ULTRASOUND PEARLS

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LSUHSC Radiology

7/3/2013

TO: 3rd Year Med Students—

There are a lot of slides here. I wouldn't consider reviewing all these post lecture, to be good use of your time, unless you are just really interested in ultrasound, and you want to get as much info as you can.

I didn't show all these slides.

Thanks, Michael J Morin, MD July 2013

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- To: 1st yr Rad Residents…….
- This an intro, and will focus atttention some on same topics and some on different things than when I give this to 3rd year med students.

Disclaimer

- To: Non 1st year Rad Residents
- I didn't ask you to be here, but someone did-----I'm focusing more on the new residents,
- But…….
- Fundamentals are important. I hope **AND BELIEVE** there will be some useful stuff here for you, but some of it won't be.

Goal is to briefly look at-----

- **A Little on history/ where it going.**
- **WHAT IS ULS GOOD FOR?**
- WHAT IS IT NOT GOOD FOR?
- WHAT ARE SOME ISSUES?

Thoughts?? (1st years only please, and yáll please say something, w/o fear of being right or wrong.)

- What is uls good for??
  - _____
  - _____
  - _____
  - What is it not good for???
  - _____
  - _____
  - _____

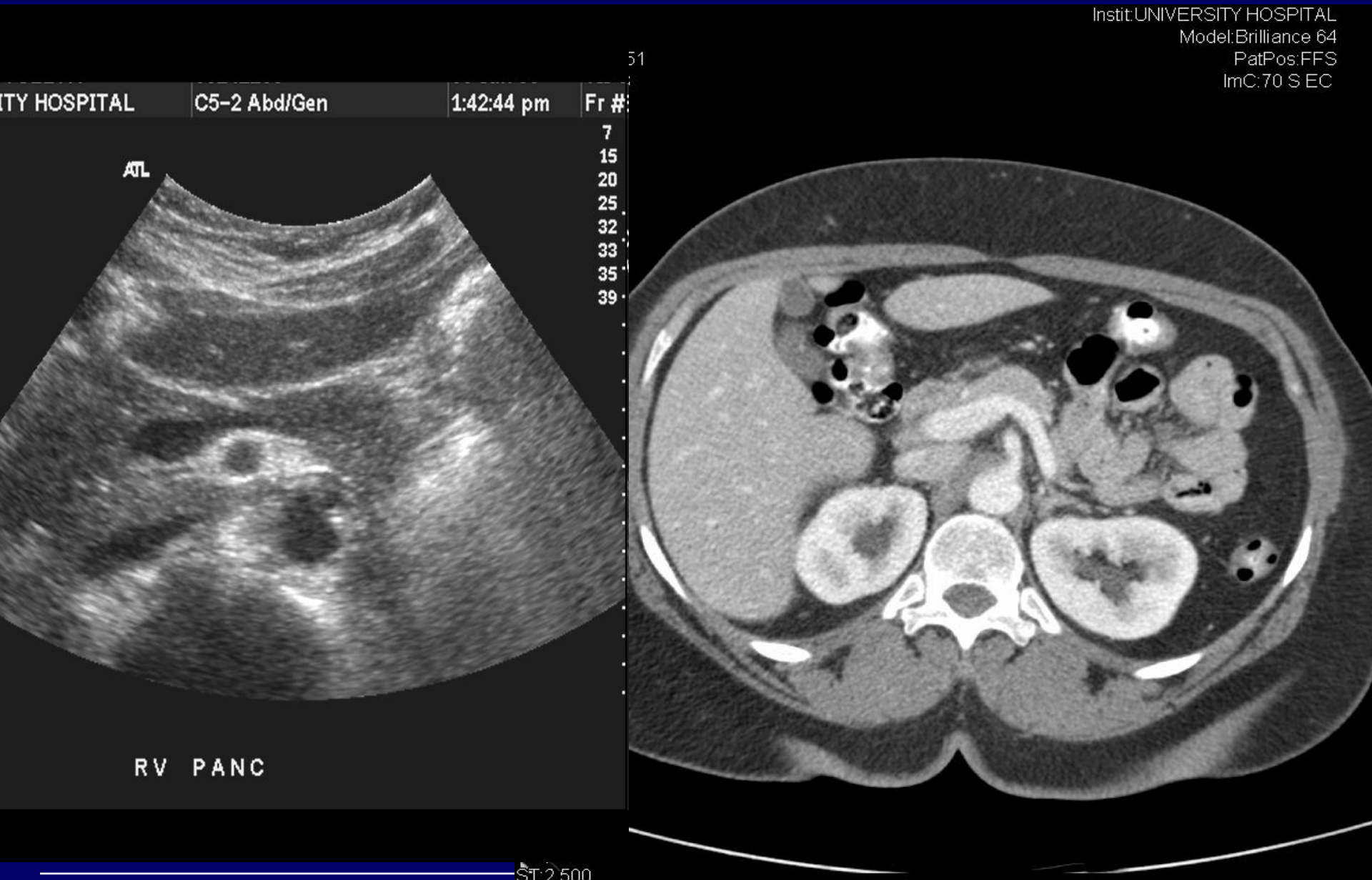
UltraSOUND

Sound waves either --------

- Reflected
- Refracted
- Absorbed
- Scattered
- Transmitted

Ex of uls image


ERSITY HOSPITAL
C5-2 Abd/Gen
1:42:44 pm
Fr #
7
15
20
25
32
33
35
39
ATL
TRV PANC


ITY HOSPITAL
C5-2 Abd/Gen
1:42:44 pm
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Instit:UNIVERSITY HOSPITAL
Model:Brilliance 64
PatPos:FFS
ImC:70 S EC
ST:2.500
AcqDt:5/9/2008
AcqTm:2:53:27 PM
ImC:70 S EC

