



Vascular investigations

Objectives:

Not given.

Pictures are not included in the MCQs but can be asked in the OSCE

Resources:

- Davidson's.
- Slides

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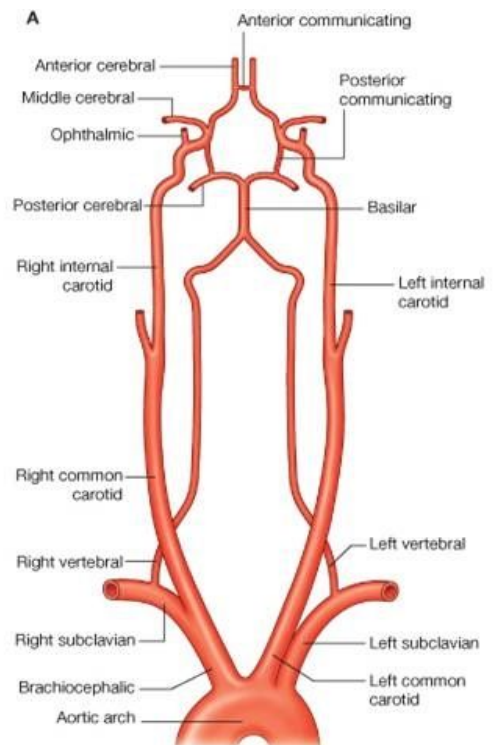
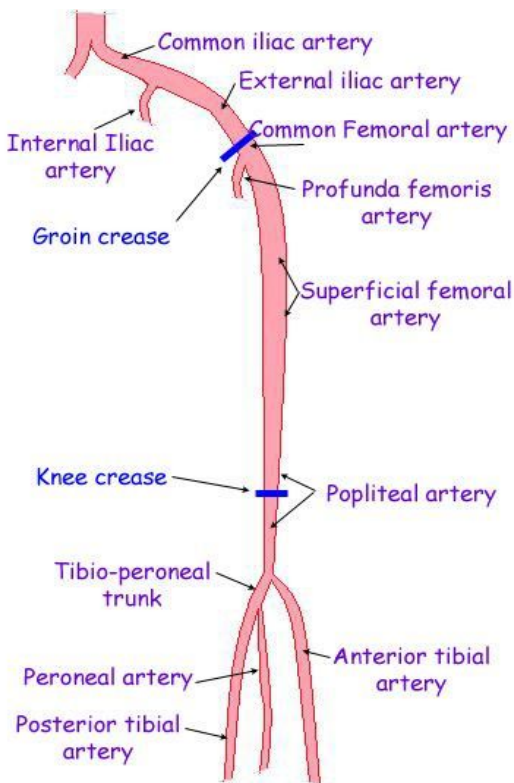
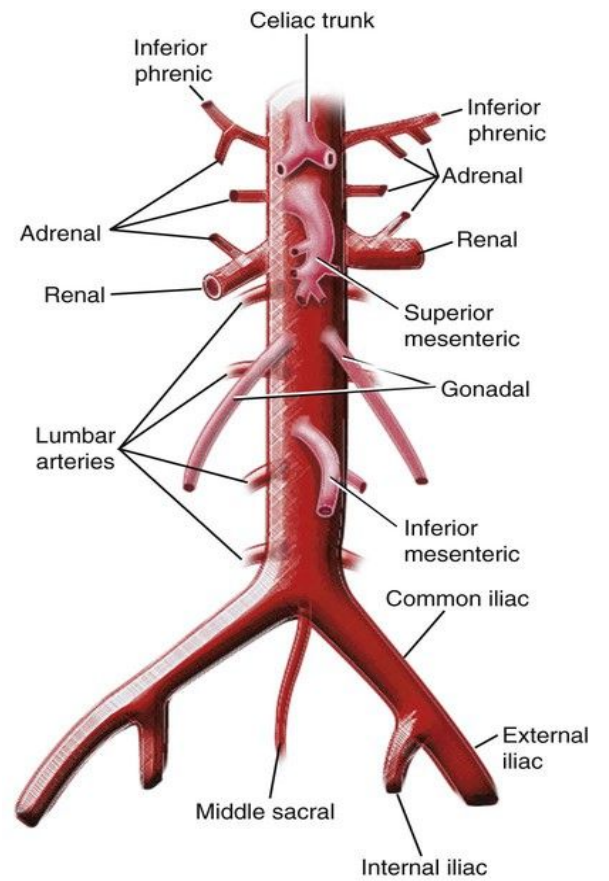
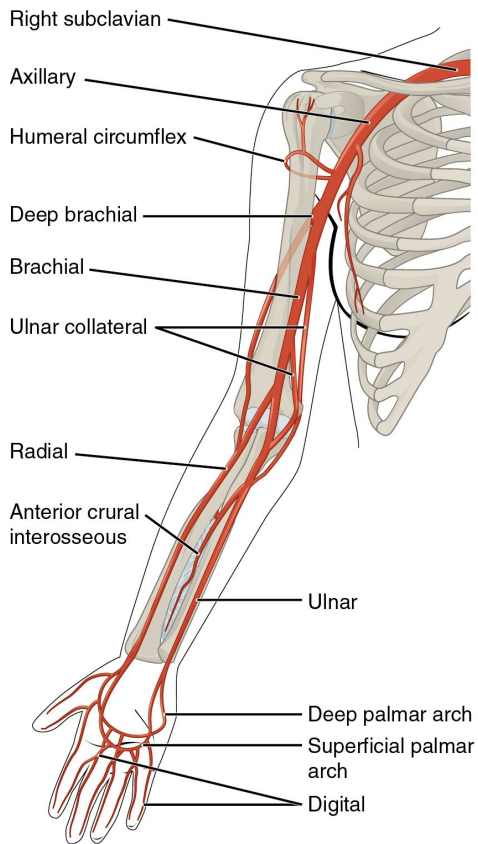
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[[Color index](#) | [Important](#) | [Notes](#) | [Extra](#)]
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Once you stop learning
you start dying.

