VASCULAR SURGERY

Peripheral Vascular Disease Hx

1. HPS

FOCUS INTERMITTENT CLAUDICATION ➔ [SOCRATES]

**PVD/PAD = reduce circulation to arteries outside of heart and brain*

	Ischemia type	Signs
Intermittent claudication [6 P's]	**Demand ischemia** (unable to satisfy metabolic demands)	1. Cramp-like tight pain ⟶ relieved at rest **[REPLICABLE!]** a. Max claudication distance? b. **Previous events** 2. ***Calf-claudication*** *= superficial femoral artery stenosis* 3. ***Buttock/thigh claudication*** *– common iliac artery stenosis* 4. ***Leriche syndrome*** *– absent femoral pulse, thigh/buttock claudication* ***+impotence***
Acute ischaemic limb	**Supply ischemia** → Occluded BV	**Pain**, **paraesthesia** [pins + needles], **paralysis, pallor, pulselessness, perishingly cold** **local plaque rupture leading to rapid occlusion and ischeamic leg*
Critical ischemia [rest pain]	**Demand > supply = pain**	Continuous chronic rest pain → **nocturnal awakening pain [dangle feet for relief]**! • Tissue loss [*atrophic callous skin + cachetic leg*] • **ABI <0.3**
Other	**Demand > supply = pain**	• AAA, carotid artery stenosis, • cholesterol embolism "trash foot" • post-bypass peripheral arterial disease

Arterial Insufficiency

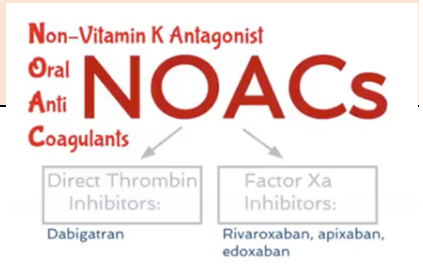
	Ischemia type	Signs
Spinal claudication	**Narrowed spinal canal**	• Cauda equina syndrome • "Neurological freeze" → back pain with exertion + relieved on leaning forward
Diabetic neuropathy	**Supply ischemia** → Occluded BV	• Glove/stocking distribution → affects both nerves and vessels • Ulceration • **NO Pain (unlike arterial ulcers)**
Arterial aneurysm [e.g. femoral]	**Demand + supply** 	• Dull aching pain → possible AAA (**if radiates to the back)** ○ **True aneurysms**: vessel dilatation affecting ALL layers ○ **Pseudo-aneurysms**: walling off of defect on vessel wall

Venous Insufficiency

Signs	Lower limb oedema | Aching in legs (SKM pump issue) | Old/new varicose veins (esp. young adults & pregnancy)
Risk factors	Previous DVT, varicose veins, thrombophlebitis

5. Past MHx

Risk factors	• **CV issues**: Angina/unstable angina/heart failure/Previous cardiac surgery • **PAD issues**: vascular investigation/surgeries /. Stroke / Previous DVT, varicose veins, thrombophlebitis • **Diabetes** [microvascular + macrovascular complications] • **Smoking + COPD** (emphysema +bronchitis) • **Renal failure** • **HTN + HC**
Medications (herbal – St John's wort)	• Antiplatelets & Anticoagulants ○ **Warfarin = arterial clotting** ○ **DOAC= venous clotting** • Diabetic medications (statins, fibrates) • Cardiac medications (HT, hypercholesterolemia)
Allergies	• Iodine, contrast agents • Antibiotic • Antiplatelet/Anti-coagulant



6. Social Hx

- **Living conditions** | **carers**? | **Independence of Activities and mobility**
- **Occupation** (e.g. truck driver with significant heart disease) |
- **Alcohol** (Standard drinks) → risk of cardiomyopathy | **smoking** (pack years)

7. Family Hx

- Family vascular diseases → PAD and AAA
- Other CV history → IHD / DM / CVA

8. SR

- **CNS| CVS | RESP | GIT | GU | Locomotor |General** – fatigue/weight loss/fever

Peripheral Vascular Disease Examination

GOOD SIGNS GUIDE 6.1
Peripheral vascular disease

Sign	LR+	LR–
Sores or ulcers on feet	5.9	0.98
Feet pale, red or blue	2.3	0.80
Atrophic skin	1.65	0.72
Absent hair	1.6	0.71
One foot cooler	5.9	0.92
Absent femoral pulse	5.8	0.94
Absent dorsalis pedis or posterior tibial pulse	3.7	0.37
Limb bruit present	5.7	0.58
Capillary refill time >5 seconds	1.9	0.84
Venous refill time >20 seconds	3.6	0.83

LR=likelihood ratio.

General inspection:
- **Responsiveness / age / body habitus / amputations / ulcers / sores**
- O2 / mobility aids / cigarettes / capillary glucose monitor
- **Exposure: supine + legs exposed**

Face
- Mitral facies

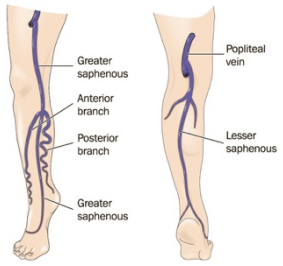
Upper limbs
- **Hands**: **nicotine (tar-stain),** pallor, gangrene, **tendon xanthomata**
- **Palpate [BILATERAL]: temp → Prolonged cap refill → pulse → BP**
  - *Radio-radio delay = Aortic dissection*
  - *Radio-femoral delay = offer to test [aortic coarctation]*
  - *BP (> 10mmHg difference) = aortic dissection, SCA stenosis*

Face
- **Eyes**: corneal arcus + xanthelasma (hyperlipidemia)
- **Mouth:** central cyanosis
- **Carotid pulse + bruits** (auscultate → carotid artery stenosis)

