



CLINICAL APPLICATIONS OF ULTRASOUND

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- It is used in cases of: abdominal, cardiac, obstetrical, gynecological, urological and cerebrovascular examination, breast examination, and small parts as well as in pediatric and operational review.

Ultrasound is a useful way of examining many of the body's internal organs, including but not limited to the:

- heart and blood vessels, including the [abdominal aorta](#) and its major branches
- [liver](#)
- [gallbladder](#)
- [spleen](#)
- [pancreas](#)
- [kidneys](#)
- [bladder](#)
- [uterus](#), [ovaries](#), and [fetus](#) in pregnant patients
- eyes
- [thyroid](#) and [parathyroid glands](#)
- [scrotum](#) (testicles)
- brain in infants
- hips in infants
- spine in infants

Ultrasound is also used to:

- guide procedures such as [needle biopsies](#), in which needles are used to sample cells from an abnormal area for laboratory testing and in usg guided drainage of pleural and ascitic fluid.
- image the breasts and guide [biopsy](#) of breast cancer .
- diagnose a variety of heart conditions, including valve problems and congestive heart failure, and to assess damage after a heart attack. Ultrasound of the heart is commonly called an "echocardiogram" or "echo" for short.

Doppler ultrasound images can help the physician to see and evaluate:

- blockages to blood flow (such as clots)
- narrowing of vessels
- tumors and congenital vascular malformations
- reduced or absent blood flow to various organs, such as the testes or ovary
- increased blood flow, which may be a sign of infection

