External diameter is the rule : we must keep it this way

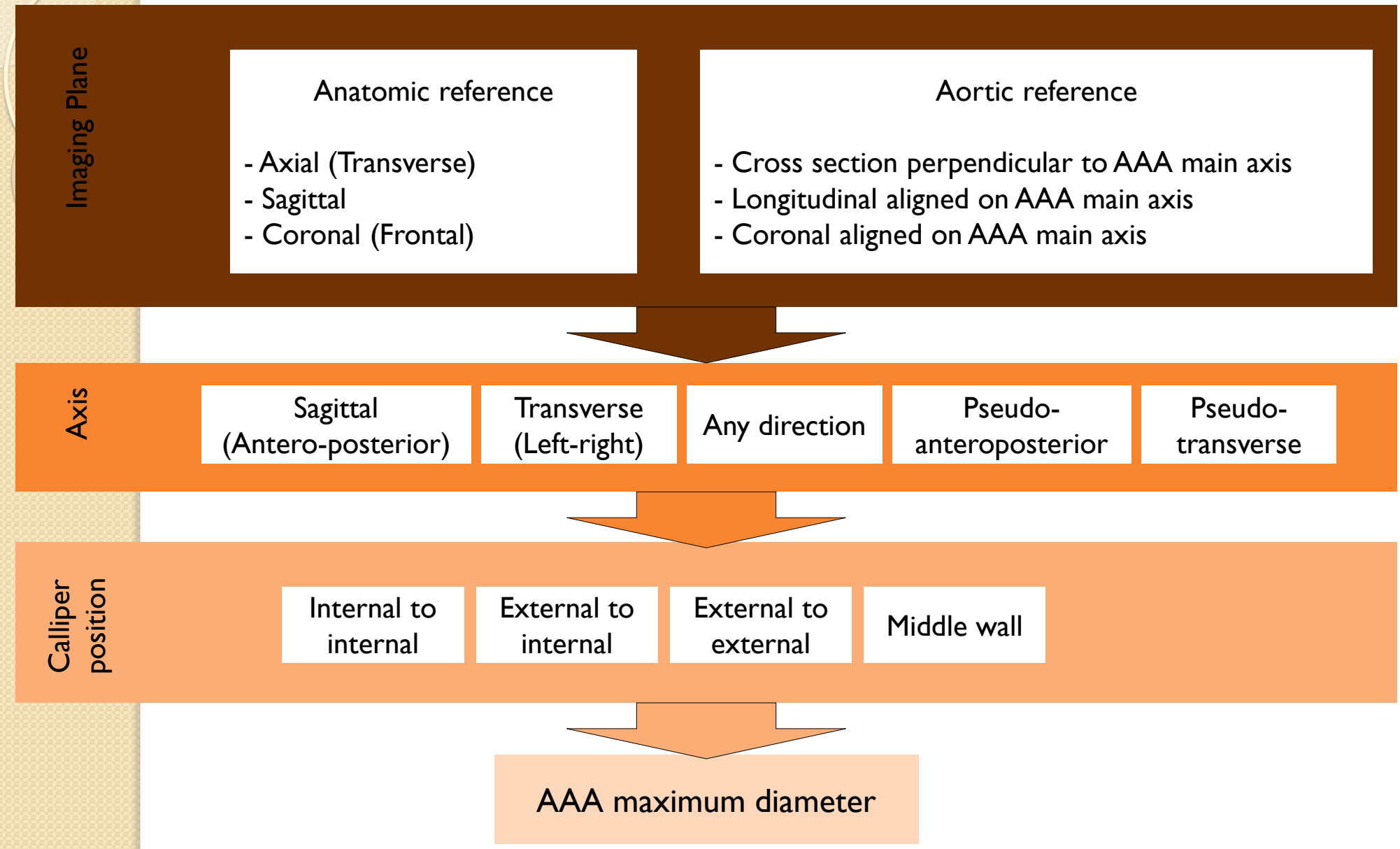
(1) A Long, (2) L Rouet

(1) Vascular Medicine, CHU de Reims, France.
(2) Medisys, Philips Research, Suresnes France