Basic review:

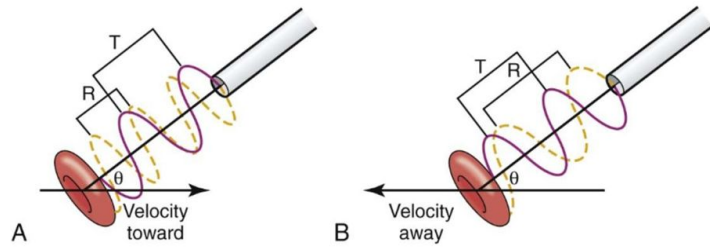


- Deep femoral vs superficial femoral arteries: deep femoral (profunda) gives branches to the thigh, superficial femoral doesn't give.
- Femoral sheath: order medial to lateral: vein > artery > nerve (VAN)

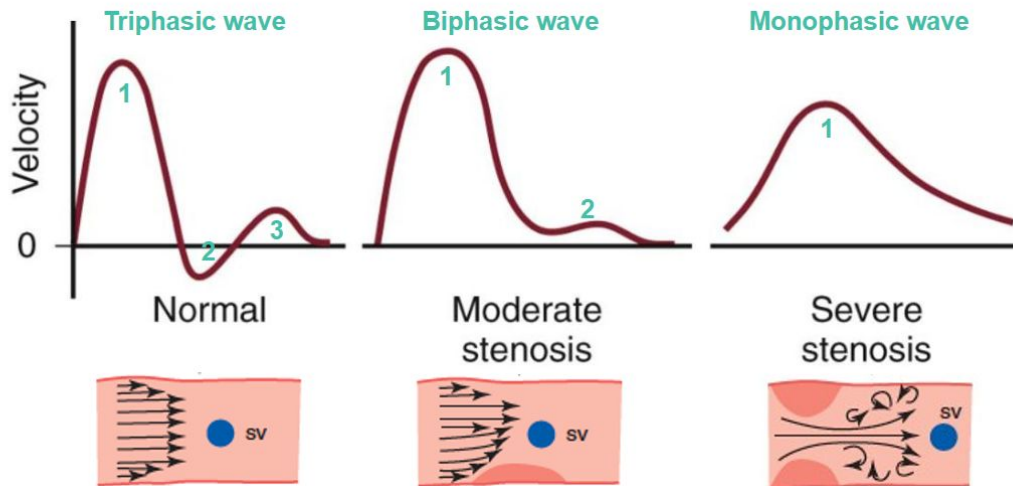
❖ Handheld Doppler: (sound only)

Used to hear the arterial flow and the velocity (speed of RBCs)

A pt came to the ER complaining of rest pain, and you suspect he has acute limb ischemia and the pulse isn't felt! So you just put the doppler prop on the arterial pulse area and see if there's blood flow.



