

Emergency Ultrasound Course

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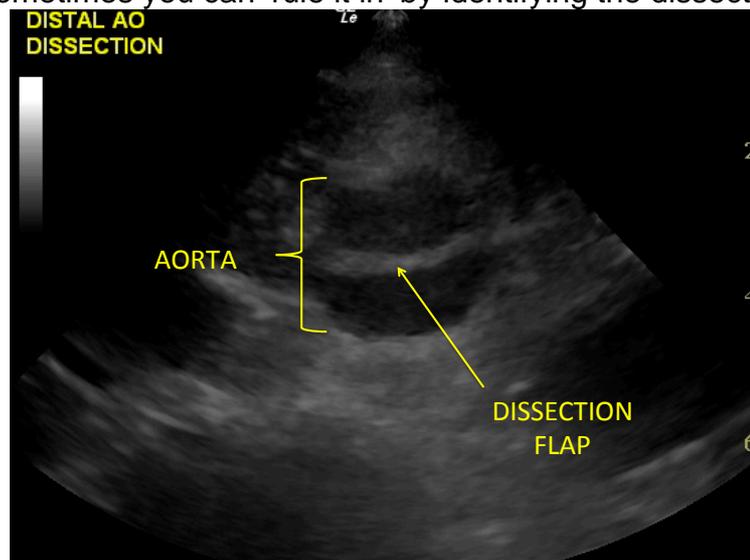
**ED Course Manual 3:
AAA
Abdominal aortic aneurysm**

An introduction to Abdominal Aortic Aneurysms (AAA)

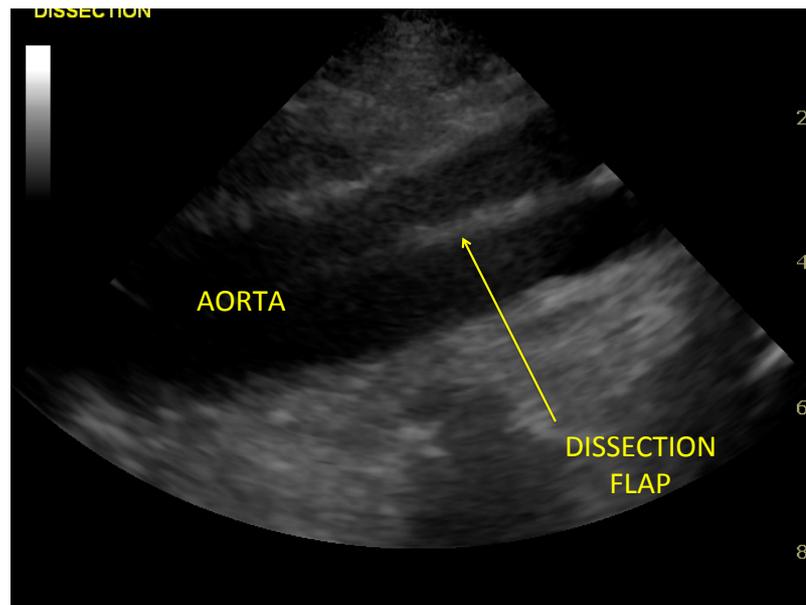
- Approximately 90-95% of abdominal aortic aneurysms (AAA) are confined to the infrarenal aorta.
- Although we define AAA as >3cm diameter for convenience, in fact they are not usually considered really dangerous until they exceed 4-5cm in maximum diameter.

Why scan for AAA in the ED?

- AAA can present unusually: suspect it in all older patients with abdo / back / loin pain, or 1st episode of 'renal colic'
- Physical exam for AAA is often unreliable (50% accuracy: may as well just flip a coin)
- ED point of care US is reliable in the detection of AAA, and safer than CT (the 'donut of death')
- It is sometimes handy to scan the abdominal aorta for another condition: **aortic dissection**. Although you can't rule out dissection with this technique (the dissection may be confined to the thoracic aorta), sometimes you can 'rule it in' by identifying the dissection flap.