***Ultrasound imaging:* What does it look like?**

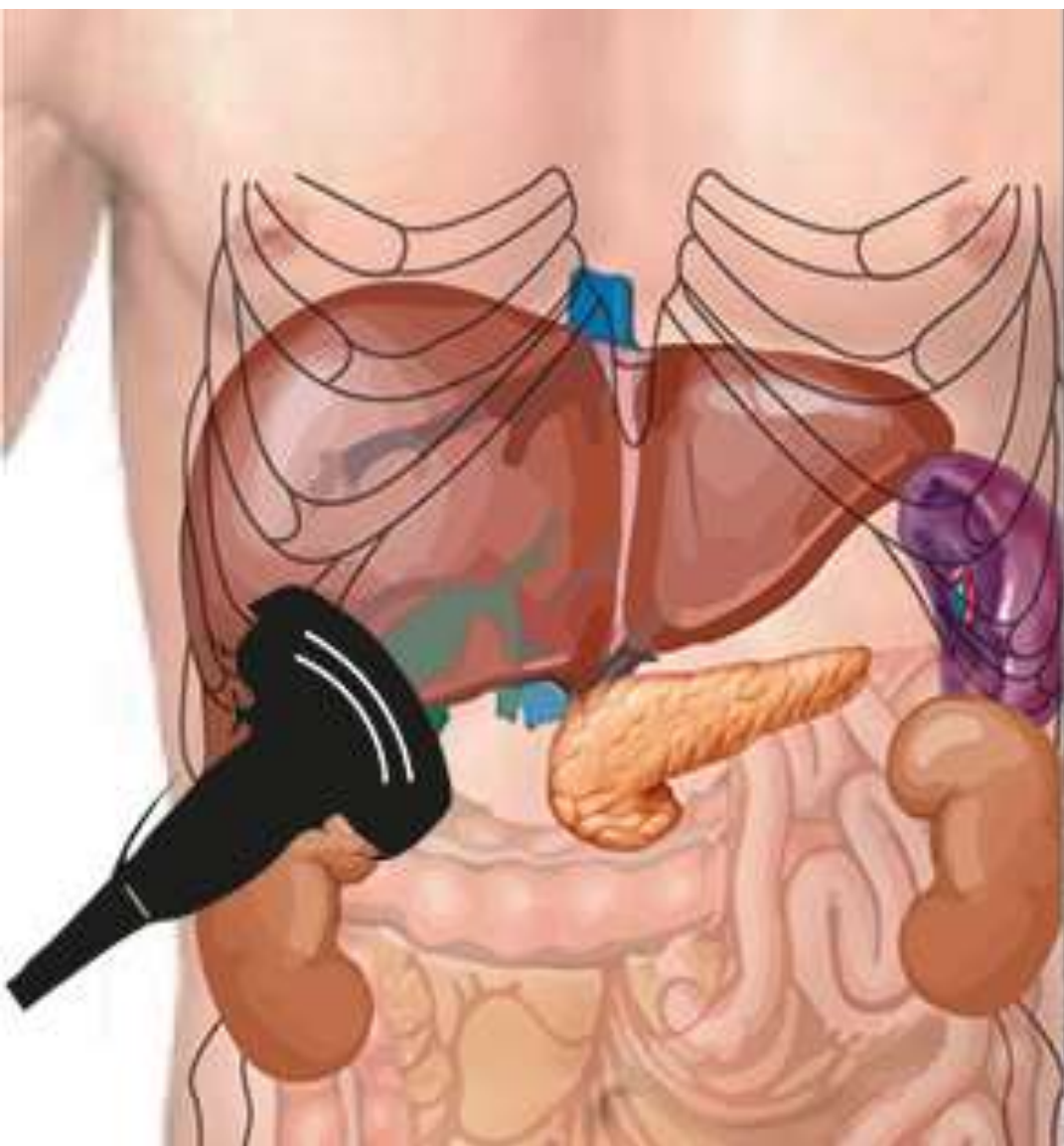


IMAGE ON LEFT REVEALS NORMAL LIVER AS COMPARED TO CIRRHOTIC LIVER SEEN IN THE ULTRASOUND IMAGE ON RIGHT



- NORMAL USG IMAGE OF GALL BLADDER ON LEFT SIDE WHICH APPEARS AS ANECHOIC STRUCTURE WITH IMAGE ON RIGHT SIDE SHOWING CALCULUS WITHIN GB LUMEN CAUSING POSTERIOR ACOUSTIC SHADOWING.