Abdomen
- **Inspect**: visible aortic pulsation
- **Aortic and femoral pulses (AAA)**
  - *Palpate between umbilicus and xiphoid process (laterally → medially)*
  - *Ulnar borders of hands **parallel** with costal margins*
  - ***Normal OR Pulsatile mass** = upward movement*
  - ***AAA** = outward movement*

Lower Limbs (main part)

Inpsection (esp. feet)
- **Scars & Skin colour** (pink, pale, **mottled** = ischeamic, **BLACK** =gangrene) + **Amputations**
  - **Buerger's disease "thromboangiitis obliterans" = swollen BV causing clots → pain, ischaemia, gangrene → Purple discoloured finger tips and toes**
    - RF: smoking, male 25-35 yo
    - Ix = angiogram (corkscrew collaterals
- **Trophic change**s (*skiny skin, hair loss, thinned skin, ulcers)*
- ***Cachexia + oedema***
- **Venous insufficiency signs:**
  - **Venous eczema + haemosiderein deposits/venous staining (red-brown patches)**
  - **Lipodermatosclerosis or panniculitis (**"*inverter champagne bottle leg → increase venous pressure causes inflammatory cells to fibrose subcutanoues tissue)*
  - **Venous ulcers** "*atrophy blanche*"
  - **Varicose veins** (*venous dilitation + tortuosity*)
    - **Check both great and lesser saphenous vein**
    - **Rx: venous stripping and sclerotherapy**



Elephantiasis

Pitting Oedema

Lipodermatosclerosis

Venous staining

Acutely ischaemic leg (6 P's)

Chronic ischaemic leg

Cellulitis

Mottled foot

Gangrene

Palpation
- **Temp** (**COOL** = poor perfusion | **HOT** = infection)→ **cap refill time** (< 2s)
- **Pulse** (*dorsalis pedis OR tibialis posterior)*
- **Squeeze calves + watch face** (*tender = critical ischeamia, DVT)*
  - **POPLITERAL ARTERY ENTRAPMENT SYNDROME (PAES) → enlarged calf muscles compresses popliteal artery**
- *Peripheral sensation (if time)*

Oedema + check calf diameter
"venous insufficiency"

Pitting (mid-calf/thigh) "indentation"	• CF, drug (CaB or other anti-hypertensives), • CKD, Hepatic (cirrhosis), CCF
Non-pitting "no indentation" "lymphatic obstruction"	• **Chronic lymphedema** (elephantiasis) ○ Cannot pinch skin of foot "stemmer's sign" ○ *DDx: lymphatic filiarisis (infective)* • **Lipoedema** (fat deposition in ankles)
Pitting (unilateral)	• DVT, tumour/LN compression
Chronic "brawny"	• Pits slowly & unwillingly • Usually above medial malleolus → sign of RHF (raised JVP)

'*Chronic venous stasis/disease = common cause of leg oedema due to **presence of incompetent vein valves in perforating valves connecting superficial and deep veins of legs OR failure of SKM pump** (leads to ulceration + necrosis)*

Special tests

	Purpose/Test	Method
Buerger's test (PAD)	**Replicate rest ischemia** (i.e. reperfusion time)	1. Check any pain prior 2. **Supine** → lift one LEG until heel becomes pale **→ hold 30s [normal** = heel does not become pale] a. **Hip Flexion Angle < 20° [severe ischeamia]** 3. Sit up → dangle leg over bed → observe feet 2-3mins [**pallor/BLUE follower by reactive hyepreamia (DARK RED) = +ve test = signifcant arterial disease]**

		ABI	Arterial insufficiency	1. Measure brachial systolic BP in **EITHER ARM**, (*place doppler probe 45° over brachial artery → inflate cuff until signal stops → gradually deflate until 1st sound = systolic BP]* 2. Measure ankle BP in **BOTH LEGS** (*repeat over dorsalis pedis or posterior tibialis)* 3. Right ABI = 4. Left ABI = 5. Take **highest value**

ABI	Pathology	
> 1.3	**Calcified** (non-compressible) artery	Greater pressure to occlude lower limb ➔ due to atherosclerosis, hence difficult to compress artery
0.9 – 1.3	**Optimal**	
< 0.9	**Mild PAD**	Lower limb pressure = lower BP required to occlude it
0.4 - 0.9	**mild-mod PAD**	**Claudication on ambulation**
< 0.4	**critical limb ischemia**	Inadequate supply → DVT

*__Limitation__: ABI assumes upper limb pressure is normal (hence coarctation of aorta, vasculitis can confound results)

**__Indications:__ *Age > 60, Age > 50 + diabetic +/- smoker*

	Trendelenberg Test	Location of incompetence	1. Supine → elevate leg (as high as possible) → milk leg to empty veins 2. Apply tourniquet → press thumb on saphenofemoral junction 3. Keep pressure → ask patient to stand (20s) a. Varicosities rapidly filled **upon standing** = incompetent perforating veins **below** junction **[deep vein incompetence – reflux from deep to superficial]** b. Repeat by moving tourniquet 3cm down → if varicosities **DO NOT** refill → incompetent perforating veins **above** tourniquet **4.** Release tourniquet → veins refill after pressure released **[superficial vein incompetence]** **superficial veins drain into deep vains*
	Perthes Test	Patency of deep veins	Apply a tourniquet to thigh → ask patient to pump calf muscles by performing heel raises whilst standing. ➢ If **superficial veins disappear →** the deep veins are functioning ➢ If **superficial veins dilate more** → a problem in the deep veins, e.g. DVT

To complete

For PAD: I would perform
- **CV exam, test sensation and use Doppler US ot further assess pulses**
- *Other Ix based on Hx* ➔ **HbA1C, ECG, ulcer swabs, MR or CT or catherter angiography**

For DVT: I would perform
- **CV and RESP exam & Review vitals (esp. O2, RR → if abnormal possible PE)**
- *Other investigations based on Hx* ➔ ***FBC, U& E's + daily weights***
  - ***D-dimer*** (if DVT Well's score < 2 to rule out DVT) – high Sn, low Sp
  - **Doppler compression USS (if** DVT Well's score > 2 or D-dimer positive) → ensure veins not collapsing under pressure