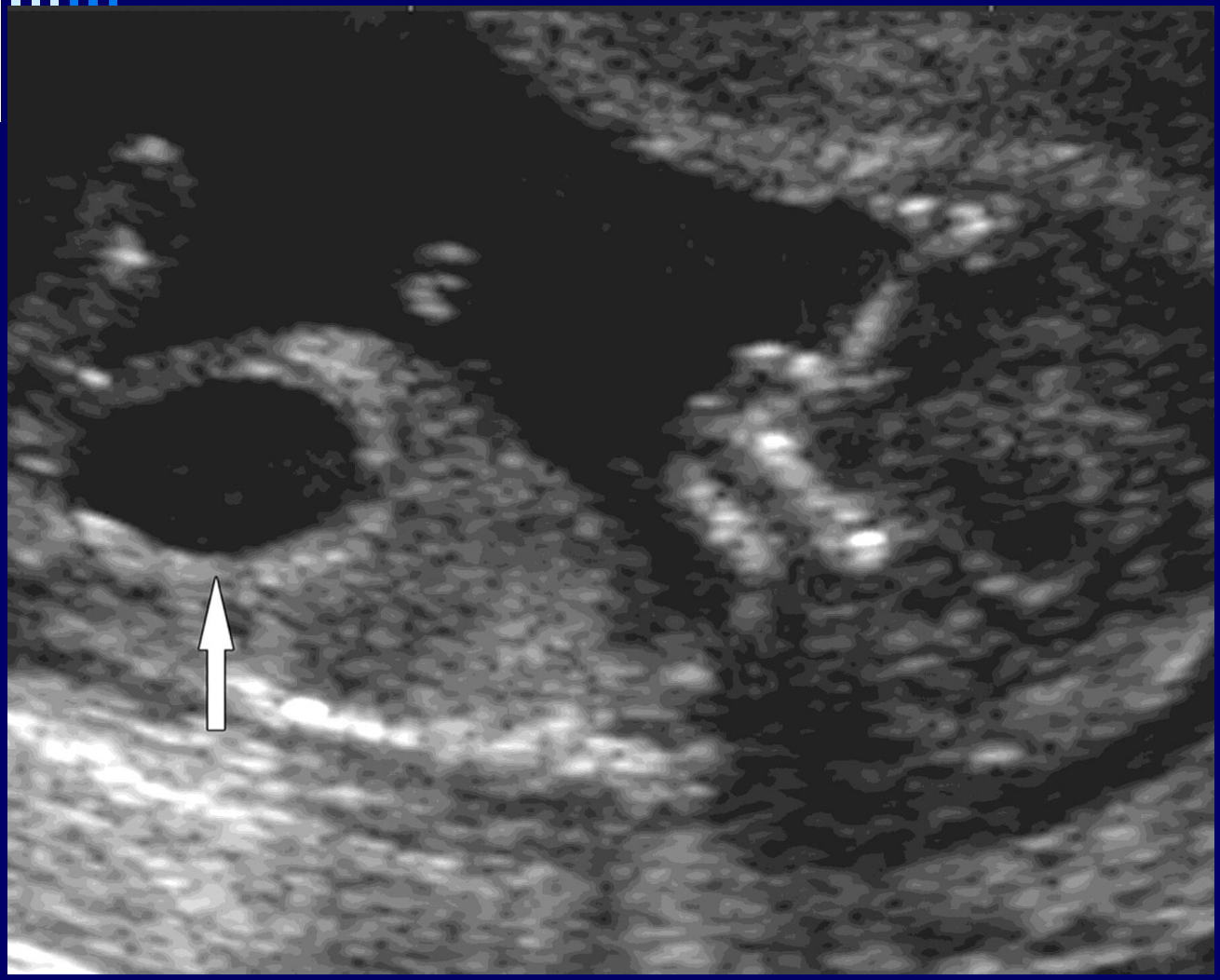
TR ML Panc Stom Liv

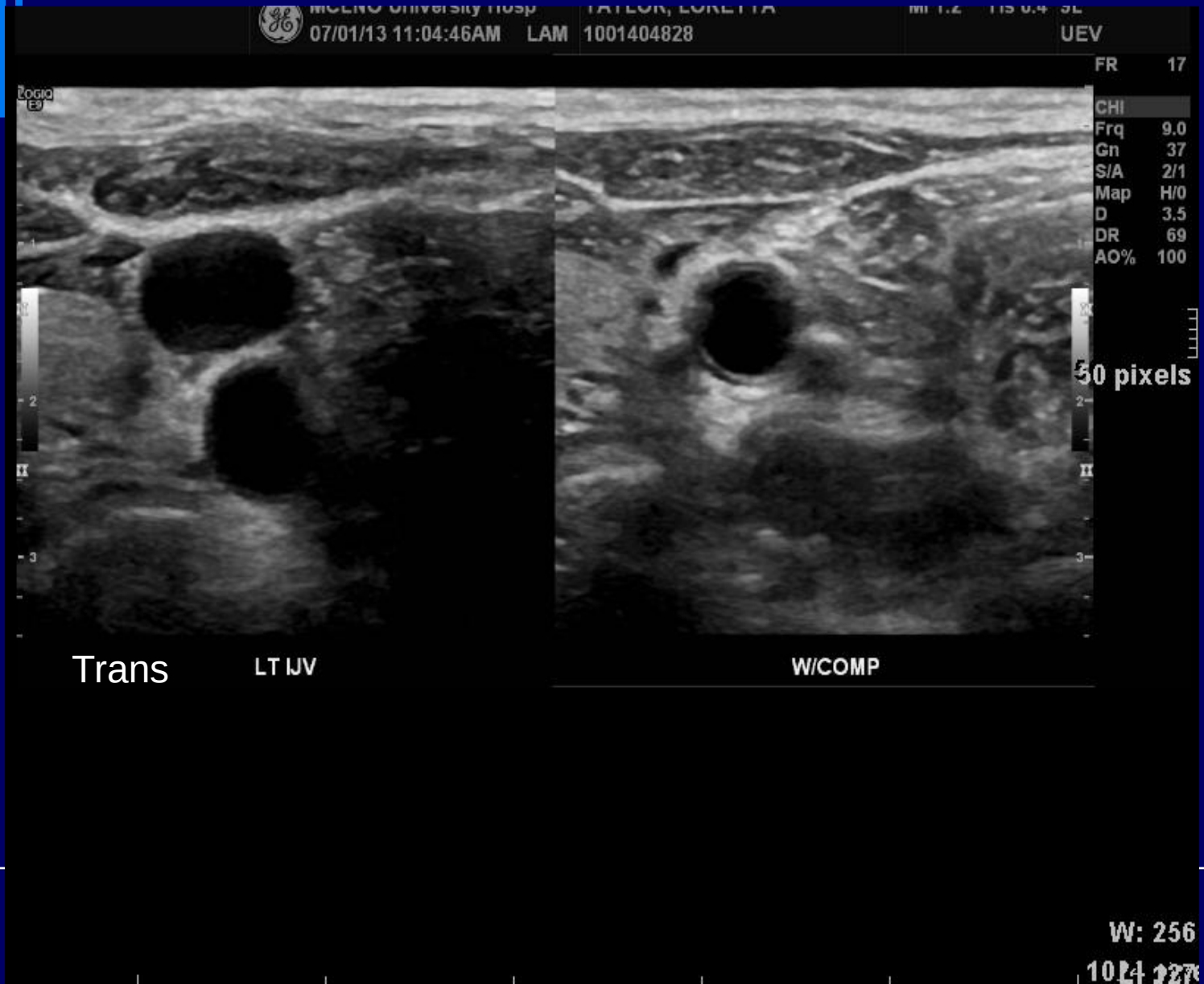
RT
Orientation
What u see
What u don't
why

ULTRASOUND PEARLS

- TRANSVERSE, like CT
- SAGITTAL –top to right, or viewers left
- and now also for exception for Musculo Skeletal uls --label short axis / long axis of tendon.)