CORONAL
APPROACH
FOR
VISUALISATION
OF LIVER AND
KIDNEY



NORMAL
PANCREAS
ON USG



URINARY
BLADDER ON
USG IMAGE

Ultrasound imaging: development of a pregnancy



Ultrasound imaging: foetus feet



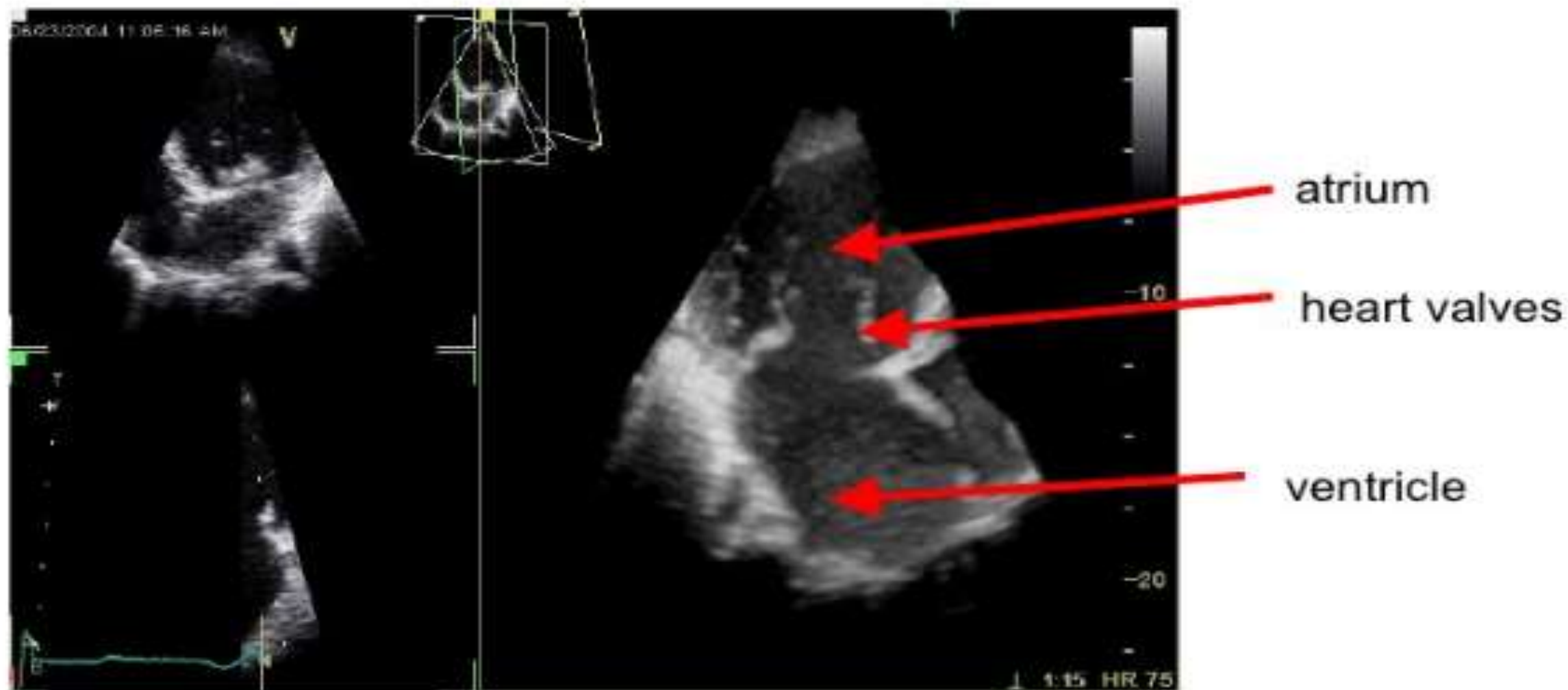
This is a 2D ultrasound scan through the foot of a foetus. You can see some of the bones of the foot.