For Varicose Veins: I would perform
- **Abdominal and pelvic exam [***for masses that could cause venous obstruction***]**
- **Review vitals & duplex US**

WELLS CRITERIA FOR DVT

Clinical Features	Points
Active Cancer	1
Immobility >3d OR Major Surgery ≤4wks	1
Calf Swelling >3cm Compared to Other Leg	1
Collateral (Nonvaricose) Superficial Veins Present	1
Entire Leg Swollen	1
Localized Tenderness Along Deep Venous System	1
Pitting Edema, Greater in Symptomatic Leg	1
Paralysis, Paresis, Or Recent Plaster Immobilization	1
Previously Documented DVT	1
Alternative Diagnosis to DVT is More Likely	-2

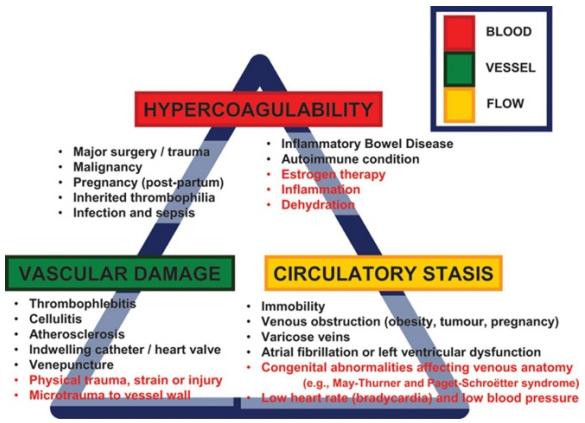
-2 – 0 LOW Risk
1 – 2 Mod Risk
≥3 High Risk

	Peripheral arterial disease	DVT	Varicose veins
Def	• Reduced blood supply to limbs and periphery due to narrowed arteries	Thrombi develop in circulation → DVT → embolise → MI/ PE or stroke	**Incompetent valves in perforators** causes blood to flow from deep vein back into superficial vein → venous engorgement
Risk factors	**Non-modifiable** • Old age, FHx, male **Modifiable** • HTN, HC, T2DM, smoking, EtOH, obesity, stress	• OCP, HRT, Pregnancy • Post-op, long-haul flight • FHx or PMHx of VTE • Malignancy • SLE • Thrombophilia diseases	• Advanced age • FHx • Female, pregnant • Obesity • Prolonged standing • Previous DVT
Sx	• **Intermittent claudication –** cramp pain usu. in calf (also in thigh and buttock) • **Acute limb ischaemia** - thrombus secondary to MI (20% UNKNOWN origin) ○ **Type 1 = viable < 6hrs** ○ **Type 2 = threatened < 12 hr** ○ **Type 3 = irreversible > 12hr** • **Critical limb ischaemia (6 P's)** – *pulse, pallor, parasthesia, paralysis, perishingly cold, pain* • ***Gangrene*** *(necrosis due to inadequate blood supply)*	• **Unilateral painful lower limb** • **Dilated superficial veins** • **Oedema + colour changes** • SOB, pleuritic chest pain • Tachycardia / tachypnoea **If bilateral painful limbs** consider: ➢ CCF ➢ Chronic venous insufficiency	**Asymptomatic** ➢ Distended superficial veins > 3mm ➢ Reticular veins are 1-3mm ➢ Telengiectasias (spider veins) < 1mm *Signs of chronic venous insufficiency:* ➢ **Haemosiderin staining** (Hb in leaked blood) ➢ **Venous eczema** (dry itchy burning inflamed skin due to pooling in distal tissue ➢ **Lipodermatosclerosis** (fibrotic and tight skin and soft tissue) ➢ **DVT or superficial thrombophlebitis**
Ix	➢ **ABPI** ➢ **Duplex USS –** speed and volume of blood flow ➢ **Angiography (CT/MRI) –** highlight blockages *Complications*: ➢ Reperfusion = compartment syn → fasciotomies ➢ Rhabdomyolysis +/- amputation	**Based on Well's score** ➢ CTPA ➢ D-dimer ➢ V/Q scan (pregnant, contrast allergy, young)	➢ **Tap test** (apply pressure on saphenofemoral junction → thrill = incompetent valves) ➢ **Cough test** ➢ **Trendelenburg** (locate incompetent valve) ➢ **Perthes** (? Deep vein issue) ➢ **Duplex USS**
Rx	**Lifestyle** ➢ Lose weight (PA, diet) ➢ Stop smoking + EtOH **Medical** ➢ Atorvastatin 80mg ➢ Clopidogrel 75mg od ➢ Optimise co-morbidities **Surgery (e.g. critical or acute limb ischaemia)** ➢ **Call vascular + 5000IU heparin bolus IV** ➢ **Ix: arrange ED CTA (best)** ➢ Endovascular angioplasty /stent / thrombolysis / mechanical thrombectomy (➢ Endarterectomy (open vessel and remove atheromatous plaque) ➢ Bypass surgery ➢ Amputation	**1st line prophylaxis** ➢ LMWH for 3/12 - CI: active bleed ➢ Anti-embolic compression stockings (CI = sig. PAD) **2nd line** ➢ DOAC (Xa inhibitor) for 3-6 months **3rd line** ➢ IVC filter (if recurrent PE) **For unprovoked DVT** Thrombophilia screen (APS, F5 leiden, anti-thrombin def.)	**Lifestyle** ➢ Lose weight (PA, diet) ➢ Stop smoking + EtOH ➢ Keep leg elevated ➢ Anti-embolic compression stockings **Surgery** ➢ **Endothermal ablation** ➢ **Sclerotherapy** (inject irritant foam to close vein) ➢ **Stripping** (veins ligated and removed)