5000
MCLNO UNIVERSITY HOSPIT
P4-2 Abd/Gen
7:44:53 pm
Fr #21
ATL
Map 3
170dB/C 3
Persist Med R U Q
2D Opt:HRes
Fr Rate:Max
0
5
10
15
SAG RT LIVER




07/01/13 11:04:46AM LAM 1001404828
UEV
FR 17
CHI
Frq 9.0
Gn 37
S/A 2/1
Map H/0
D 3.5
DR 69
AO% 100
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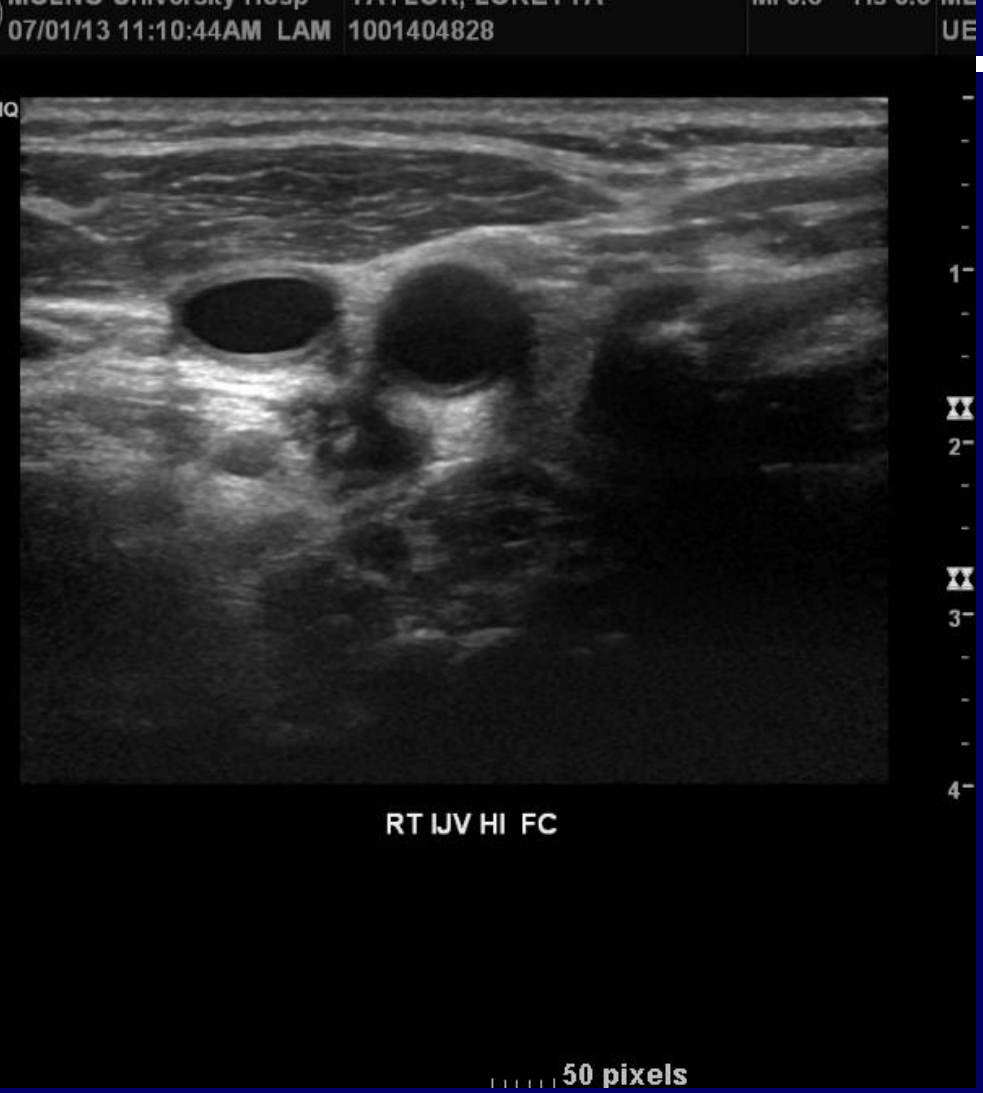
Trans
LT IJV
W/COMP
W: 256