We can process the image in a computer to find the outline of the foot. This is called *surface rendering*. Here, the foot has been surface rendered

Ultrasound imaging: more surface rendering



Ultrasound imaging: imaging the heart



Magee Womens Hospital Rm. 10
Map 7

CAE5.0

OB

GE



MF: R
FA: M
EE: L
CNS3
16cm
DR66
G46

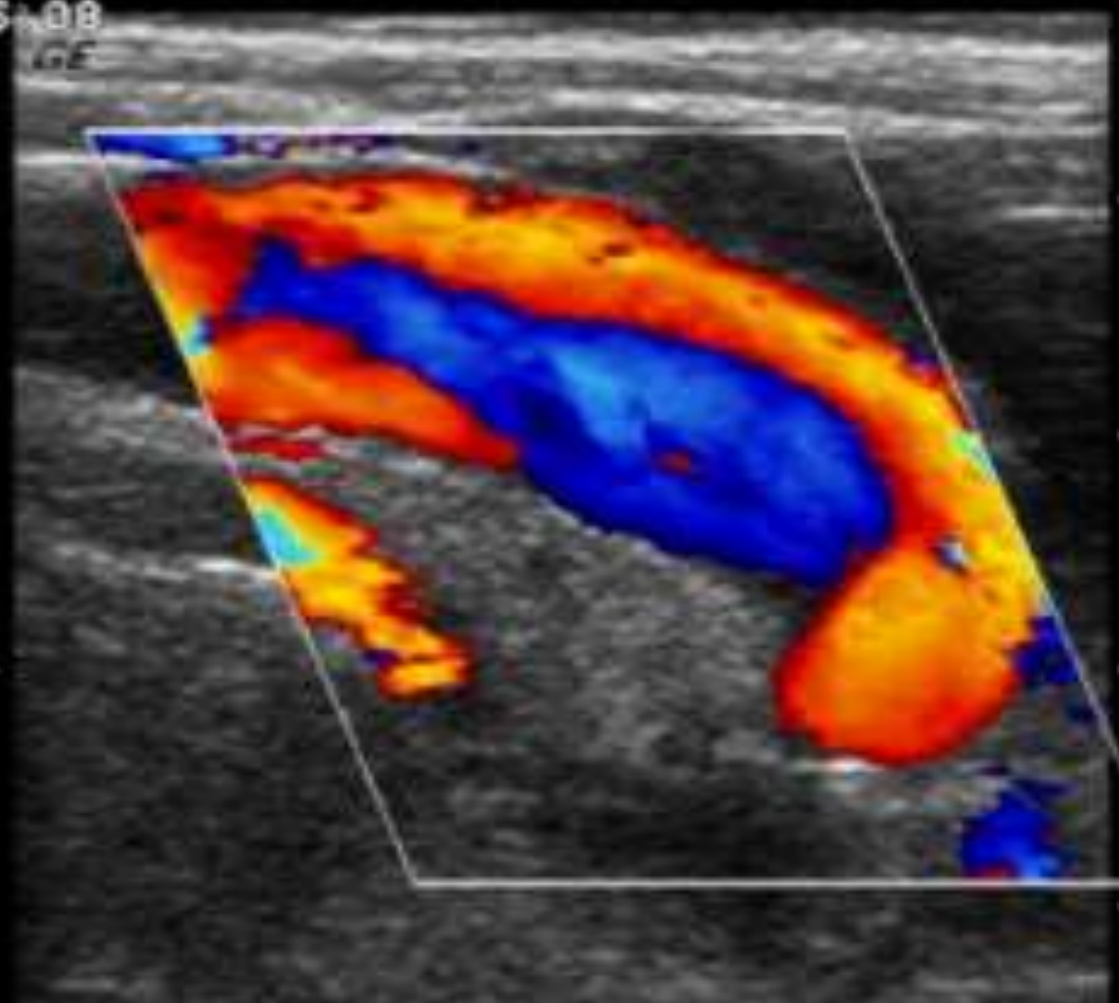


BAPTIST MED CTR
3000P +2:06:08
90F
42CG
IM#18

