dissection
 - Trauma
 - External compression
 - Popliteal entrapment
 - Cystic adventitial disease
 - Compartment syndrome

Clinical features

- Severity of ischaemia at presentation is the most important factor affecting outcome of the leg.
- Pain, paralysis, paraesthesia, pallor, pulselessness, perishingly cold.
 - Pain severe, resistant to analgesia
- Leg initially white with empty veins, after 12-24 hours vasodilatation due to ischaemia of smooth muscle causes mottled blanching appearance
 - Flow not restored: arteries distal to the occlusion fill with propagated thrombus and capillaries rupture causing fixed blue staining

Clinical features

- If collaterals present, leg less severely ischaemic

Initial management

- Manage dehydration, CCF, hypoxia and pain
 - No IM injections if thrombolysis a possibility
- IV heparin 5000 units then infusion
 - To restrict propagation of thrombus
 - Improves prognosis
- Bloods: FBC, EUC, glucose
- ECG, CXR
- Delay thrombophilia screen
 - Tests inaccurate in presence of acute thrombus
- Physical examination for aneurysms – duplex ultrasound

Revascularisation

- Irreversible leg ischaemia
 - Muscle paralysis, tense swollen fascial compartments, fixed skin staining
- Revascularisation inappropriate
- Terminal care may be kindest option
- Resuscitate and stabilise then consider amputation

Revascularisation

- Acute critical ischaemia
 - Acute white leg with sensorimotor deficit
- Requires urgent intervention to prevent limb loss
- Most likely embolic
- Surgery - embolectomy

Revascularisation

- Acute subcritical ischaemia
 - Acute onset of rest pain, no paralysis and no or mild sensory loss
- Cause often thrombosis of atherosclerotic artery or graft
- Time for investigations
 - Duplex/CTA/MRA
- Intervention: surgery or percutaneous thrombolysis

Thrombolysis

- Less invasive than surgery
- Can open small and large arteries
- May uncover the cause of the thrombosis (eg stenosis) which can be treated with angioplasty
- Better initial treatment for graft occlusions
- Surgery better for native vessel occlusions

Thrombolysis

- Thrombus dissolution achieved by stimulating conversion of fibrin bound plasminogen to active plasmin
 - no specific protease capable of degrading fibrin and producing thrombus dissolution
- Catheter placed within the thrombus via percutaneous route
 - Thrombolytic agent delivered locally
 - Plasmin less likely to be neutralised by circulating antiplasmins

Thrombolysis contraindications

- Absolute
 - Active internal bleeding
- Relative
 - Known pregnancy
 - CVA/TIA within 2 months
 - Known intracerebral tumour/aneurysm/AVM
 - Severe bleeding tendency
 - Craniotomy within 2 months
 - Vascular surgery within 2 weeks
 - Abdominal surgery within 2 weeks
 - Previous GIT haemorrhage
 - Trauma within 10 days
 - Puncture of non-compressible vessel or biopsy within 10 days

Thrombolysis technique

- Adequate analgesia, IV access, IV hydration
- Arteriography/duplex to define occlusive disease
- Percutaneous access on palpable pulse side
- Pass guidewire through occlusion (soft thrombus will dissolve) then catheter placed within thrombus
- Agent delivery: initial high dose bolus then infusion or several high dose boluses
 - Streptokinase, urokinase, tissue plasminogen activator
 - Urokinase, tPA better and equivalent
 - Combine with heparin infusion and continue for 48 hours ?
warfarin

Complications

- AMI/CVA
- 12.4% mortality at 30 days
- Major haemorrhage 9%
 - Can give aprotinin (plasmin inhibitor), whole blood, FFP, fibrinogen concentrate
- CVA 3%
- Minor haemorrhage 40%

Outcome

- Successful thrombolysis 70%
- Limb salvage 93% (usually 75%)

Surgical management

- Balloon catheter embolectomy
 - Both groins prepared
 - Foot in sterile bag to inspect
 - Common femoral artery bifurcation exposed
 - SFA, PFA, CFA secured with silastic slings
 - Transverse arteriotomy proximal to bifurcation
 - No inflow: 4F or 5F balloon catheter proximal to aorta and withdrawn (pressure contralat femoral artery)
 - 3F or 4F balloon catheter passed distally down PFA, SFA
 - Completion arteriography should always be performed

Surgical management

- Failed embolectomy
 - Streptokinase/tPA infusion via catheter for 30 mins then repeat arteriogram

Further management

- Revascularisation of ischaemic leg
 - Sudden venous return of blood with low pH and high K
 - Can get hypotension and arrhythmias
 - Large area ischaemic tissue revascularisation: SIRS due to neutrophil activation
 - Can cause MODS/ARDS
 - Watch for myoglobinuria causing ARF
 - Compartment syndrome must be watched for
 - Anticoagulate with IV heparin/warfarin
 - Look for embolic source – 20% no cause found

Overall prognosis

- 70% limb salvage
- 33% mortality
 - Poor cardiac function
 - Associated PVD
 - Short duration of symptoms
 - Need for amputation