07/01/13 11:10:44AM LAM 1001404828
RT IJV HI FC
50 pixels


07/01/13 11:09:36AM LAM 1001404828
RT IJV


07/01/13 11:10:00AM LAM 1001404828
LOGIQ E9
cm/s
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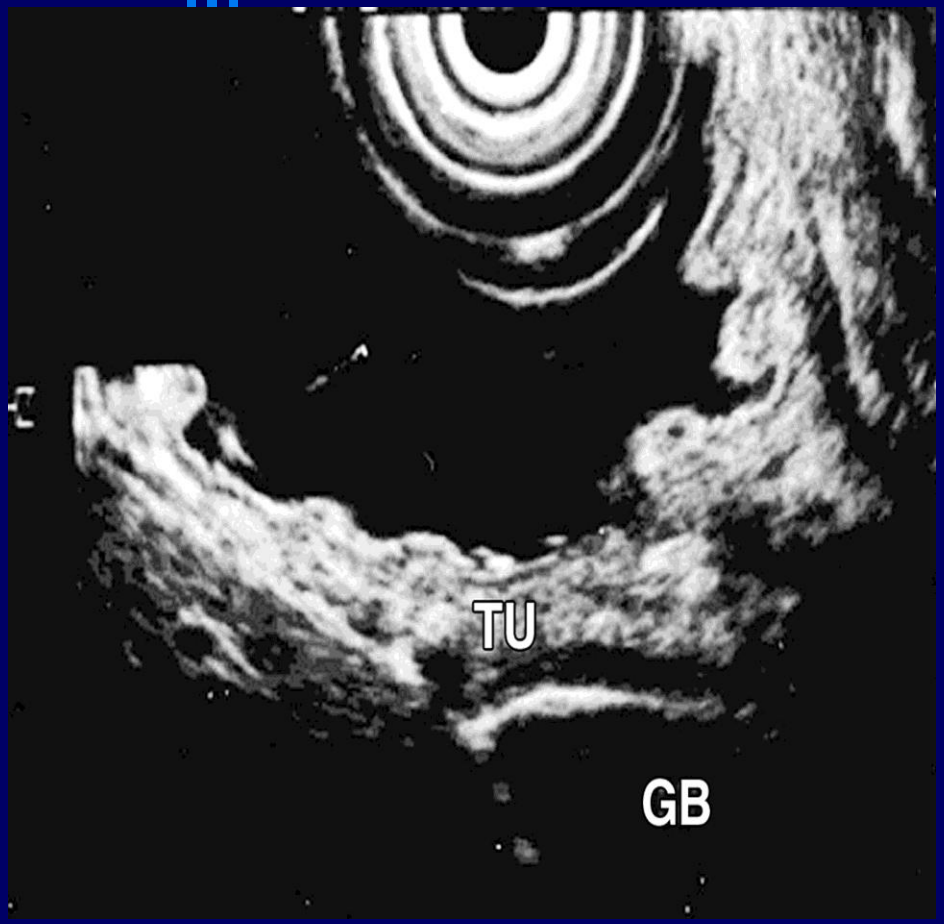
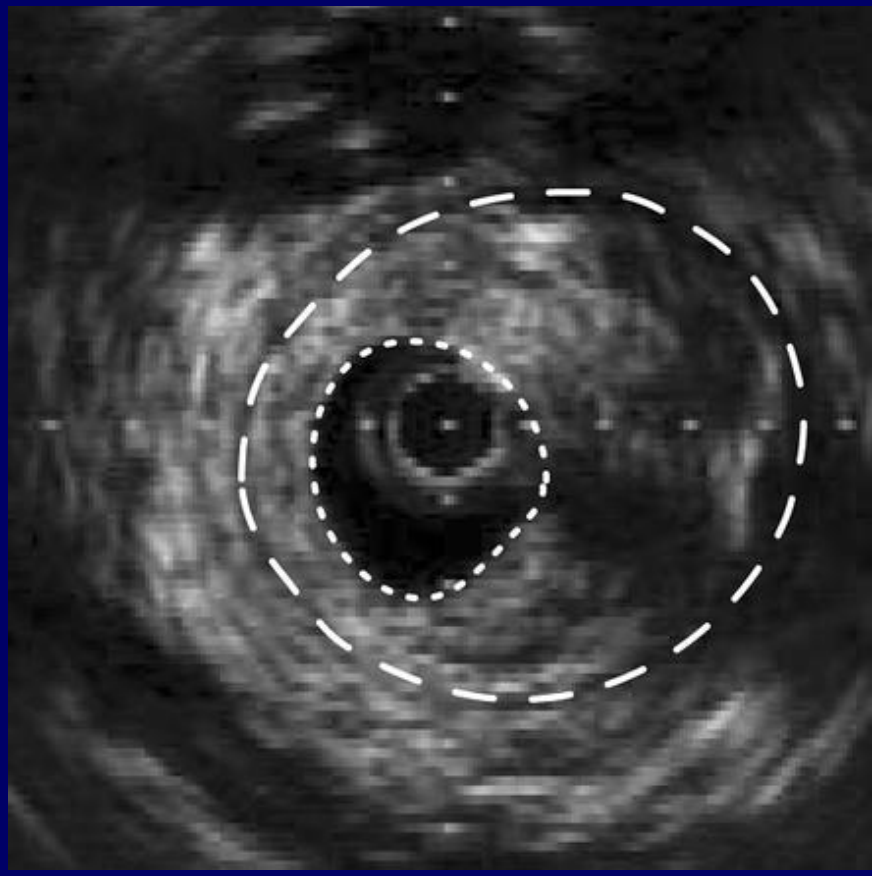
ULTRASOUND PEARLS

- FLUID = FRIEND
- AIR = ENEMY
- TISSUE = OK –the smoother the better.
- CALCIUM = see to but not thru



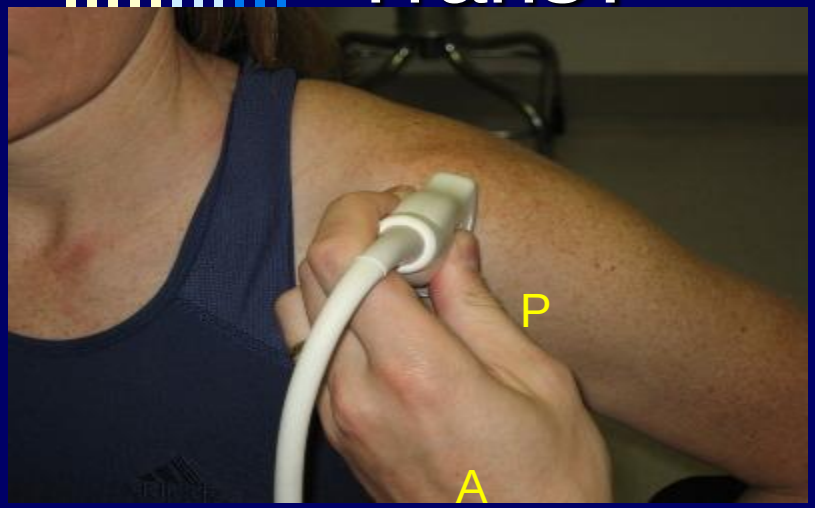


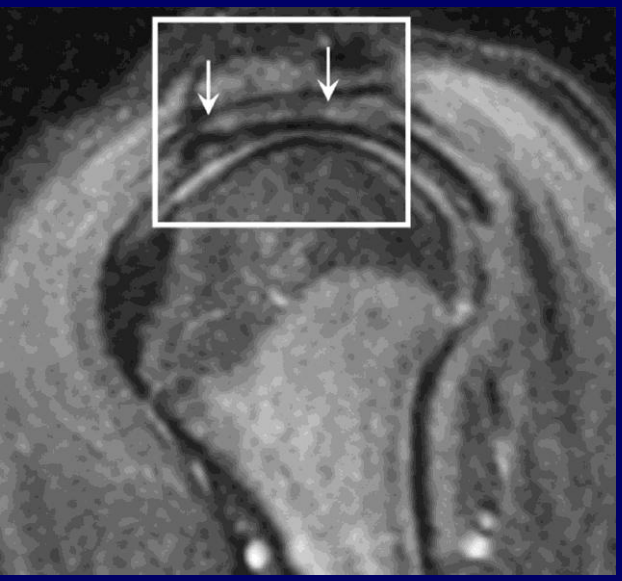
Endoscopic uls of stomach
(Fill stomach with fluid)