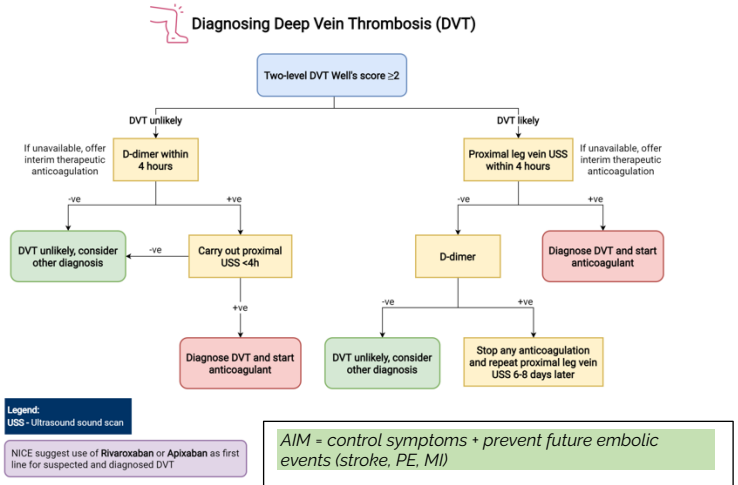
CLOTTING CASCADE

Clotting cascade:

1. **Vasoconstriction of injured BV** due to nerve reflex, myogenic spasm and cytokines released
2. **Platelet plug** formation
3. **Coagulation/clotting** (prothrombin, fibrinogen)
    a. Intrinsic (APTT) = amplify response for faster stable clot
    b. Extrinsic pathway (PT) = initiates stable clot formation
4. **Clotting terminates** via antithrombotic mechanisms
    a. Dilution via blood flow
    b. Anti-thrombotic pathways (protein C/S, anti-thrombin III, C1 esterase inhibitor)
5. **Clot removal** by fibrinolysis VIA t-PA (plasminogen → plasmin)

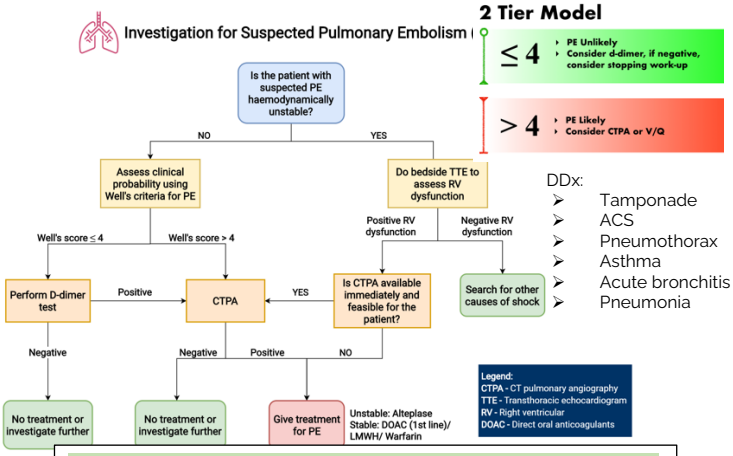


VENOUS THROMBOEMBOLISM



AIM = control symptoms + prevent future embolic events (stroke, PE, MI)

Consider: weekly USS surveillance +
- Compression stockings
- IVC filter (if proximal DVT and anti-coag contraindicated)
- Thrombolysis (young pts w/ large DVT)



DDx:
- Tamponade
- ACS
- Pneumothorax
- Asthma
- Acute bronchitis
- Pneumonia

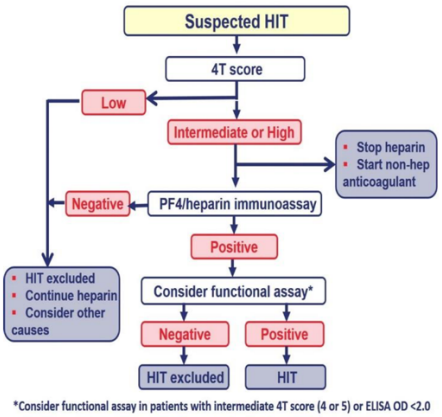
AIM = prevent recurrence + death

Consider: at least 3 months therapy for DOAC
- Mainly prolonged therapy (same as DVT)
- *Ensure FBC, EUC, LFT and B-HCG before starting COAGS*
- IVC filter
- Thrombolysis

WHO NEEDS VTE PROPHYLAXIS?

- > 40 after significant operation
- At least one thrombotic factor (i.e. malignancy, clotting disorder, Limited immobility
- Use 40mg clexane or 5000U UFH

Figure 1. Approach to suspected HIT



*Consider functional assay in patients with intermediate 4T score (4 or 5) or ELISA OD <2.0

Table 1. "4 T's" clinical probability score

	2 points	1 point	0 points
Thrombocytopenia (platelet count)	>50% decrease to nadir ≥ 20 x 10^9/L	30-50% decrease, or nadir 10-19 x 10^9/L	< 30% decrease or nadir < 10 x 10^9/L
Timing of onset of platelet count fall or other sequelae of HIT. (Day 0 = first day of heparin exposure)	Days 5-10, or ≤ day 1 with history of heparin exposure within past 30 days	> Day 10 or timing unclear; or < day 1 with heparin exposure in past 31 – 100 days	< Day 4 (no recent heparin prior to current exposure)
Thrombosis or other sequelae	Proven new thrombosis; skin necrosis; or acute systemic reaction after IV UFH bolus	Progressive or recurrent thrombosis; erythematous skin lesions; suspected thrombosis	None
Ther cause(s) of thrombocytopenia	None evident	Possible	Definite

Total points	Clinical probability of HIT
6-8	High
4-5	Intermediate
0-3	Low

Modified Wells criteria for pretest probability of PE

Score +3 points
- Clinical signs of DVT
- Alternate diagnosis less likely than PE