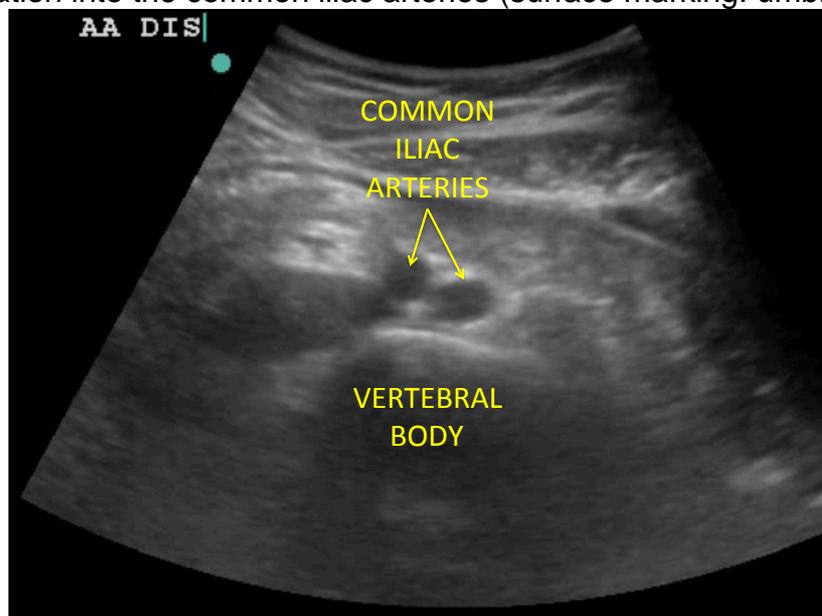
AORTA, TRANSVERSE SECTION:
DISSECTION FLAP



SAME DISSECTION AS ABOVE:
LONGITUDINAL (SAGITTAL) VIEW

Anatomy of the aorta

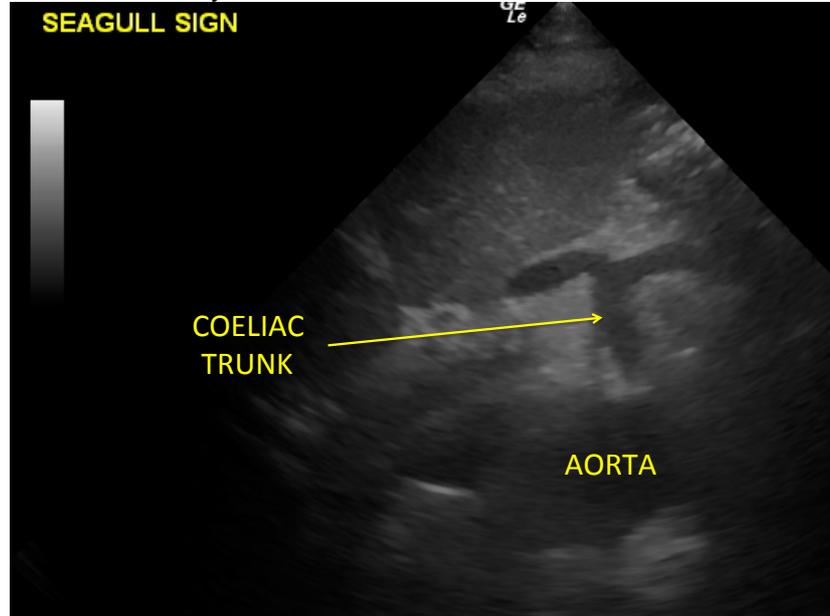
- The aorta is retroperitoneal and lies to the **right** of the IVC, and **in front** of the vertebral column.
- It runs from the diaphragm (surface marking: xiphisternum) to its bifurcation into the common iliac arteries (surface marking: umbilicus).