- Recent review of the litterature :

  diversity of protocols used for measuring AAA maximum diameter

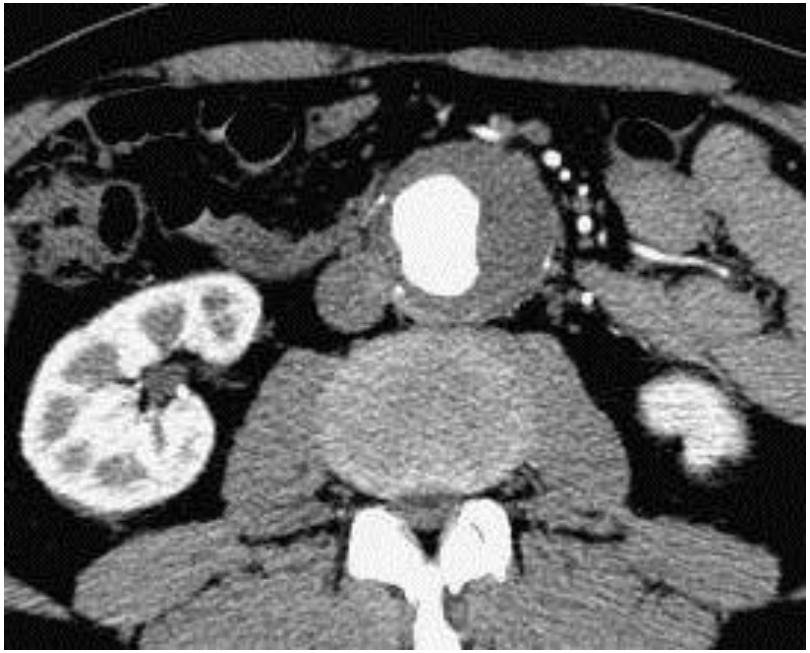
Long A. Eur J Vasc Endovasc Surg. 2012;43:515-24


Imaging Plane
Anatomic reference
- Axial (Transverse)
- Sagittal
- Coronal (Frontal)
Aortic reference
- Cross section perpendicular to AAA main axis
- Longitudinal aligned on AAA main axis
- Coronal aligned on AAA main axis
Axis
Sagittal (Antero-posterior)
Transverse (Left-right)
Any direction
Pseudo-anteroposterior
Pseudo-transverse
Calliper position
Internal to internal
External to internal
External to external
Middle wall
AAA maximum diameter