Score +1.5 points
- Previous PE or DVT
- Heart rate >100
- Recent surgery or immobilization

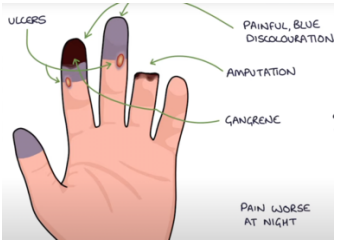
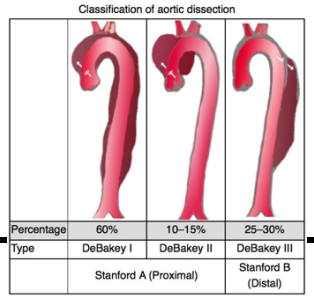
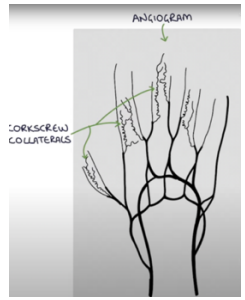
Score +1 point
- Hemoptysis
- Cancer

Total score for clinical probability
≤ 4 = PE unlikely
> 4 = PE likely

Arterial vs. venous vs. Neuropathic (Diabetic) ulcers

					
		Arterial Ulcers	**Venous ulcers (90%)**	**Neuropathic/Diabetic Ulcers**	**Pressure ulcers**
Location		• **Areas of poor blood supply** (e.g. tips of toes, pre-tibial area) • On bony prominences	• **Gaiter region** (from mid-calf down to ankle)	• **Pressure points** (metatarsal heads, soles, heels) under calluses	• **Sacrum while sitting** • **Diabetic foot ulcers**
Cause		➢ **Ischemia secondary to inadequate blood supply (**atherosclerosis**)**	➢ **Impaired drainage and venous pooling**	**Poor diabetic control – damaged nerve fibres in extremities**	**Immobile patient** **T2DM – Poorly controlled**
Sx		➢ **Nocturnal pain +** ➢ **worse on leg elevation**	➢ **Less painful worse on standing** Assoc. Varicose veins, DVT Hx, obesity, pregnancy, thrombophlebitis, post-op	➢ **Painless + sensory loss + diabetes** ➢ Poorly fitted shoes	➢ **Painless** ➢ **Immobile in one position** ➢ **Post-op**
Complications		➢ **Gangrene**	➢ **Amputation**	➢ **Osteomyelitis** ➢ **Infected ulcers**	➢ **Fournier's gangrene**
Desc.	**Margins + Appearance**	*Well-demarcated regular punched out small ulcers (1cm)*	*Large superficial **irregular** ulcer (14cm) on medial gaiter region of right leg*	*Well-demarcated punched out small ulcer (1cm) on dorsal aspect of 1st MTP joint*	*Well-demarcated small or large punched out*
	Ulcer	**necrotic base – covered by pale and white eschar**	Ulcer has exudating & granulating base	• granulating base	**necrotic base – covered by pale and white eschar**
	Surrounding Skin / oedema	• **pale** • **NO oedema**	*Chronic venous insufficiency*: • **Lipodermatosclerosis** (panniculitis – inverted champagne bottle) • **Venous eczema** (itchy dry flaky red skin) • **Atrophic blanche** (smooth white scar tissue surrounded by hyperpigmenetation) • **Haemosiderin deposits**	• Hyperkeratotic (thick callus edge) • Reduced sensation peripherally	• Erythematous • Exudative
	Pulse + temp	**Absent/weak and cool**	**Present + warm**	**Absent/weak + cool**	**Present + warm**
Management		• **Referral to vascular surgeon** • Lifestyle (↓Wt, ↑PA, local exercise program) • Stop smoking • Statin • Anti-platelets (clopidogrel) • Optimise diabetic control *Last resort* ➢ Balloon angioplasty ➢ Bypass occluded artery ➢ amputation	*Acute Mx* • **leg elevation** = reduce pain • **Compression bandaging** (After PAD excluded by ABI) • **Topical steroids** = venous eczema and lipodermatosclerosis • **+/- Abx (if infection present)** • Analgesia *General Mx*: ➢ Link with community nurses ➢ **Clean → debride → dress wound** ➢ Maintain good skin hygiene ➢ Lose wt + keep active ➢ Compression stockings *Rx varicose veins* • **Ligate sapheno-femoral junction** → strip long saphenous vein to treate varicose veins • **Sclerotherapy**	• **MDT input** – diabetic nurse, endocrine, vascular and ID • **Optimize T2DM control** – regular BSL, HbA1C • Debridement + appropriate footwear (**orthotics, podiatrist**) • **Rx infections early** (zoo of organisms) (e.g. tacosin OR metro + penicillin + gentamicin) • **Vascular reconstruction** • **Amputation**	• Regular repositioning, • special inflating mattresses, • regular skin checks • protective dressings and creams