AORTIC BIFURCATION
TRANSVERSE VIEW

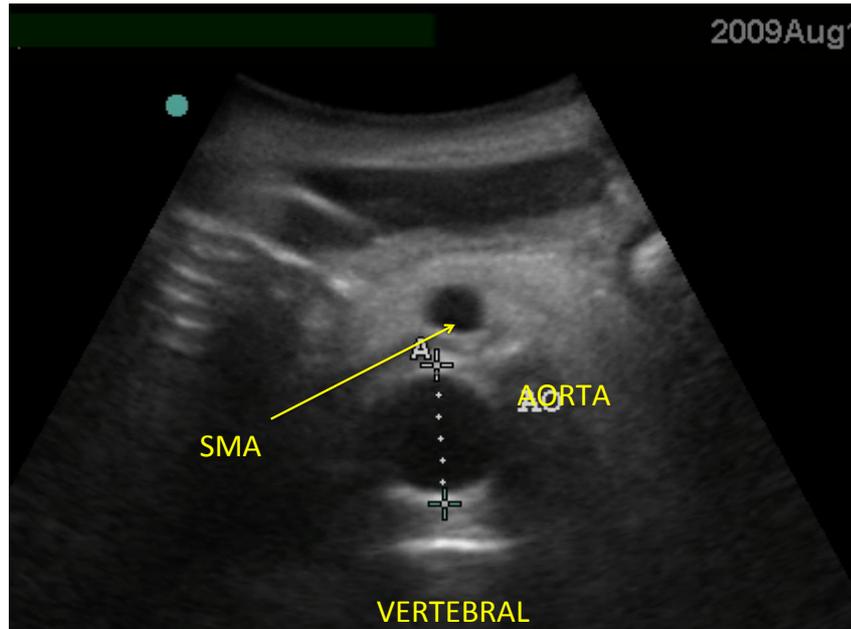
- For convenience, we use the following cutoffs:
 - Normal aorta <2cm diameter
 - Ectatic aorta 2-3cm diameter
 - AAA >3cm
- However, the aorta tapers as it descends and gives off branches.

- The most useful branches to note are the following:
 - **Coeliac trunk:** this first anterior branch comes off soon after the aorta pierces the diaphragm. In turn, it branches quickly into two arteries, causing the classic 'seagull sign' on a transverse view. While not essential, it's nice to see it because it confirms that you have correctly identified the aorta.



THE SEAGULL SIGN:
COELIAC TRUNK BIFURCATING
(TRANSVERSE WINDOW)

- **Superior mesenteric artery (SMA):** this second anterior branch is a very handy 'surrogate marker' for the renal arteries, which come off at roughly the same level and are much harder to identify. If a AAA is seen only below the SMA, it's infrarenal. The SMA is easy to spot because:
 - It runs parallel to, and in front of, the aorta
 - It is surrounded by brightly echogenic fascia, making it stand out clearly.



SMA (SUPERIOR MESENTERIC ARTERY)
AND AORTA
(TRANSVERSE WINDOW)

How to scan for AAA

Patient Position

- Supine is most practical, especially if the patient is shocked.
- Try and avoid sitting the patient up / in flexion, because this narrows your 'scanning window'.



CURVED PROBE

Probe / preset / depth

- Curved probe is best (but sector probe will do)
- Select the 'aorta' preset if there's one available. Just about any abdo preset will do, but the aorta preset will increase the contrast and make the aorta more obvious.
- Depth approx 15cm (more if obese, less if scrawny)