Peripheral vascular disease

- Natural history:
 - Asymptomatic: 7-15% develop intermittent claudication within 5 years
 - Risk for progression: age, current cigarette use, HT, diabetes, raised LDL
 - Asymptomatic PVD associated with systemic cardiovascular complications
 - Risk of death or disability from cardiac/cerebral events much higher than lower limb symptoms

Intermittent claudication

- Over 5 year period
 - 50% stable
 - 25% significant deterioration
 - 63% angiographic deterioration
 - 5% need revascularisation
 - 1-2% need amputaion

epidemiology

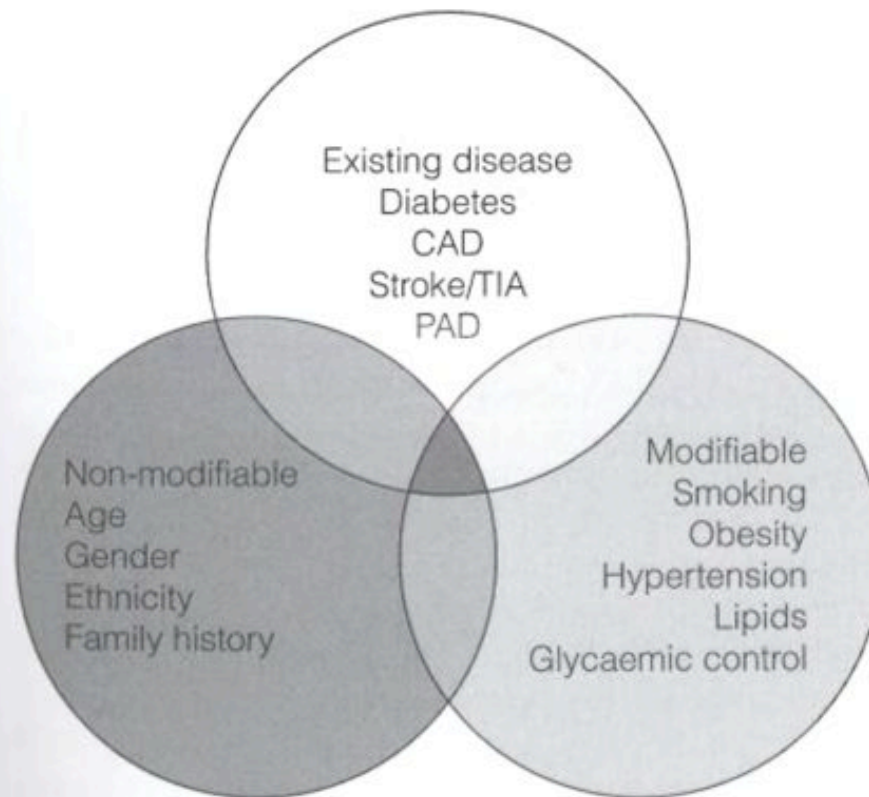


Figure 1.4 • Major CV risk factors can be grouped into: existing disease; non-modifiable risk factors; and modifiable risk factors, where placebo-controlled trials have shown the benefits of intervention.

Assessment

- Atherosclerosis is a generalised disease with a preponderance for the arteries of the lower limbs
 - Most often SFA
 - Aortic bifurcation
 - Common femoral artery bifurcation
 - Tibial arteries affected in diabetics and very elderly

Intermittent claudication

- 14% men over 65
- Pain on walking in muscle groups distal to the occlusion
 - Ache/cramp/tightening
 - Symptoms relieved by rest
- DDx: OA hip/knee, lumbar nerve root irritation/spinal stenosis

Critical ischaemia

- Ischaemic rest pain
- Ischaemic ulceration
- Gangrene of the feet
- Need urgent investigation and revascularisation
- Critical limb ischaemia: rest pain for more than 2 weeks, or ulceration/gangrene, and ankle pressure $<50\text{mmHg}$ or toe pressure $<30\text{mmHg}$

Rare causes of ischaemia

- Persistent sciatic artery
- Cystic adventitial disease
- Popliteal artery entrapment
- Fibromuscular dysplasia
- Buerger's disease

Assessment

- History
 - Including other cardiovascular risk factors
- Examination
 - CVS
 - BMI
 - Palpation of pulses
 - BP/HR and rhythm, heart sounds
 - Abdo exam for AAA
 - Hand held doppler
 - Ankle brachial pressure index

Blood tests

- All patients:
 - FBC, ESR
 - Anaemia
 - Polycythaemia
 - Thrombocythaemia
 - Biochemistry
 - Diabetes
 - Renal impairment
 - Hypercholesterolaemia
 - hypertriglyceridaemia
- Selected patients:
 - Age <50 or unusual thrombus
 - Thrombophilia screen
 - Hyperhomocysteinuria
 - ‘Ex’ smokers
 - Thiocyanate
 - Carboxyhaemoglobin
 - Urinary cotinine

Imaging

- Arterial duplex ultrasound
- CT angiogram
- MR angiogram (best) (contrast enhanced)

Medical treatment

- Exercise
 - 30 mins at least 3x/week for 6 months most benefit
 - Better at improving walking distance over long term compared to angioplasty
- Drug treatment (not commonly used currently)