- Normal Peripheral Arterial Doppler signal: **Triphasic arterial signal.**



*Severe stenosis is similar to venous flow which is continuous with no pulsation.

❖ Ankle Brachial Index (ABI): **imp**



The severity of ischaemia in the leg can be simply estimated by determining the ratio between the ankle and brachial blood pressures.

$$ABI = \frac{\text{Ankle systolic blood pressure (dorsalis pedis or posterior tibial artery)}}{\text{highst arm systolic blood pressure (brachial artery)}}$$

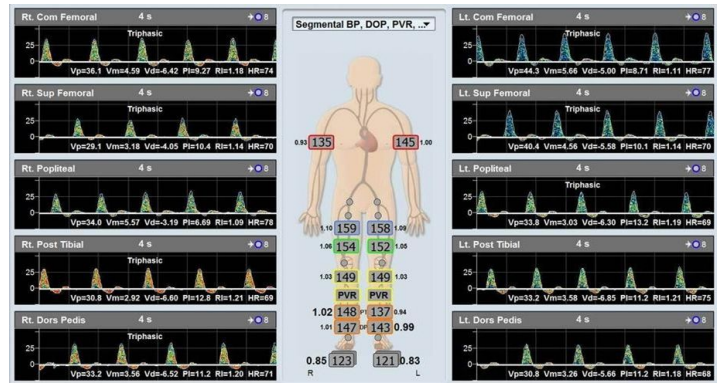
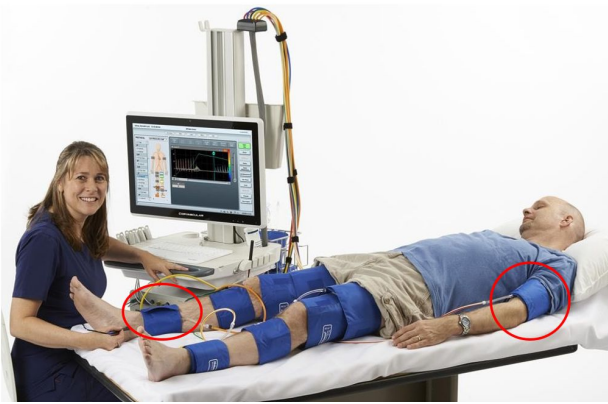
Interpretation of ABI	
> 1.30	Non-compressible (in pt with DM or renal failure)
1.00 - 1.29	Normal
0.91 - 0.99	Borderline (acceptable)
0.41 - 0.90	Mild to moderate peripheral arterial disease (pt with IC)
0.00 - 0.40	Severe peripheral arterial disease (pt with CLI)

In healthy, people ABI should be at least 1; the pressure at the ankles should be at least as high as that in the arms. (BP should be equal, however, a difference of 10-15 mmHg is borderline and considered normal)

ABI is **not reliable** In patients with long standing **diabetes** and **chronic renal failure**, as the arteries are often **calcified** and **incompressible**, this result in false high values.

(>1.30) : the machine will try to compress but it won't be able to, so it will give a number من راسها

❖ Segmental pressure: (handheld doppler + ABI) Done in the vascular lab



Simple, non invasive, gives us an indication if there is a decrease in the blood flow or not, but doesn't tell us what's the disease if it's complete occlusion or stenosis

Sensitive	Operator dependent	toxic	Therapeutic
✓ Limited sensitivity	✓✓✓ الي يسويه ممكن يغلط بمكان البروب وممكن يعطينا false reading	×	×

❖ Duplex ultrasound: B - mode¹ + Color Doppler (sound + image)

It shows the anatomy of vessels, the disease and the flow velocity.