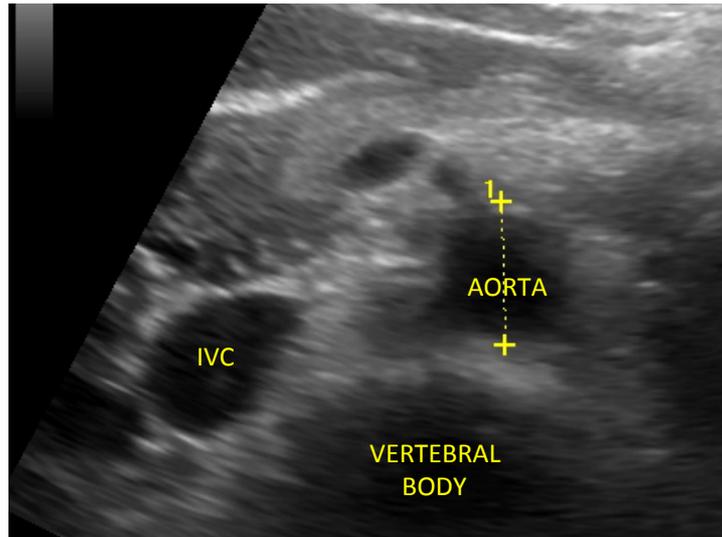
Performing the scan

- Start halfway between the xiphisternum and umbilicus (the transpyloric plane). NB the starting point is really up to personal preference, and some advocate starting just below the xiphisternum.



PROBE POSITION:
BEGINNING THE AAA SCAN

- Just as for all vessels, begin by placing the probe at right angles to the aorta: this means **transverse position** with probe marker to patient's right.
- Identify the following structures:
 - Vertebral body (VB, note bone's acoustic shadow)
 - Aorta in front of VB
 - Inferior vena cava (IVC) to the anatomical right of the aorta (remember this means to the left onscreen)
 - Liver anterior and to the anatomical right (again, this means to the upper left of the screen)
- **Bowel** is the problem: quite often the air-filled bowel gets in the way of the aorta. Sustained, firm pressure usually gets it out of the way.



TRANSVERSE SCAN:
AORTA, IVC AND VERTEBRAL BODY

Aorta or IVC?

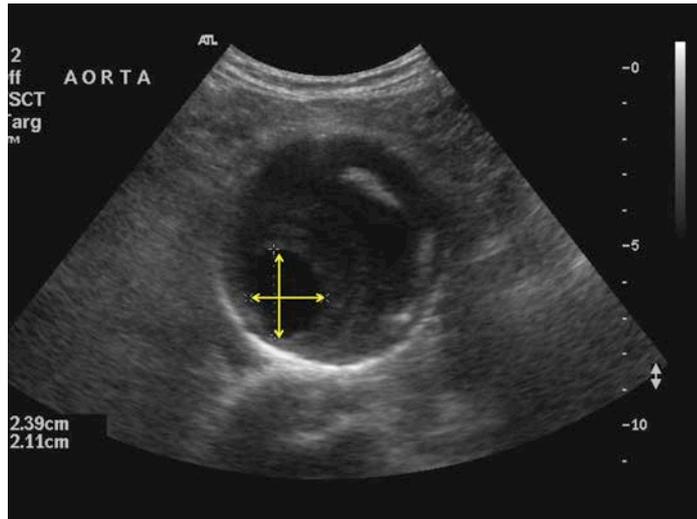
- The IVC):
 - Lies to the anatomical right (= left on screen)
 - Its walls are thinner
 - Its cross section is usually oval
- The aorta:
 - Has a rounder cross section
 - Is often calcified in elderly patients
 - Is often tortuous in elderly patients

Scan all of the aorta!