- Caliper position : the last step of the process

Imaging modalities

- CT and US have different physical properties



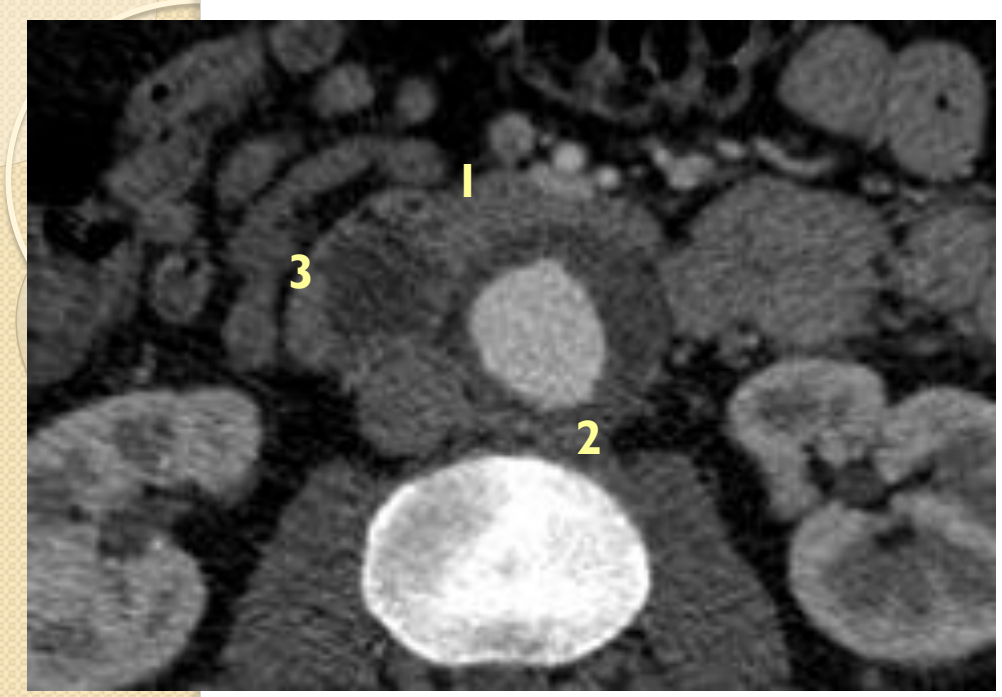
Imaging with CT

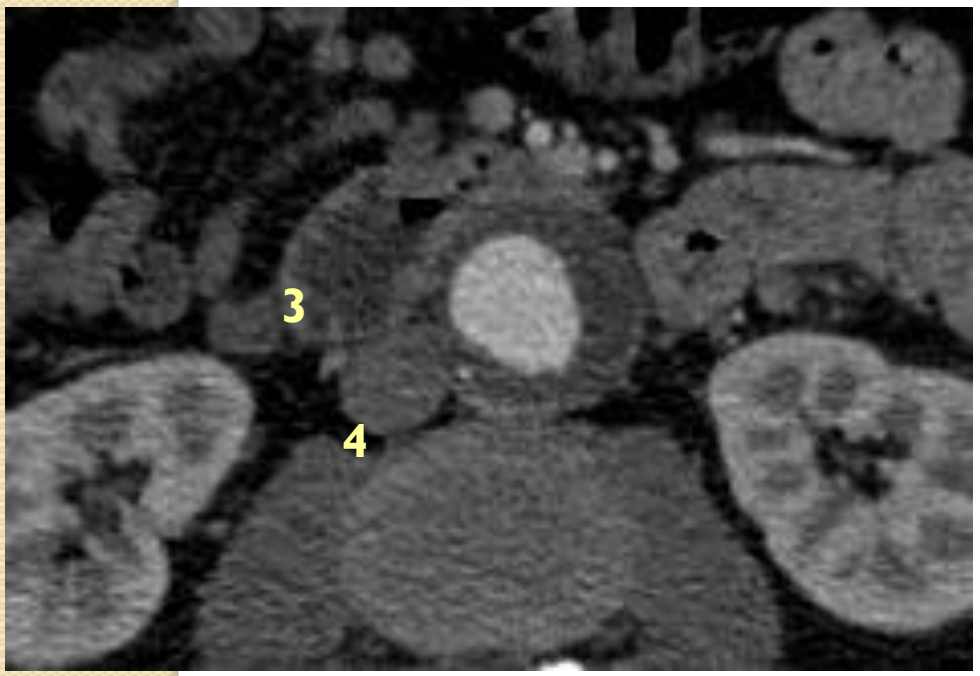
- Xray penetration differs between AAA and surrounding tissues

- ***Spiral*** acquisition offers a good resolution in any direction

  => Interface between peri-arterial tissues (fat) and AAA walls easy to find

- Difficulties : adenopathies, inferior vena cava, duodenum, small bowel close to the aortic wall