IVUS/ endoscopic uls of an
atheromatous artery w/ plaque

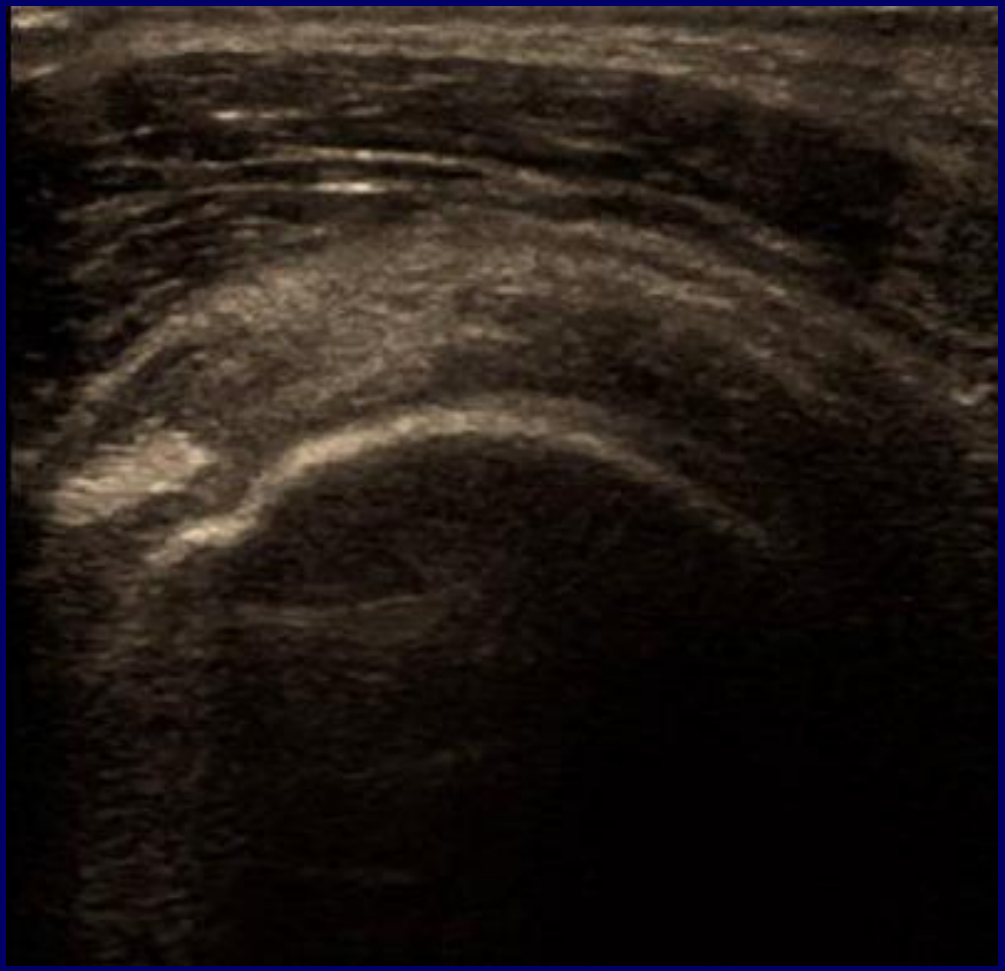
Needle Uls guided bx – hepatoma.

Trans?





This would be SAG by MRI



Sag ish Lt / short axis ok, at times they call trans, but its not really trans by gen uls,

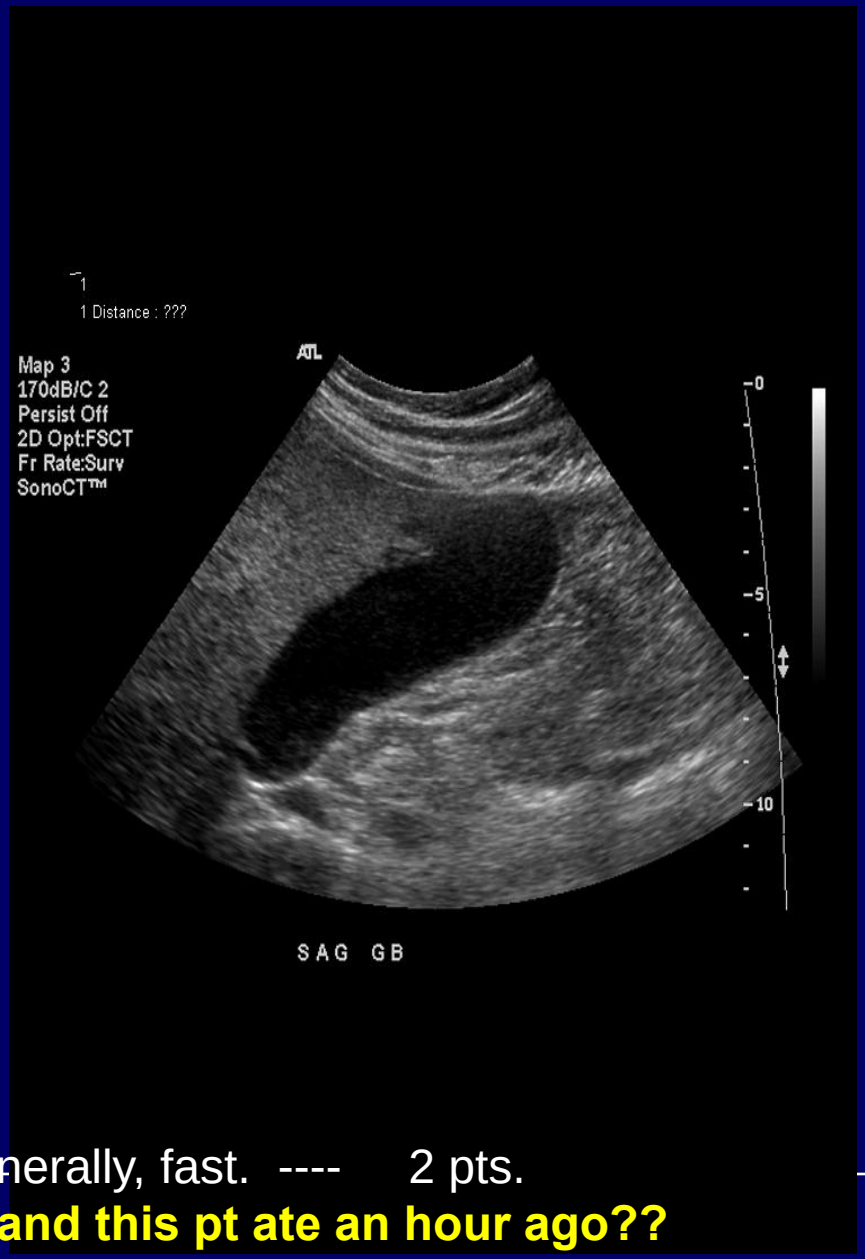
But is trans / short axis of RCT/ SST.