UNCOMMON vascular diseases

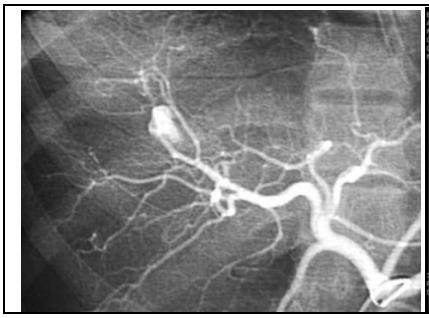
	LYMPHODEMA	Abdo or thoracic AA	Aortic Dissection	Carotid artery stenosis	Buerger Disease
Def	Chronic impairment of lymphatic drainage (XS protein rich fluid) ➢ primary = inherited in <30yo ➢ secondary = post-breast ca after axillary LN removal	Dilation of Abdominal aorta > 3.5 cm Or thoracic aorta (usu. ascending aorta) > 4.5cm	• Break or tear that forms on inner layer of aorta • Most common site = tear of intima layer in R) lateral ascending aorta	Narrowing of carotid arteries secondary to atherosclerosis or embolis 	➢ AKA: thromboangiitis obliterans. ➢ **Inflammatory condition** → stimulates thrombus formation in small and medium BV in distal arterial system
Risk factors	• FHx • Recent lymph node removal surgery	• OLDER - advanced age • Males • Smoking + HTN • FHx • Existing CVD • Marfan + Ehler's	• **Advanced age** • **Male** • **HTN** • **CT disease** (Marfan, Ehlers) • **Procedures** (bicuspid, coarctation, aortic valve replacement, CABG)	• **Advanced age** • **Male** • **HTN** • HC • Smoking • Poor diet and low PA	➢ SMOKING!!! ➢ Younger < 50yo ➢ **NO other risk factors**
Sx	• *Stemmer's sign = unable to pinch skin* • *Bilateral swollen limbs including feet* • ***DDx: lipodema** (build up of fat tissue in legs -feet sparing)* *Avoid on limb lymphodema:* ➢ *Taking blood* ➢ *Inserting cannula* ➢ *BP measurements*	*Asymptomatic until ruptured* ➢ Non-specific chest or abdo pain radiating to back ➢ Pulsatile expansile mass ➢ Incidental on AXR, USS, CT scan *If thoracic AA* → cough, stridor, SOB, ➢ Hiccups = phrenic nerve comp ➢ Dysphagia = oesophagus comp. ➢ Hoarseness =RLN compressed *Ruptured AAA*: ➢ Syncope ➢ Beware of "Trash foot"	➢ **Severe sudden onset tearing chest or abdominal pain** ➢ Collapse / syncope ➢ HypoTN – lightheaded ➢ Radio-femoral delay ➢ Radio-radio delay (> 20mmHg difference) ➢ Diastolic murmur ➢ Limb weakness and parasthesia	➢ **Asymptomatic** ➔ Usually, it is diagnosed after a TIA or stroke. ➢ Carotid bruit = "WHOOSH Sound" Monitor for: ➢ Carotid artery disease ➢ STEMI ➢ Stroke/TIA	
Ix	***Assess limb volume**:* ➢ *Circumferential measurements* ➢ *Water displacement (put limb in water and see how much water displaced)* ➢ *Perometry* ➢ **Lymphoscintigraphy scan (Assess structure of lymphatic system)**	**Non-ruptured AAA:** ➢ **ECHO** ➢ **CT angio (guide elective surgery if > 5.5cm)** **Ruptured AAA but haem stable:** ➢ Urgent CT angiogram ➢ Likely slow leak	➢ **ECG** ➢ **CXR** ➢ **CT angio** ➢ **MRI angio** **Major complications** ➢ MI /Stroke ➢ Tamponade + aortic valve regurg ➢ Death	➢ Carotid USS ➢ ECG ➢ CXR ➢ CT or MRI angiogram ➢ Mild – less than 50% reduction in diameter ➢ Moderate – 50 to 69% reduction in diameter ➢ Severe – 70% or more reduction in diameter	CT or MRI angiogram - **CORKSCREW COLLATERALS (bypass affected arteries**)
Rx	**Lifestyle** ➢ Massage – manual lymphatic drainage ➢ compression bandages ➢ weight loss ➢ good skin care **Medical** ➢ Abx if infection present ➢ CBT + anti-depressants to deal w/ psychological impact **Surgery** ➢ Lymphaticovenular anastomosis (attach lymphatic vessels to nearby veins)	**Lifestyle** ➢ Stop smoking ➢ weight loss (diet and PA) ➢ Optimise co-morbidities (HTN, T2DM, HC) **Indications for elective repair** (open laparotomy repair or endovascular aneurysm repair) ➢ Symptomatic aneurysm ➢ Diameter > 1cm grow/year ➢ Diameter >5.5cm *Consider medico-legal issues:* ➢ *Cannot drive if > 6.5cm* ➢ *Inform RMS* **Ruptured AAA (80% mortality rate)** ➢ Surgical emergency ➢ **Permissive hypoTN** (to avoid removing clot) ➢ CT angiogram	**Acute Mx** ➢ **Surgical emergency (need MDT – senior)** ➢ Analgesia ➢ Permissible hypoTN → BB **Surgical Mx:** ➢ **Type A** = midline sternotomy – remove section of arota with defect and replace w/ synthetic graft ➢ **Type B** - thoracic endovascular aortic repair (TEVAR) – insert graft to affected area via femoral artery 	**Lifestyle** ➢ **Stop smoking** ➢ weight loss (diet and PA) ➢ Optimise co-morbidities (HTN, T2DM, HC) **Medical** ➢ **Statins** ➢ **Anti-platelets** (aspirin, clopidogrel, ticagrelor) **Surgery** ➢ **Carotid endarterectomy** ➢ **Angioplasty and stenting** (XR guidance from femoral artery) – balloon inflated to widen lumen then stent **Complications of endarterectomy**: 1. ***Facial nerve** injury = **facial weakness** (the **marginal mandibular branch** causing drooping of the lower lip)* 2. ***Glossopharyngeal nerve** = dysphagia* 3. ***Recurrent laryngeal nerve** (CNX) injury = hoarseness* 4. ***Hypoglossal nerve injury** ➔ **unilateral tongue paralysis***	**Lifestyle** ➢ Stop smoking (**MOST IMPORTANT**) **Last resort:** ➢ Specialist referral ➢ IV iloprost (prostacyclin analogue) to dilate BVs 

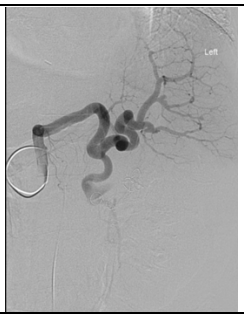
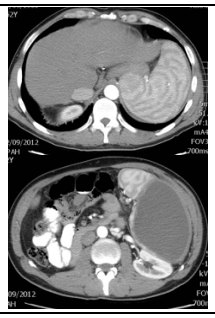
Interventional Radiology (EMBOLISATION = stop bleed,