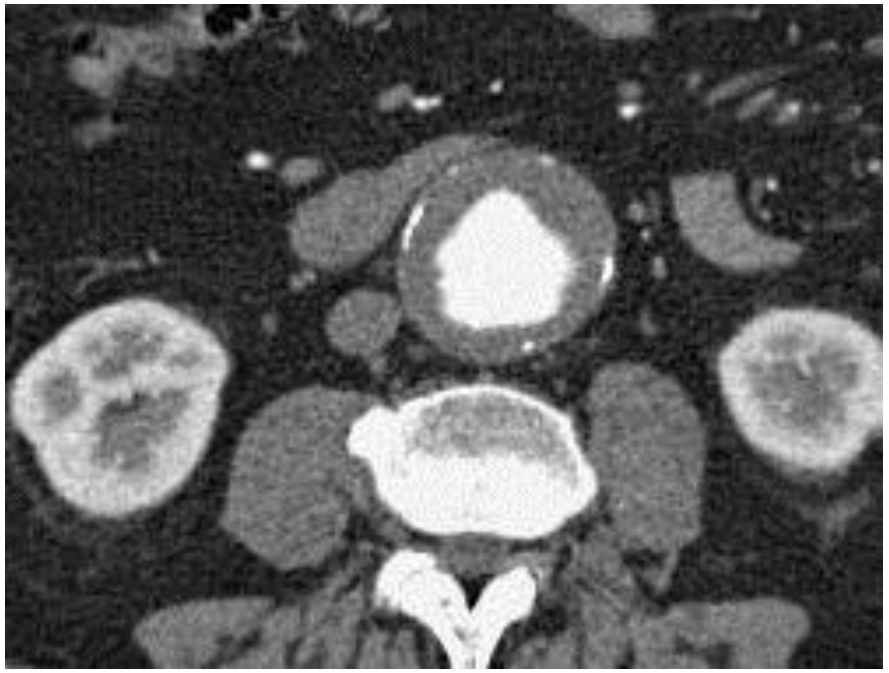




- Duodenum (1)
- Retro-aortic left renal vein (2)
- Small bowell (3)
- Inferior vena cava (4)

Imaging with CT

- In the litterature, measurements made with external diameter



Lederle FA for the ADAM VA Cooperative Study Group. J Vasc Surg, 1994;20:296-303.
Vega de Ceniga M. Eur J Vasc Endovasc Surg 2006;31:231-6. Ann Vasc Surg 2008;22:37-44
Cao P, CAESAR Trial Collaborators. Eur J Vasc Endovasc Surg 2005;30:245-51