Where ant? A LHbiceps P

Where ant goes on a sag image not as classical w uls, or plain xrays

- THIS **IS NOT** A TALK TO GIVE MASSIVE DETAIL ON THE PHYSICS OF HOW AN ULTRASOUND IMAGE IS OBTAINED

TM 908



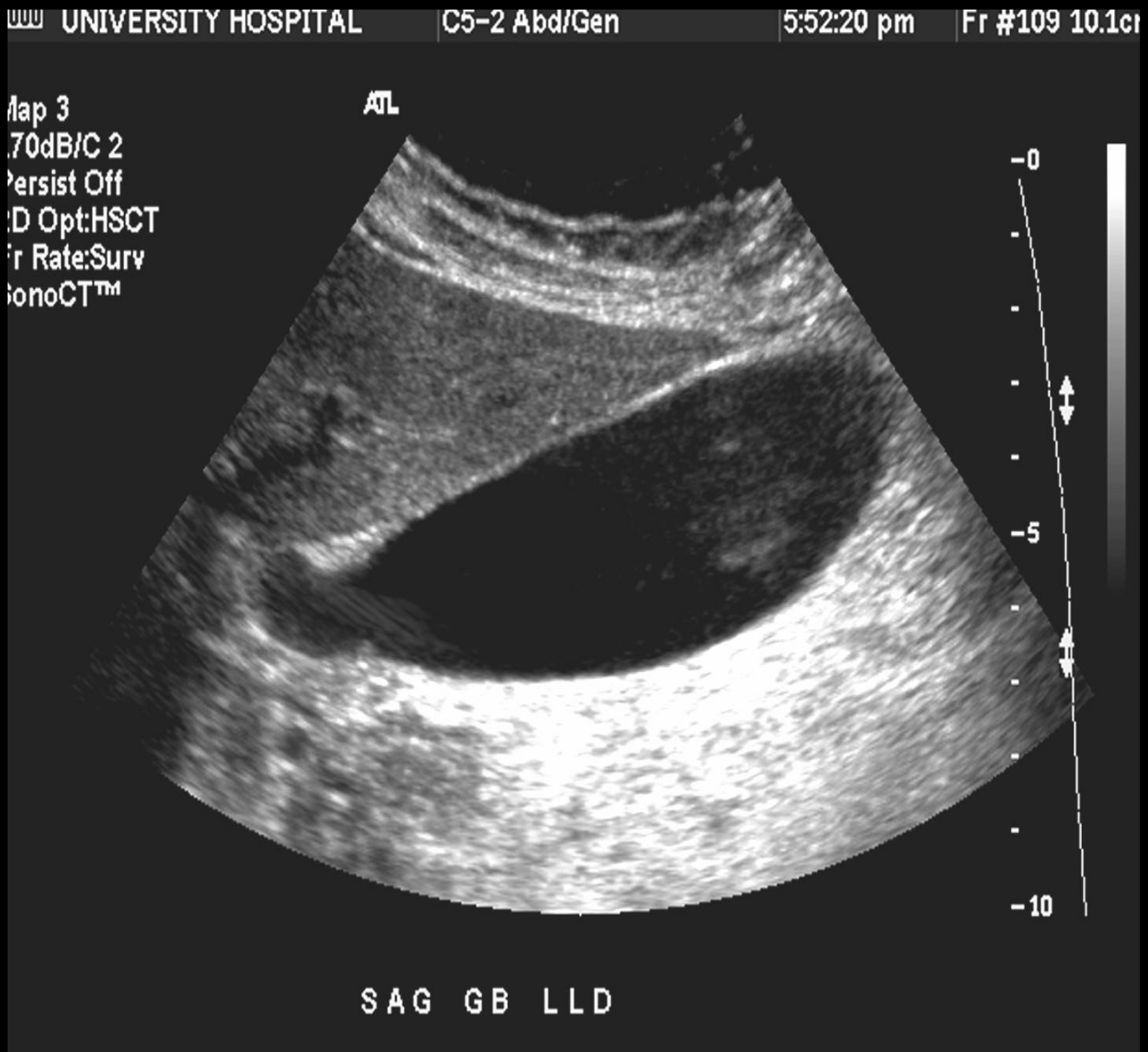
YOU need to know fasting status! Generally, fast. ---- 2 pts.

What if this pt fasting ……and this pt ate an hour ago??

Making an image ---Reflection vs Scatter

- When sound reflected, there is non specular and specular reflection
- SPECULAR= from smoother surfaces and much returns to trans / to make an image

- NON SPECULAR= from rough surfaces and little back to transducer……so more like scatter, I'd say.
- When uls wave encounters objects smaller than its wavelength— leads to scatter
- P 164 - 5 HUDA



Why is gallbladder black?
Why is it bright behind gallbladder?
Why are there some scattered echo's in gallbladder?