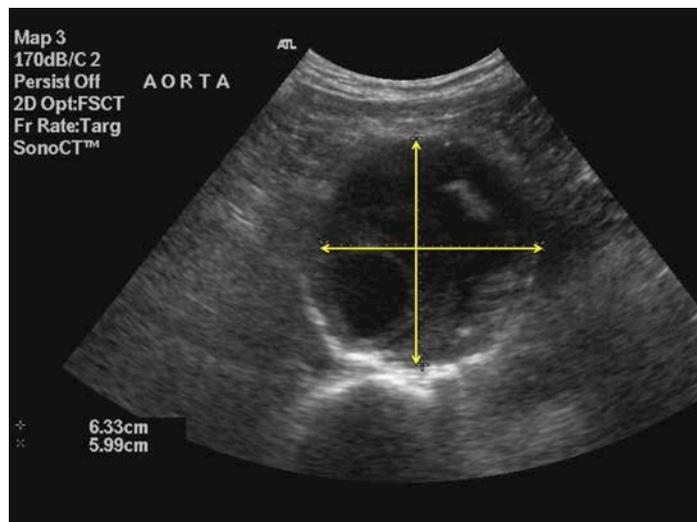
- Maintaining the transverse position, move the probe up and down until you reach the bifurcation.
- This usually requires a combination of sliding and angling the probe.
- Look for the coeliac trunk & SMA (see note above).

Measuring the aorta's diameter

- Find the spot where the aorta is widest.
- If time permits, alter your depth & focus to obtain the best image.
- Measure transverse or AP diameter (whichever is larger): make sure you are measuring the outer diameter, not the inner.



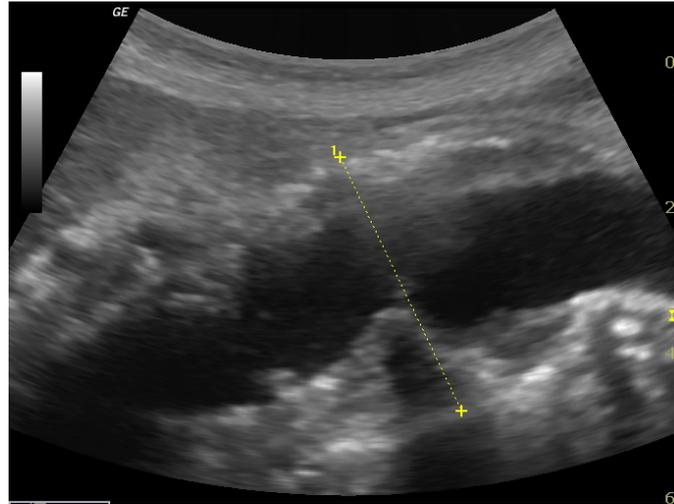
AAA MEASURED INCORRECTLY:
LUMEN IS MEASURED



AAA MEASURED INCORRECTLY:
OUTER DIAMETER IS MEASURED

Longitudinal scan

- This isn't necessary but it's nice if you can get it.
- It can be tricky, because the IVC runs alongside. So how do you make sure it's the aorta you're imaging in long axis?
- A: by keeping the image of the aorta in the middle of the screen, when you rotate the probe into longitudinal position.



AAA LONG AXIS:
AP DIAMETER MEASURED

Essential Views

For ruling out AAA, you need to see all of the aorta.

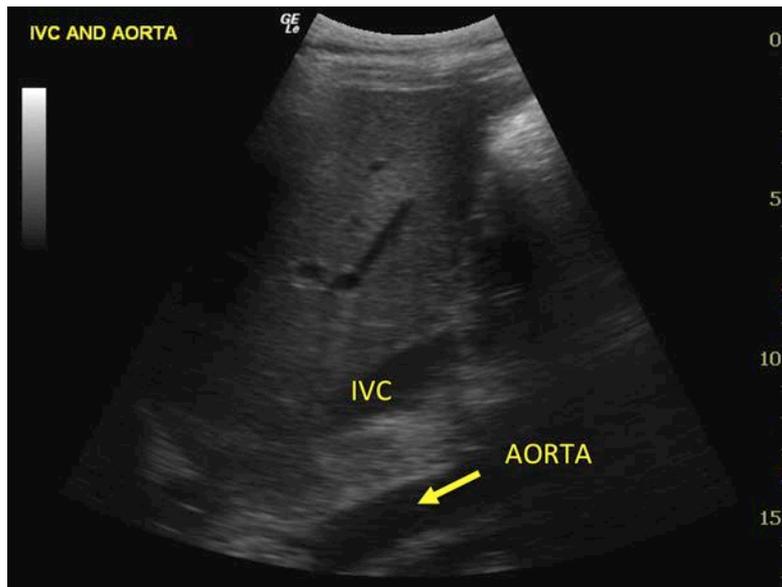
But for credentialing, it would be impractical and time consuming to save images of the entire thing. So a reasonable compromise is to save a minimum of three images unless the scan is positive:

- Transverse image at level of greatest diameter, measured
- Transverse movie image / loop at level of bifurcation
- Longitudinal section or a third transverse section (ideally with origin of celiac trunk or SMA)

TOP TIPS

Bowel gas is a big problem, particularly because distressed patients in extreme pain often inadvertently 'swallow air'. Tricks include:

- Sustained, firm pressure with the probe on the abdominal wall to move the bowel. (Try not to hurt the patient!)
- Scan from a different spot on the abdomen
- Scan through the loins (ie from behind) or through the liver / spleen. You can often see the upper abdominal aorta in this way.



IVC AND AORTA, SEEN FROM RUQ
USING LIVER AS WINDOW

Take your time and don't expect miracles.

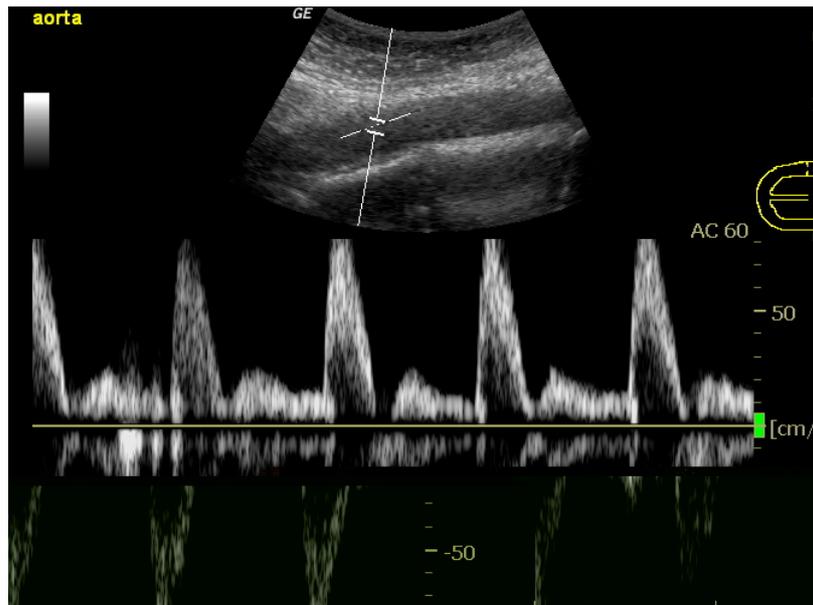
AAA scanning is much easier to describe than EFAST, but much harder to perform when it's crunch time. Practise on as many asymptomatic obese volunteer patients as possible to hone your skills.

Beware mural thrombus.

If you're not careful, your eye will be drawn to the lumen of the aorta and may inadvertently ignore the true diameter.

You don't need Doppler.

Although Doppler will differentiate between IVC and aorta when properly applied, it's (a) too prone to be misleading, and (b) unnecessary. If you can't tell between the aorta and IVC using US, you shouldn't be scanning. (See PHYSICS & KNBOLOGY for more details on why you should avoid Doppler.)



LONG AXIS DUPLEX IMAGE OF AORTA:
NOTE ARTERIAL WAVE FORM

What point of care US can tell you

- Is there an aneurysm (AAA)? USS can detect AAA in at least 97% of cases.

What it can't tell you

- Is the aneurysm leaking?

USS is insensitive in detection of retroperitoneal fluid (such as blood). If you detect AAA in a shocked patient, assume it has ruptured or is leaking.