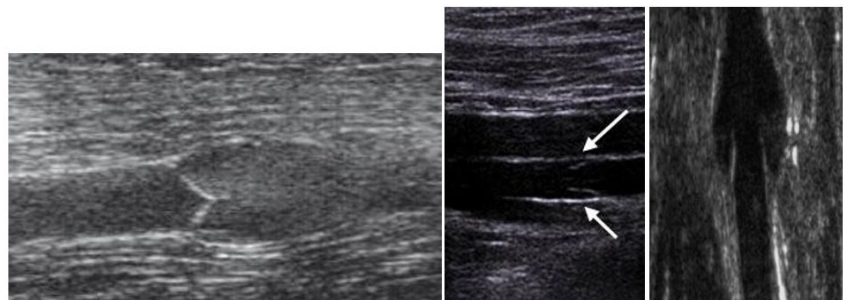
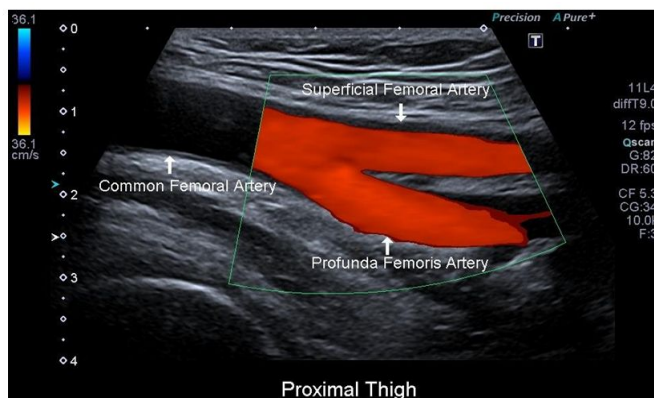
Normal velocity <100 (120 is acceptable) **increase** in velocity means that there is **stenosis**. (remember physics)

*So if we suspect stenosis we check the velocity

When we get a duplex ultrasound image we check for 3 things:

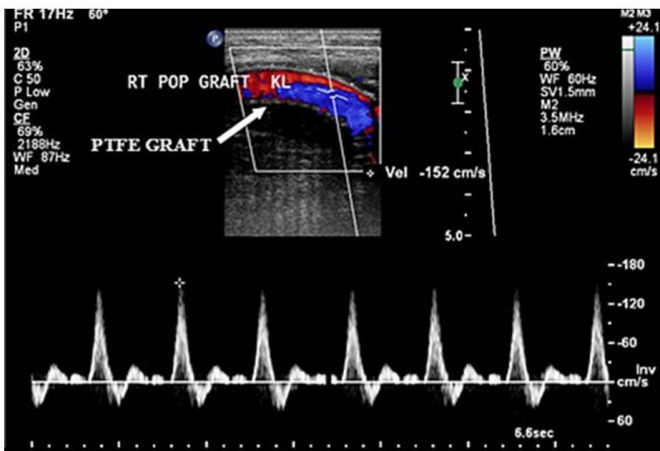
- Waveform (normal: triphasic wave)
- Velocity (<100)
- Anatomically clear

Sensitive	Operator dependent	toxic	Therapeutic
✓✓✓ More sensitive than ABI	✓✓✓ الي يسويه ممكن يغلط	×	×

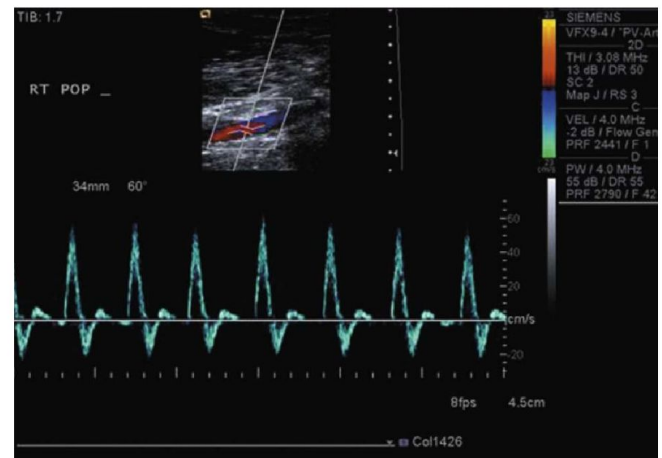


Veins (has a valve)

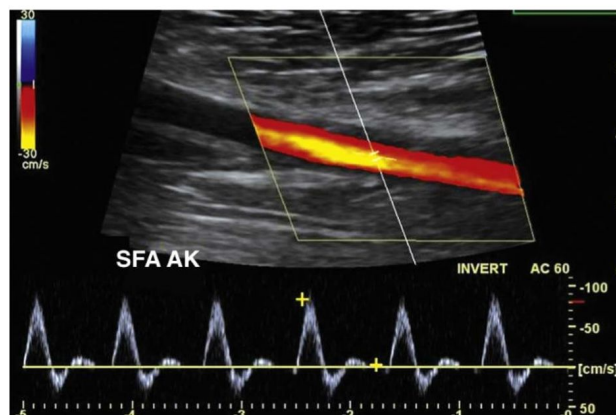
¹ B-mode (brightness mode) ultrasound, More commonly known as 2D mode now.