Imaging with US

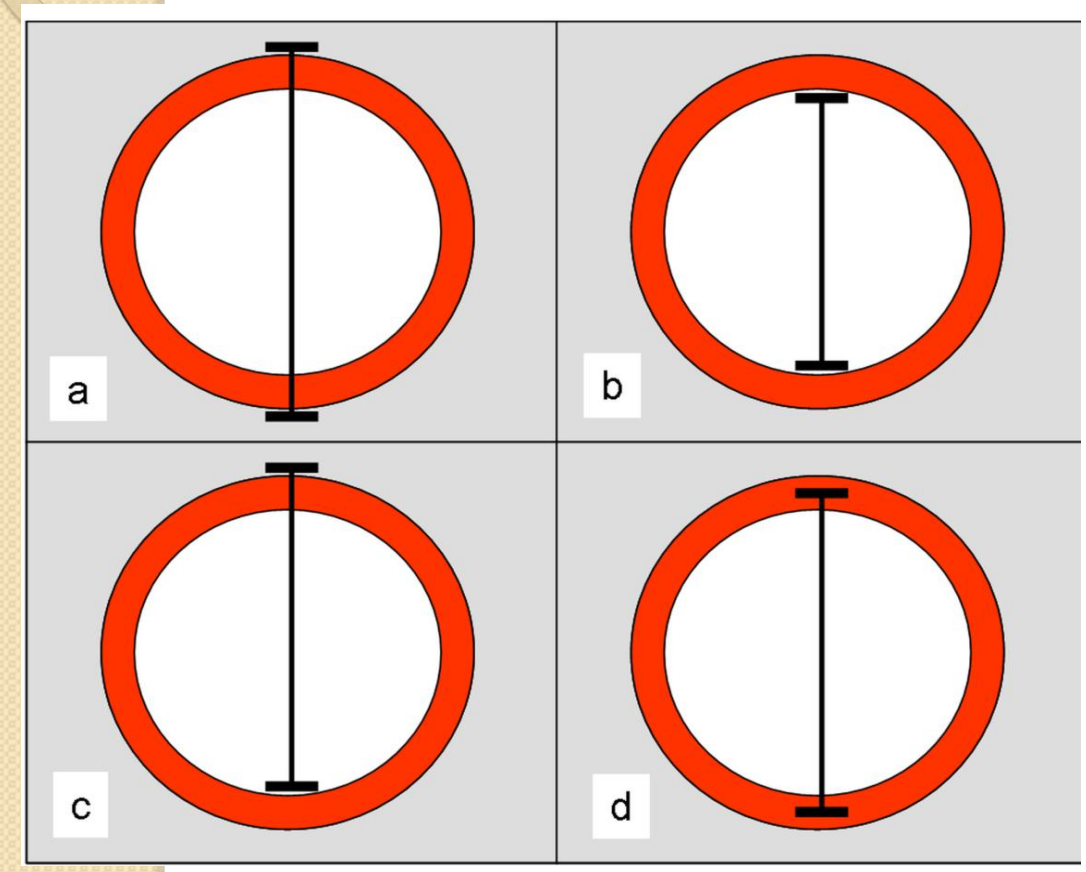
- Best interface depends

- on the impedance difference between tissues

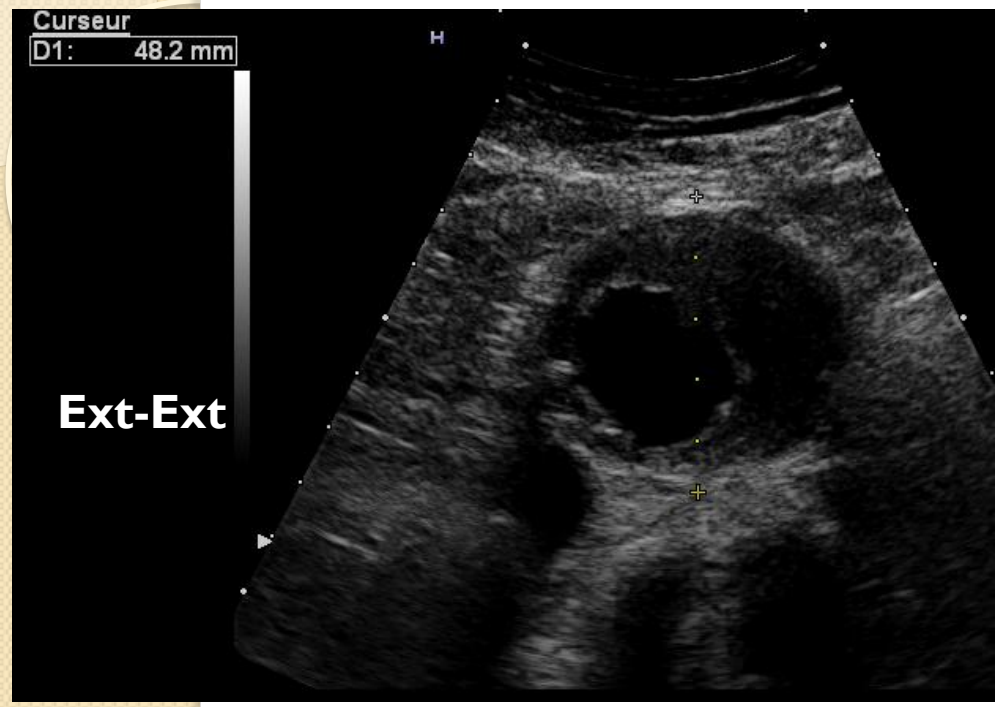