D0. 2cm 5739L
AC CAROTID
CINE 0052
22G
72DR
R1 R1 P16

23
23
cm/s

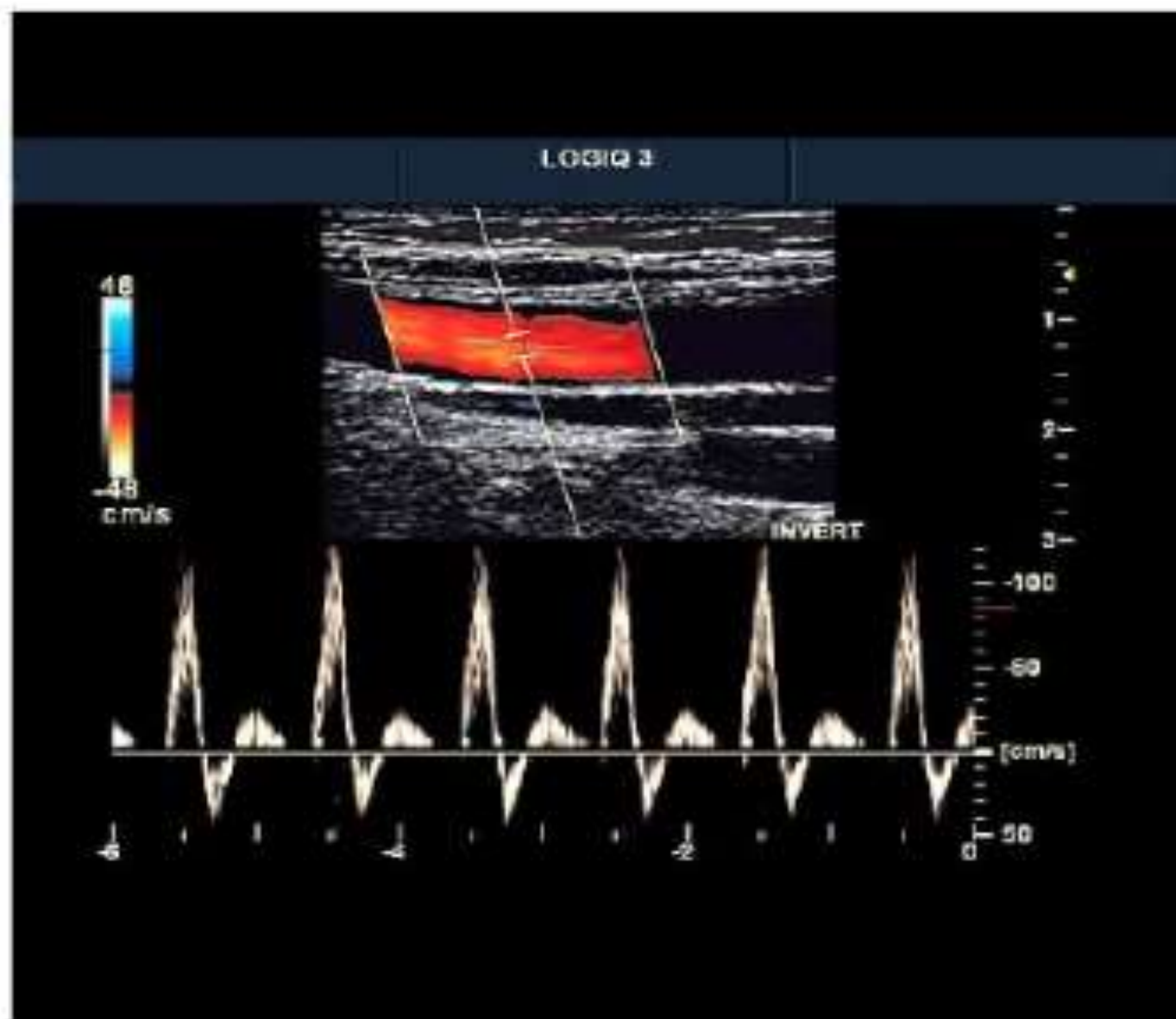
RIGHT
COMMON
CAROTID
ORIGIN



TIS=2.0 MI=0.8 AO=69%

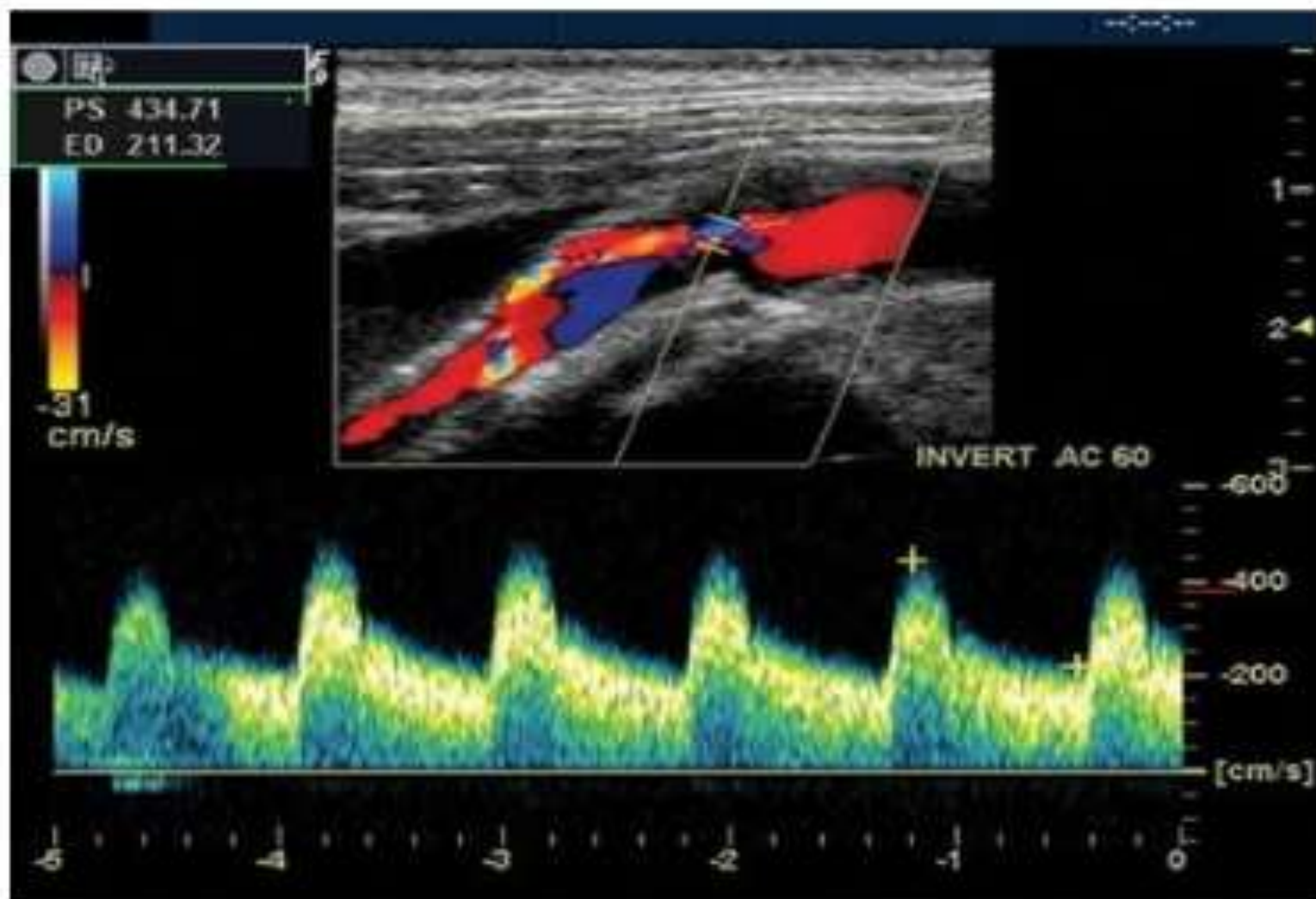
Ultrasound imaging: carotid artery

- Doppler imaging looks at artery
- Get image and trace of blood flow
- This is a healthy artery. The flow is smooth and all in the same direction, like water in a large, slow river