A pt had bypass graft from the femoral to the popliteal



Triphasic wave + velocity 50 = normal flow



Normal Superficial femoral artery
Triphasic wave + velocity 70 + anatomically clear artery

❖ CT Angiogram: (CT with contrast)

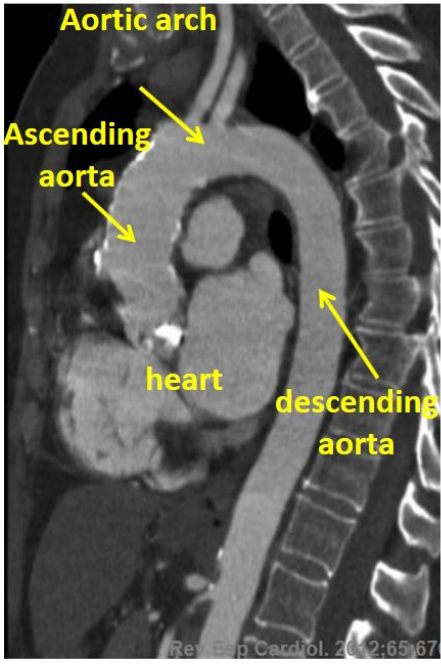
The difference between CT angiogram and CT venogram is the timing. The dye goes this way: veins > heart > arteries. Thus an early CT will show veins, and a late CT will show arteries. "

Due to the use of contrast:

- DM pts on metformin have to stop it at least 2 days before doing a CT angiogram because it may cause lactic acidosis.
- if the patient has renal failure (on dialysis) it's okay to use contrast, because the kidney is not functioning anyway and the pt is on dialysis. But the problem is in pts with borderline kidney function; they may develop renal failure from the contrast, so in this case we check creatinine level. If elevated, we hydrate the pt with IV normal saline 6 hours before CT contrast.

Sensitive	Operator dependent	toxic	Therapeutic
✓✓✓✓✓ Very sensitive Tells you if it's stenosis, aneurysm or occlusion	×	✓✓✓ Contrast, allergy and radiation²	×

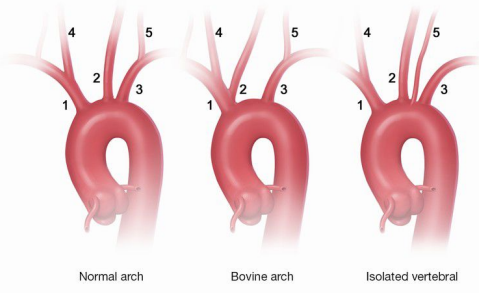
² mostly affecting gonads, thyroid, and eye (cataract)