Interventional radiology uses imaging guidance to perform targeted minimally invasive procedures

Indications for embolization	Embolisation Principles	Embolic Agents	
		Large vessel	**Small vessel**
• **Bleeding causes:** ○ Trauma ○ Inflammation ○ post-op, diverticulosis • **Tumour vessels** • **Hypertrophied organs** (e.g. prostate, spleen) • **Aneurysms**	Treat lesion w/ non-target embolization depending on goal: • Small vessel occlusion for chornic process (e.g. neoplastic, inflammatory) • Arterial occlusion for single vessel injury (e.g. post-biopsy) • Review pre-angio cross-sectional imaging and planning	• **Coils** (macro/micro) *Stainless steel, platinum 2-20mm dia, 2mm to 50cm length* • **Plugs** (detachable/ resheathable) • **Glue (NBCA)** → tissue adhesion • **On**yx (*non-adhesive polymer dissolved in DMSO) → mechanically occludes w/o tissue adhesion (unlike NBCA) → GOOD for AV malformation in brain*	• **Poly-vinyl alcohol (PVA)** ○ non-spheres = clump, cheap, less conformable ○ Embospheres = • **Gelfoam slurry** → temporary • **EtOH**

Solid Organ Embolization	Imaging Indications	Embolization Process	
• Trauma to (liver, spleen, kidney) ➔ **STOP THE BLEED** • Tumour vessels (e.g. AMLs) • Hypertrophied organs (e.g. prostate, spleen) • Pseudo-Aneurysms • True aneurysms • HTN from non-functional kidney	• Contrast extravasation or false aneurysm • High grade >grade 3 injury to liver, spleen or kidney • Large haemoperitoneum	**Liver embolism**	• Dual BV supply allows liver to tolerate arterial occlusion w/o infarction • GB depends on arterial supply → sensitive to non-target embolisation → need selective embolisation
		Spleen embolism	• Better than splenectomy to avoid post-op sepsis • Coil/plug = **Distal embol** = focal bleed → allow some residual splenic perfusion to avoid organ infarction • **Proximal embol** = diffuse bleed
		Renal embolism	• Done as selectively as possible since renal arteries are terminal → i.e. infarct is expected



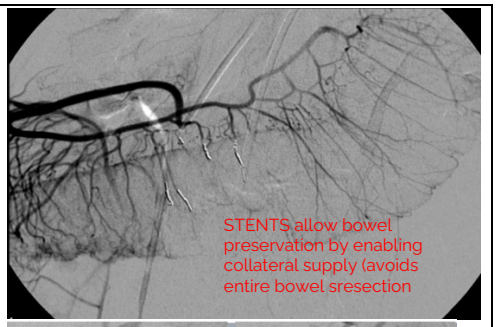



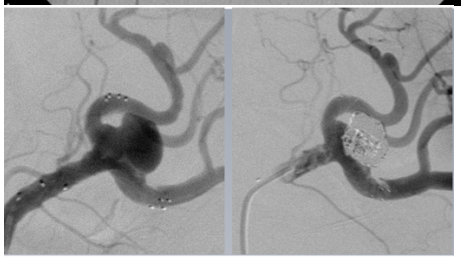
Ring pattern =contrast:

Superior spleen remains perfused

Inferior spleen is **NOT** perfused

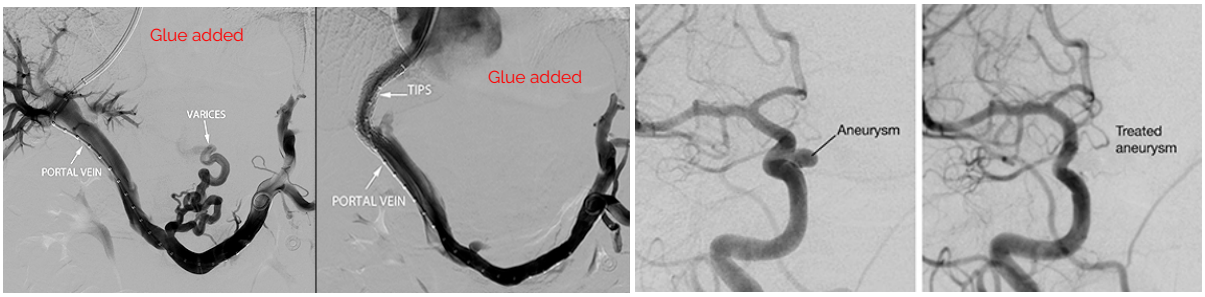
Embolization Process		
Lower GIT haemorrhage	• Diverticular disease, CRC, angiodysplasia • Need pre-op angio/embob → source of bleed, anatomically distribution of arteries and check if there is an active bleed ○ Ensure NO oral contrast given	
Visceral Aneurysms	• Usu. asymptomatic discovery on CT → ***may present w/ haematemesis, haemobilia, haematochezia*** • **Ischeamia** → distal pancreatitis, bowel iscehamia, distal embolism	
	RF	• portal HTN, chronic inflammation, • trauma, PAN,SLE , ehler-danlos
	Indications	• > 2cm, • any pseudo-aneurysms or rupture/herald bleed • portal HTN/cirrhosis and planned pregnancy
	Rx	• coil packing ➔ TRUE aneurysms • stent assisted coil ➔ bifurcation lesions (renal aneurysms) → keep stent to keep patent while working on the aneurysm at bifurcation • coil afferent and efferent vessel ➔ pseudoaneurysm





Splenic artery aneurysm (SAA) → generalized abdominal pain → unruptured 13mm saccular SAA at bifurcation of main splenic artery