Refraction example.
Is the pole really bent?
Of course not

Sound Frequencies measured in Hertz

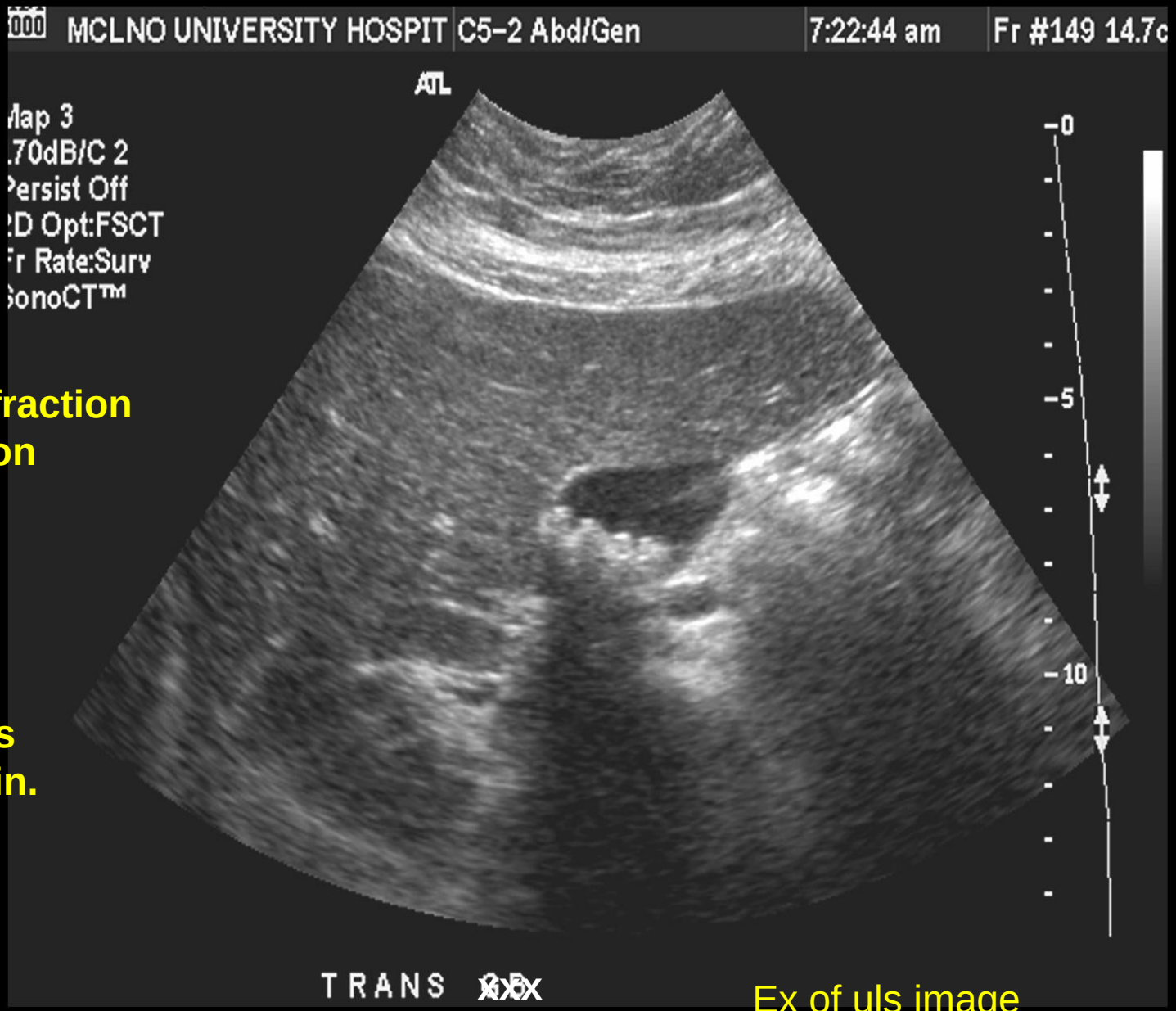
Velocity (in substance) = Freq x wavelength.

- Freq = oscillations in ea second
- 1 Hz = 1 oscillation / sec
- Audible sound = 15 Hz to 20,000 Hz, or 20kHz
- 20 kHz = 0.020 MHz
- Diagnostic ULS = 1 – 20 MHz

- ULS freq higher than audible sound.
- Penetration of uls much more limited than audible sound.
- Penetration of HIGH FREQ uls much more limited than LOW FREQ uls.

Reflection
(A little) Refraction
Transmission
Absorption
Scatter
ALL HERE

Where?
Upper levels
Can chime in.



Ex of uls image
Good forFLUID

Diagnostic ULS = 1 – 20 MHz

- Different transducers scan at different level of MHz, and thus scan differently.
- *Hi Freq= 7 - 20 MHz = help image what is close up but little depth.
- *Low Freq= 2 - 5 MHz = good to image deeper structures, but not as detailed as Hi Freq

Sound Velocities

- Air= 330 m/ sec
- Fat= 1450 m/ sec
- Fluid=1480 m/ sec
- Soft tissue= 1540 m/ sec
- Bone = 3300 m/ sec
- Fat slow / Fluid / Tissue (alphabetically speed of transit)
- Velocity = Freq (MHz) x wavelength

Uls - What is happening?