Abnormal calcification of the aorta



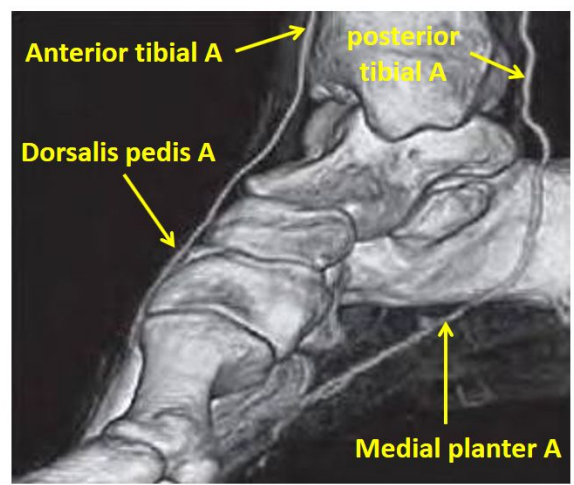
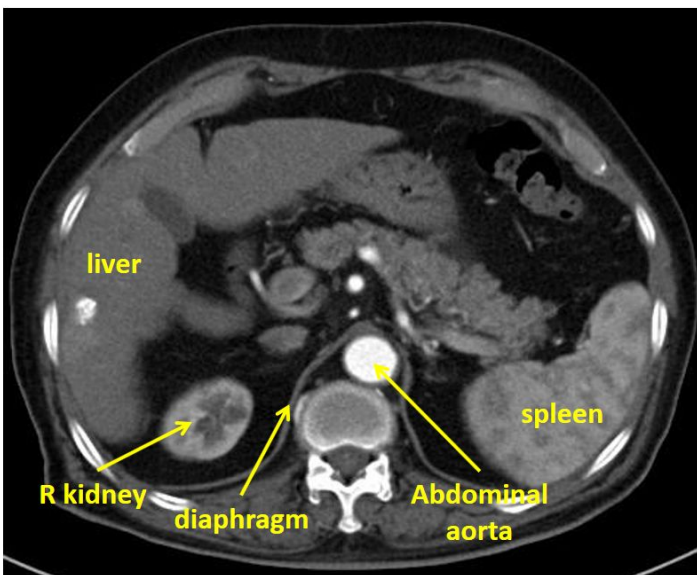
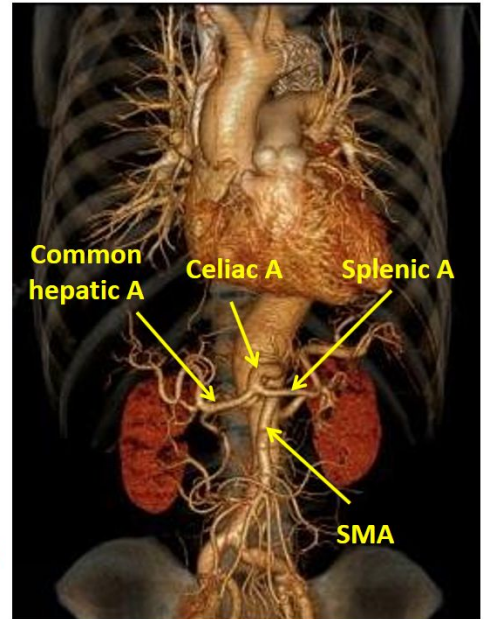
Superficial femoral A aneurysm



computer 3D reconstruction is important to perform before surgery involving the aortic arch (e.g. aortic dissection) to prevent blocking/harming the anatomical variant arteries"



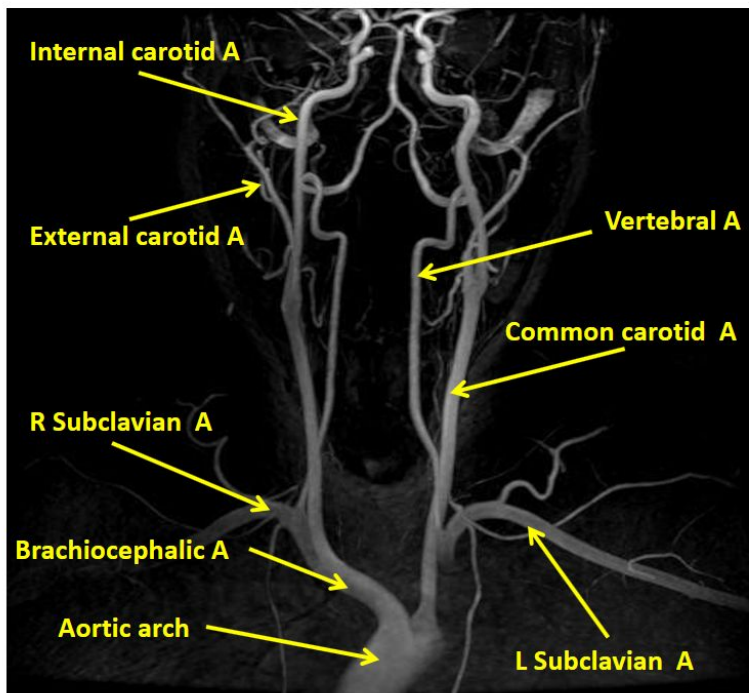
normal aortic arch with an anomaly



❖ MR Angiogram:

MRA is so helpful in soft tissue disease, such as popliteal entrapment syndrome³.

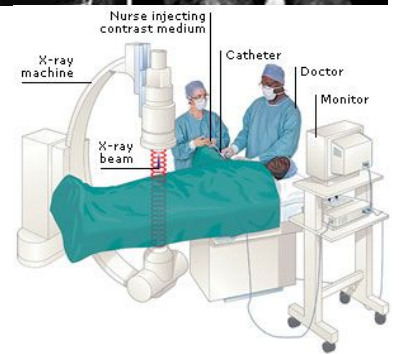
Sensitive	Operator dependent	toxic	Therapeutic
✓✓✓✓	×	✓✓✓ gadolinium contrast in renal failure can cause Nephrogenic systemic fibrosis	×



❖ Angiography: x-ray + dye

30 years ago, angiography was to 99% to diagnose, but nowadays its 95% therapeutic not used to diagnose cause there other easier non-invasive methods.