- on the US beam orientation with respect to the imaged structures (less resolution of lateral walls)

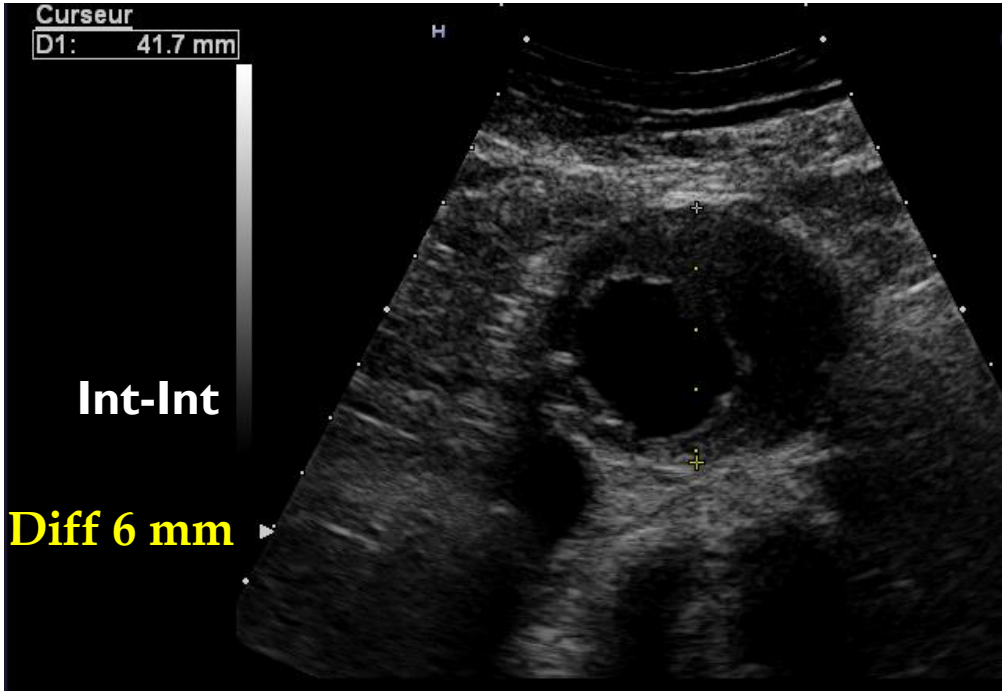
- Artefacts created by reverberation, parietal calcifications