Surgical treatment

- For

- Short walking distance
- Employment affected
- No improvement with exercise
- Stenosis/short occlusion
- Unilateral symptoms

- Against

- Short history
- Still smoking
- Other limiting conditions
- Long occlusion/diffuse disease
- Bilateral symptoms

Surgical options

- Endovascular
 - TASC: Trans-Atlantic Inter-Society Consensus and SIR: Society of Interventional Radiology have recommendations for lesions suitable or unsuitable for endovascular or open surgical treatment
- Open
 - Prosthetic grafts only last resort

Vascular disorders of the Upper Limb

- Arterial obstruction
- Large artery:
 - Atherosclerosis
 - Radiotherapy
 - Thoracic outlet syndrome
 - Arteritis
- Small artery
 - Atherosclerosis
 - Connective tissue disease
 - Myeloproliferative disease
 - Buerger's disease
 - Vibrating tools
- Arterial vasospasm
- Large artery
 - Ergot-containing medications
 - Beta blockers
 - Drug abuse (cocaine)
 - Dopamine overdose
 - Cytotoxic drugs
- Small artery
 - Raynaud's disease
 - Vibrating tools

- Embolism

- Heart
- Ulcerated arterial plaques (arch/subclav)
- Aneurysm
- Thoracic outlet syndrome

- Subclavian-axillary vein thrombosis

- Primary: thoracic outlet syndrome
- Secondary: catheter, hypercoagulable states

- Hypercoagulable states
 - Heparin antibodies
 - Deficiencies
antithrombin III, protein
C and S
 - Antiphospholipid
syndrome
 - Malignancy
 - cryoglobulinaemia
- aneurysms

Clinical examination

- Vascular assessment including thoracic outlet
 - Palpation and auscultation in subclavian region to look for cervical rib, subclavian stenosis or aneurysm
 - Examine arm pulses in neutral position and also abduction and external rotation
 - Axillary, brachial, radial and ulnar pulses
 - Check blood pressure in both arms – difference of more than 15% is abnormal
 - Allen's test

Occlusive disease

- Mean age 50-60
- Atherosclerosis>Buerger's>Takayasu's arteritis
- Symptoms: muscle fatigue, ischaemic rest pain
- MRA/CTA/duplex U/S
- Most interventions surgical (open)

Aneurysmal disease

- Uncommon
- Subclavian most frequent
 - Usually caused by thoracic outlet compression
 - Distal ischaemia, embolism, acute thrombosis
 - False aneurysms from trauma/infection
 - Often motor or sensory impairment due to brachial plexus compression
- Axillary aneurysms: blunt or penetrating trauma
 - False aneurysm with humeral fractures and anterior shoulder dislocation

- Ulnar artery aneurysm (hypothenar hammer syndrome)
- Can lead to distal necrosis
 - Workers with repetitive trauma to hands (carpenters/pipe fitters) or volleyball/karate
 - Trauma between distal margin of Guyon's canal and palmar aponeurosis

Upper limb embolism

- 20-32% major peripheral emboli
- Cardiac origin 90%
- Brachial bifurcation most frequent site for embolus to lodge
- Clinical examination and duplex ultrasound/
CTA/MRA
- Immediate systemic heparinisation

Upper limb embolism

- Distal brachial transverse embolectomy
 - S shaped incision antecubital fossa
 - Bicipital aponeusis divided to expose brachial artery
 - 2F fogarty catheter to clear both radial and ulnar arteries

Thoracic outlet syndrome

- A variety of symptoms caused by compression of the brachial plexus or subclavian vessels at the thoracic outlet
- 90% symptoms neurological due to C8/T1 compression
- 5% due to arterial or venous symptoms
- Compression of neurovascular bundle between R1 and clavicle
 - Low lying shoulder girdle or loss of muscle tone
 - Congenital fibromuscular bands, scalene abnormality or hypertrophy, bony lesions (cervical rib/fractures)

Thoracic outlet syndrome

- Arterial complications often associated with bony abnormalities
 - Cervical rib
 - Fracture callus of 1st rib
- Fibrotic thickening with intimal damage and poststenotic dilatation
 - Leads to aneurysmal degeneration with mural thrombus and risk of embolisation
 - Small emboli localised in hand vessels (unilateral raynaud's) – need imaging

Thoracic outlet syndrome

- Surgical management
 - Removal of cervical ribs
 - Supraclavicular or transclavicular approach

Subclavian-axillary vein thrombosis

- Spontaneous or effort related thrombosis in a fit young patient = Paget-Schroetter syndrome
- Due to anatomical venous compression in the thoracic outlet during exercise (25%)
- Secondary DVT mostly due to trauma/central catheters
- Arm can be swollen and cyanosed with dilated shoulder girdle veins
- Duplex venous ultrasound
- Management: primary DVT
 - open venous thrombectomy/thrombolysis and thoracic outlet decompression
- Management: secondary DVT
 - Anticoagulation with IV heparin
 - Removal of central line
 - Consider thrombolysis