*More selective⁴



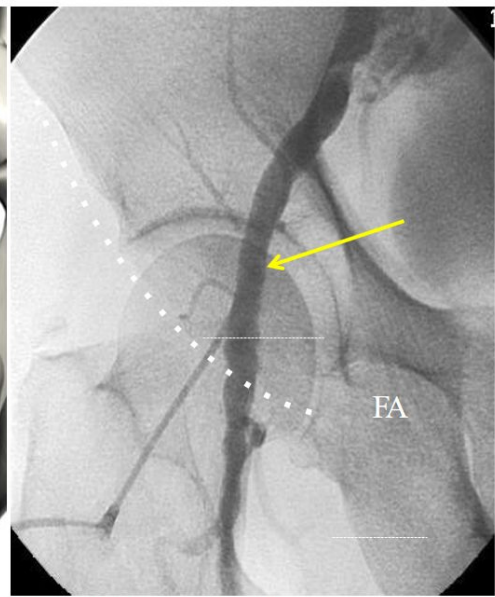
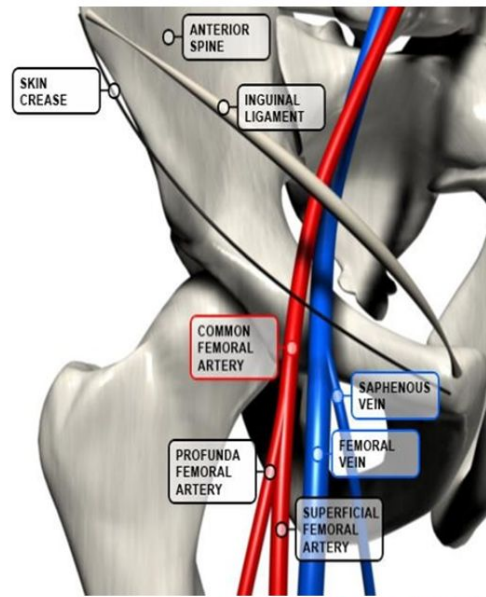
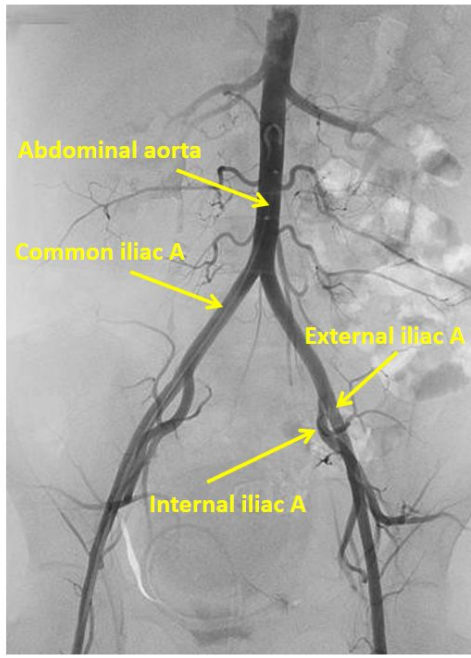
Sensitive	Operator dependent	toxic	Therapeutic ⁵
✓✓✓✓✓ Very sensitive	×	✓✓✓ Contrast, allergy and radiation Less contrast than CT because its selective	✓✓✓ The <u>only</u> therapeutic investigation.

³ The popliteal artery may be compressed behind the knee, due to congenital deformity of the muscles or tendon insertions of the popliteal fossa.

⁴ unlike the CTA, you go in with a percutaneous catheter to the selected artery and inject the contrast.