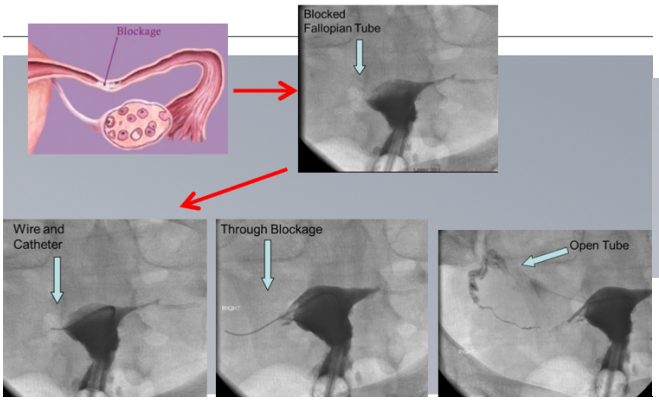
➢ Stent-assisted coil approach

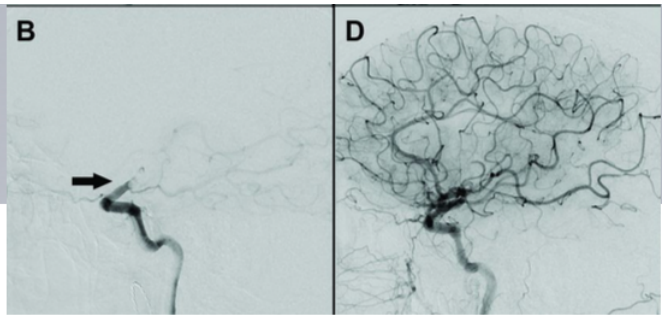


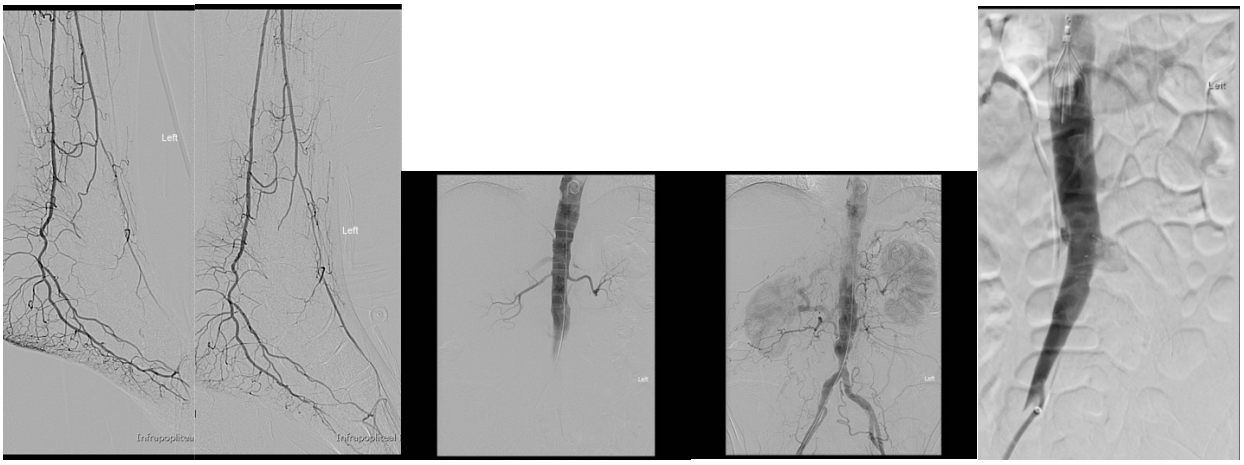
*Blocking vessels **with glue** or coils*

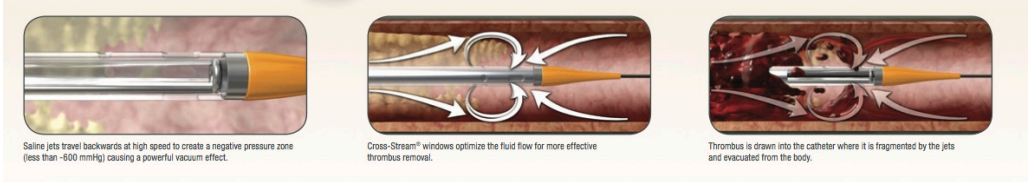
Revascularisation (ischaemia) → OPEN BLOOD VESSELS

Revascularisation Techniques	Principles	Common scenarios	
• Angioplasty (opening up balloon) • Stents: *Balloon = precise placement (esp. common iliac, RAS)* *Self-expanding* = best in vessels with external force (e.g. EIA, popliteal, SVC) • Occlusion recanalization (e.g. fallopian tube) • Drug eluting (e.g. paclitaxel) balloons and stents • High-pressure balloons • Thrombolysis (catheter-directed urokinase) or mech. • Atherectomy	• Femoral artery access ○ Uphill (contralateral) ○ Downhill (ipsilateral) • Pre-op angio • Crossing lesion: *Heparin before cross Steerable catheter (180-300cm) w/ hydrophilic guidewire*	**Lower limb**	• Iliac, femoropopliteal, infrapopliteal • For lifestyle limiting claudication (usu. superficial femoral artery) , rest pain or tissue loss
		Visceral	• Renal artery, mesenteric artery (coeliac, SMA, IMA) • *Chronic mesenteric ischemia (CMI) = "Abdominal angina"* ○ Intermittent post-prandial pain ○ Usu. atherosclerosis induced on ≥*2 mesenteric arteries* ○ *UWL*
		Venous thrombolysis	• **Mech. Thrombolysis:** Angiojet (medrad), trellis • Suction / disruption of clots → too dangerous to leave to anti-coagulation ○ Massive and sub-massive PE ○ Extensive Pelvic and IVC thrombosis
		Other	• Carotid • SVC syndrome (e.g. mediastinal mass compression or thrombus or both) • **Dialysis fistula**









Mechanical thrombolysis **<u>needed</u>** when anti-coagulation is insufficient