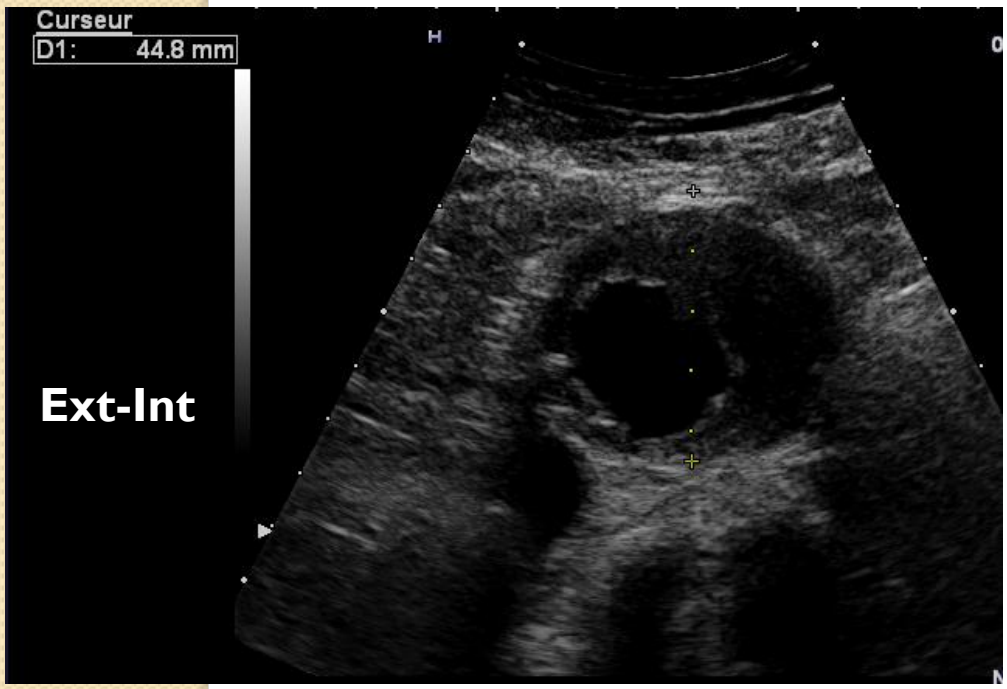
Caliper positions



- External to external
- Internal to internal
- Leading edge
- Middle wall

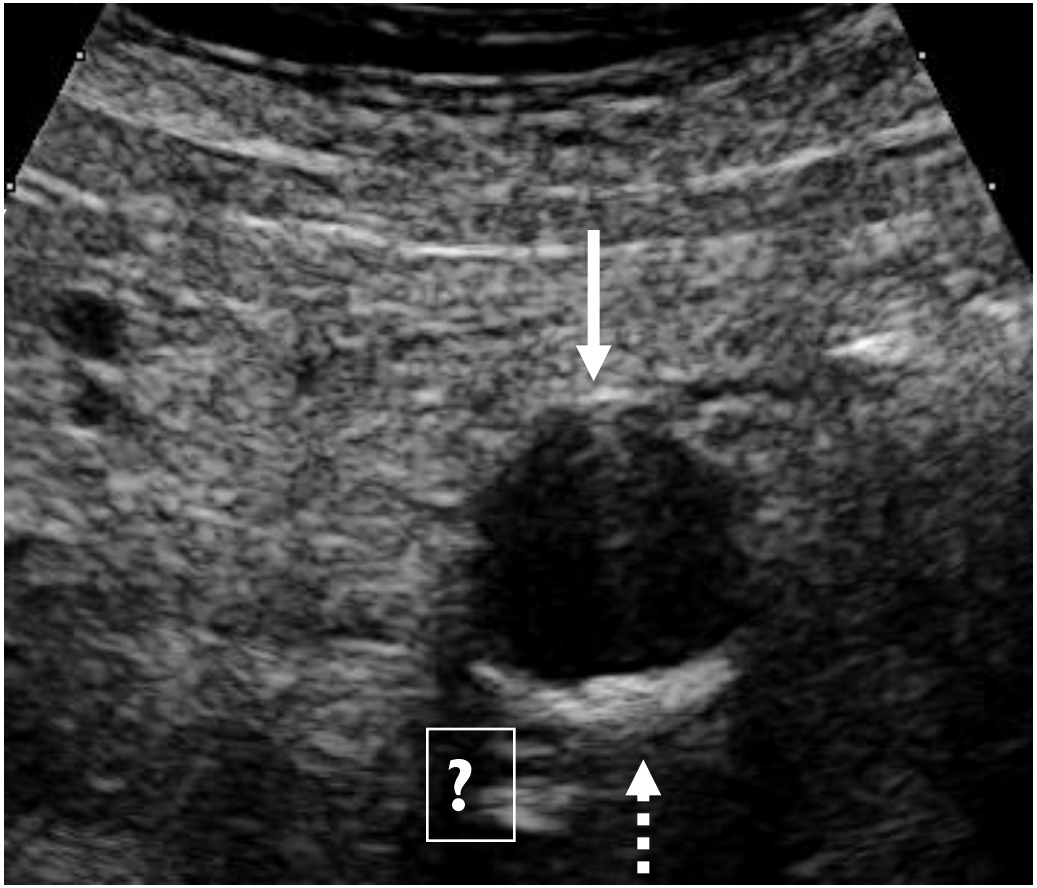

Curseur
D1: 48.2 mm
Ext-Ext

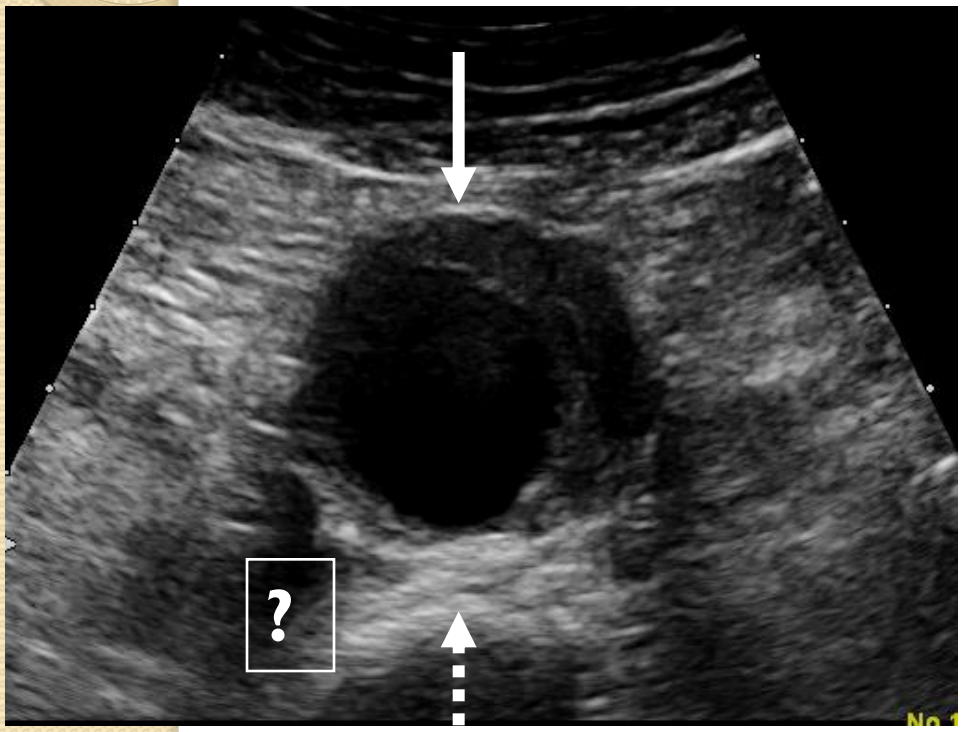

Curseur
D1: 41.7 mm
Int-Int
Diff 6 mm

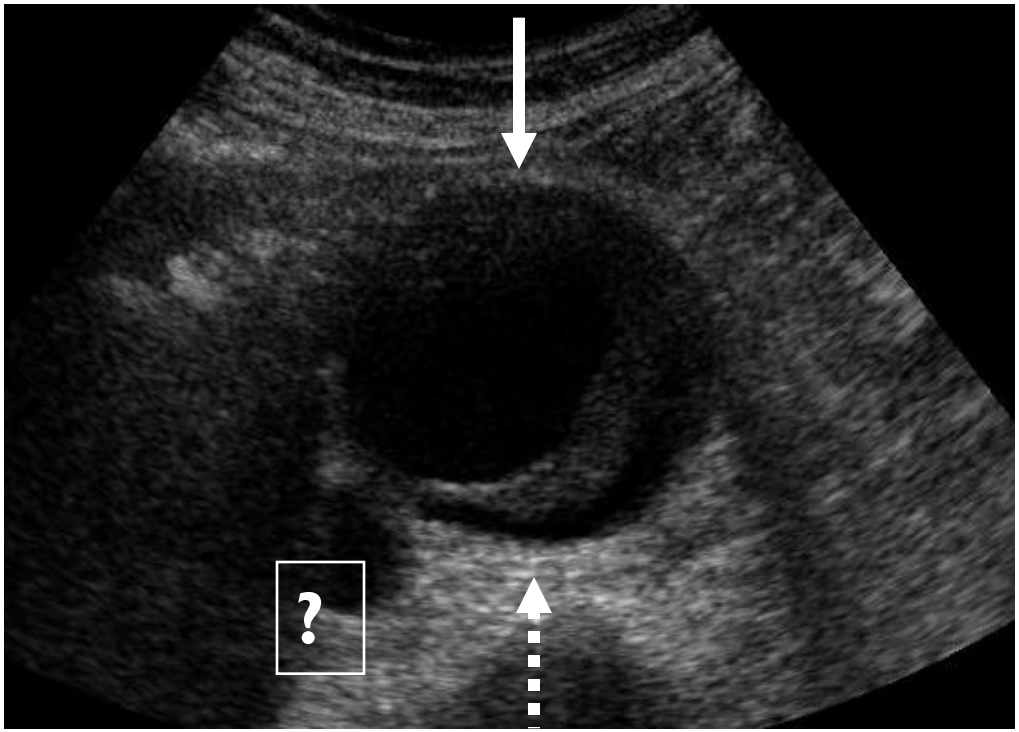

Curseur
D1: 44.8 mm
Ext-Int


Curseur
D1: 44.6 mm
Middle
Wall

Aortic diameter measurement with US : exemples







Criteria for choice

- **Best reproductibility with US**

  2 papers with contradictory results

  -> **Internal** > External

  Hartshorne et al. Eur J Vasc Endovasc Surg 2011;42: 195-9

  -> **External** > Internal

  Thapar et al. Ann R Coll Surg E,gl 2010; 92:503-5.

- **Best agreement between US and CT**

  -> **US < CT** in most papers

  Foo Eur J Vasc Endovasc 2011 ; 42 : 608-14

  However in most studies, no common methodology used for measurement with both techniques

Proposition

- US and CT : same imaging plane and axis

- CT : external diameter (reference)
- US : 4 different calipers positions

- Final choice for caliper position :
  Best reproducibility
  Best agreement between values (CT vs US)

Conclusion

- No clear argument to recommend external or internal diameter method of measurement

- The diversity of protocols used for AAA maximum diameter measurement is in favor to a Consensus taking into account all the steps