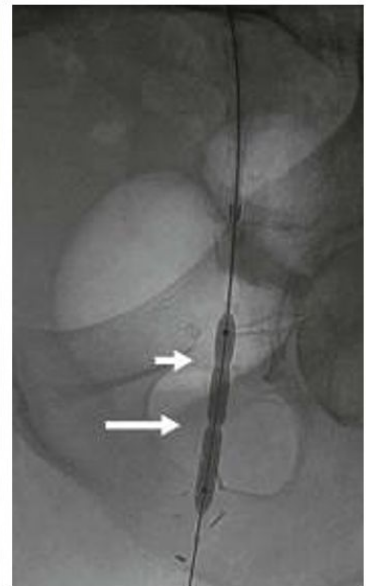
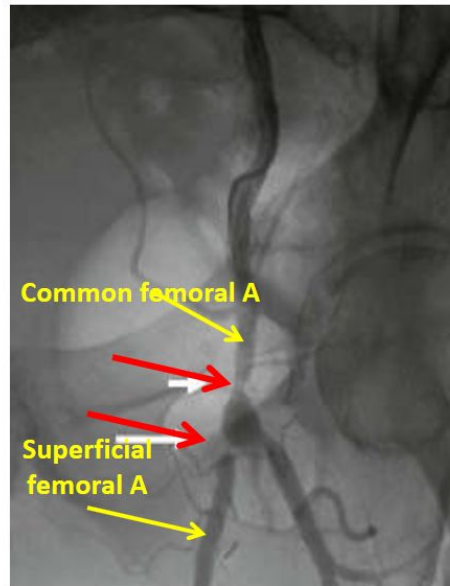
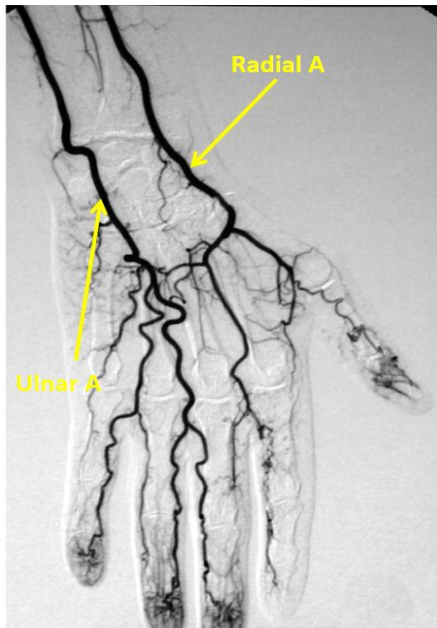
⁵ stenosis>angioplasty + stent

Aneurysm> endovascular repair (instead of open surgery)

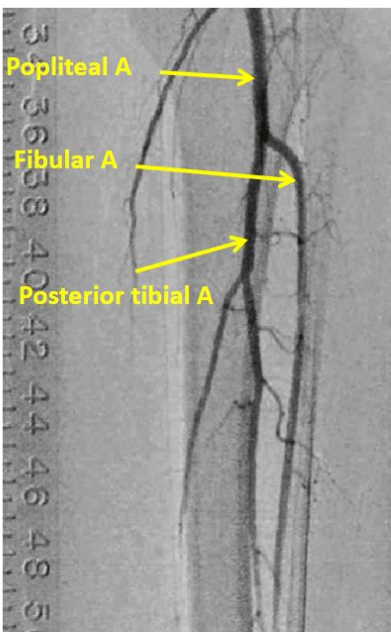


Common femoral artery above the femoral head

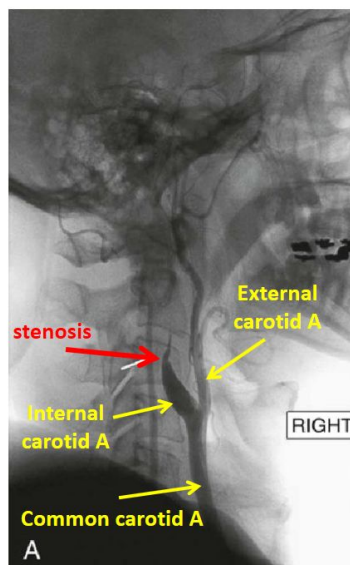
Why do we use the common femoral artery for procedures?
because it lays on the femoral head > compression will stop the bleeding"



There was stenosis in the S.femoral A then by intervention stent or balloon was placed



Posterior tibial (most medial) > Fibular/peroneal > Anterior tibial (most lateral)



Internal carotid artery has no branches in the neck unlike the external



Stenosis in the R popliteal A

Summary:

Modality	Sensitive	Operator dependent	toxic	Therapeutic
Handheld doppler	✓	✓✓✓	✗	✗
Duplex ultrasound	✓✓✓	✓✓✓	✗	✗
CT Angiogram	✓✓✓✓✓	✗	✓✓✓	✗
MR Angiogram	✓✓✓✓	✗	✓✓✓	✗
Angiography	✓✓✓✓✓	✗	✓✓✓	✓✓✓ The only therapeutic investigation