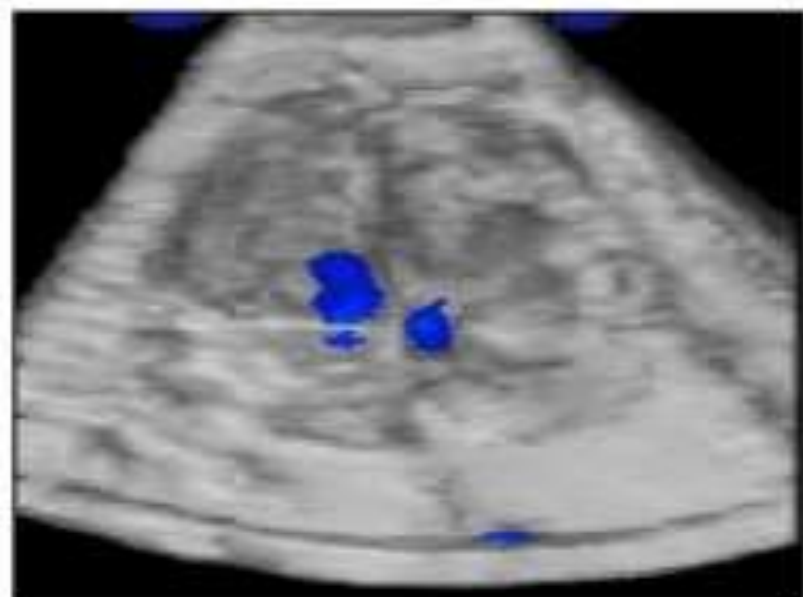
Ultrasound imaging: carotid artery

- This is also a carotid artery.
- The flow is not all in the same direction. It is turbulent, like rapids in a river.
- This is usually due to a build-up of fatty deposits in the artery



Ultrasound: safety

- Ultrasound is energy and is absorbed by tissue, causing heating
- Question: 2D ultrasound has been used to image the foetus for about 50 years. It is thought to be completely safe and does not cause significant heating
- 4D ultrasound is new, requires more energy and therefore generates more heating. We think it is safe.
- **Should we use it to diagnose foetal illness?**
- **Should we use it to make videos of healthy babies for parents?**



ADVANTAGES OF ULTRASOUND

- Ultrasound uses non-ionizing sound waves and has not been associated with carcinogenesis. This is particularly important for the evaluation of fetal and gonadal tissue.
- Ultrasound is more readily available than more advanced cross-sectional modalities such as CT or MRI.
- It is less expensive to conduct than CT or MRI.
- There are few (if any) contraindications to use of ultrasound, compared with MRI or contrast-enhanced CT.

- The real-time nature of ultrasound imaging is useful for the evaluation of physiology as well as anatomy (e.g. fetal heart rate).
- Doppler evaluation of organs and vessels adds a dimension of physiologic data, not available on other modalities (with the exception of some MRI sequences).
- Ultrasound images may not be as adversely affected by metallic objects, as opposed to CT or MRI.
- It can easily be extended to cover another organ system or evaluate the contralateral extremity.

DISADVANTAGES OF ULTRASOUND

- Training is required to accurately and efficiently conduct an ultrasound exam and there is nonuniformity in the quality of examinations ("operator dependence").
- ultrasound is not capable of evaluating tissue types with high acoustical impedance (e.g. bone, air). It is also limited in evaluating structures encased in bone (e.g. cerebral parenchyma inside the calvaria).
- the high frequencies of ultrasound result in a potential risk of [thermal heating](#) or [mechanical injury](#) to tissue at a micro level. This is of most concern in fetal imaging.
- ultrasound has its own set of unique artifacts ([US artifacts](#)), which can potentially degrade image quality or lead to misinterpretation.
- some ultrasound exams may be limited by abnormally large body habitus.

Summary:

- We can get images of the body by recording echoes of ultrasound
- Ultrasound is good at imaging soft tissues
- The Doppler effect can be used to detect blood flow