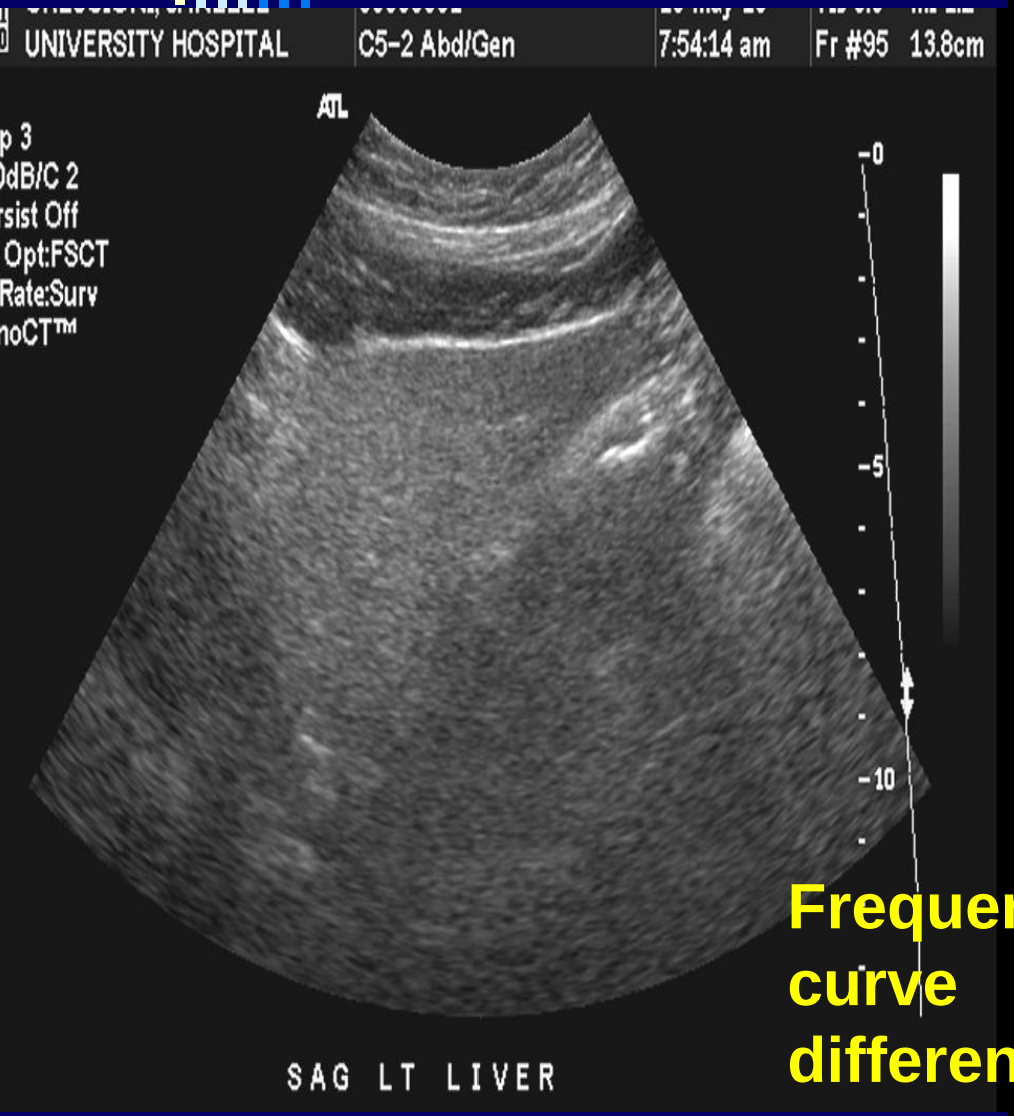
An ultrasound image.
Where are we?
Low freq or Hi freq probe? What do we see? How is image made?

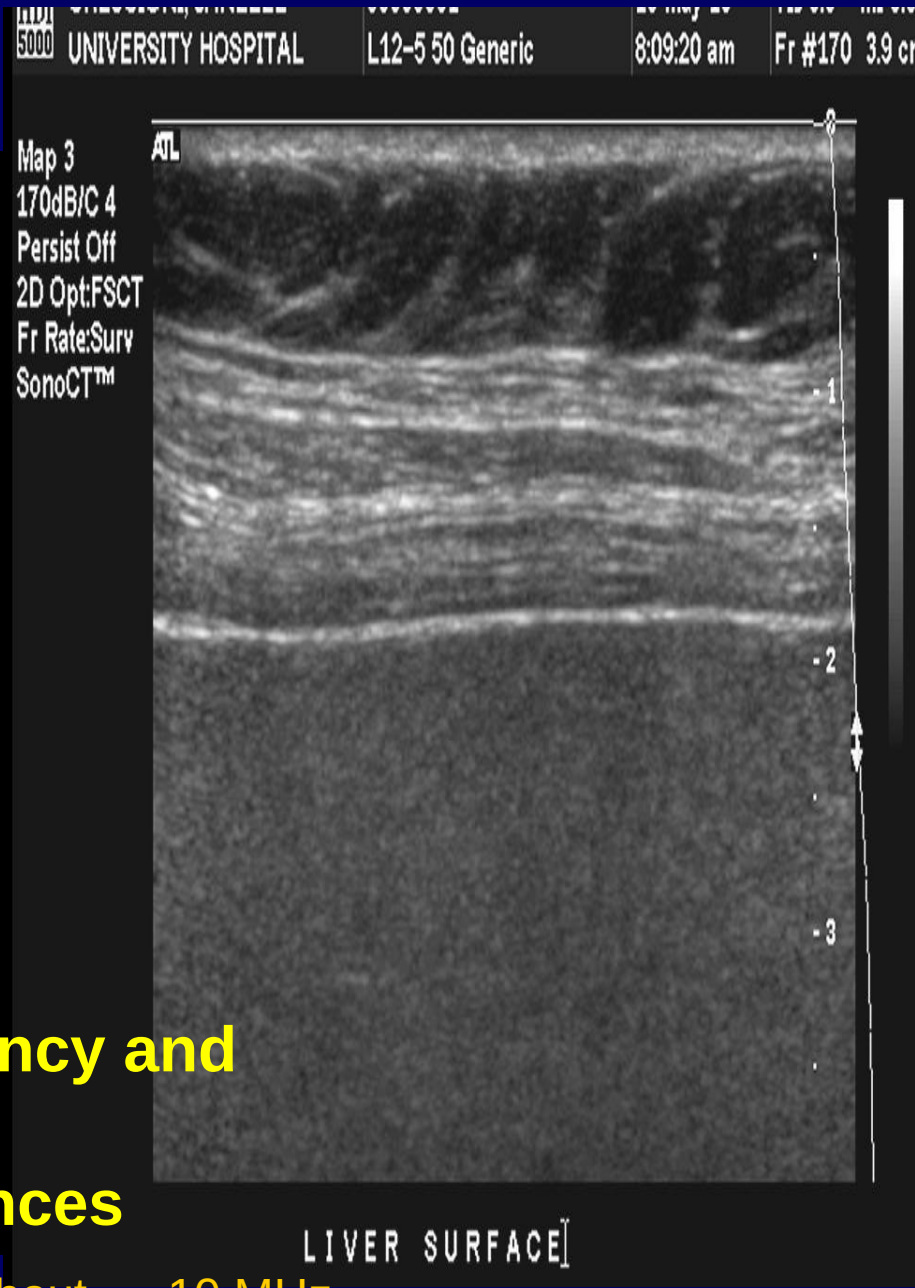
Low freq probe/ nl abd probe

Hi Freq probe/ nl Endo vag probe

ULTRASOUND PEARLS

- **STD TRANSDUCERS**
- --CURVED ---3-5 MHZ / Std Abd and pelvis work
- --LINEAR --- 5-9 MHz / deep vascular work / thigh arteries / veins.
- **HIGHER FREQ TRANSDUCERS**
- --MORE LINEAR BUT SOME CURVED
- -- 6-18 MHZ
- --FOR SMALL / SUPERFICIAL PARTS, like breast, thyroid, scrotum, carotid/ jugular.





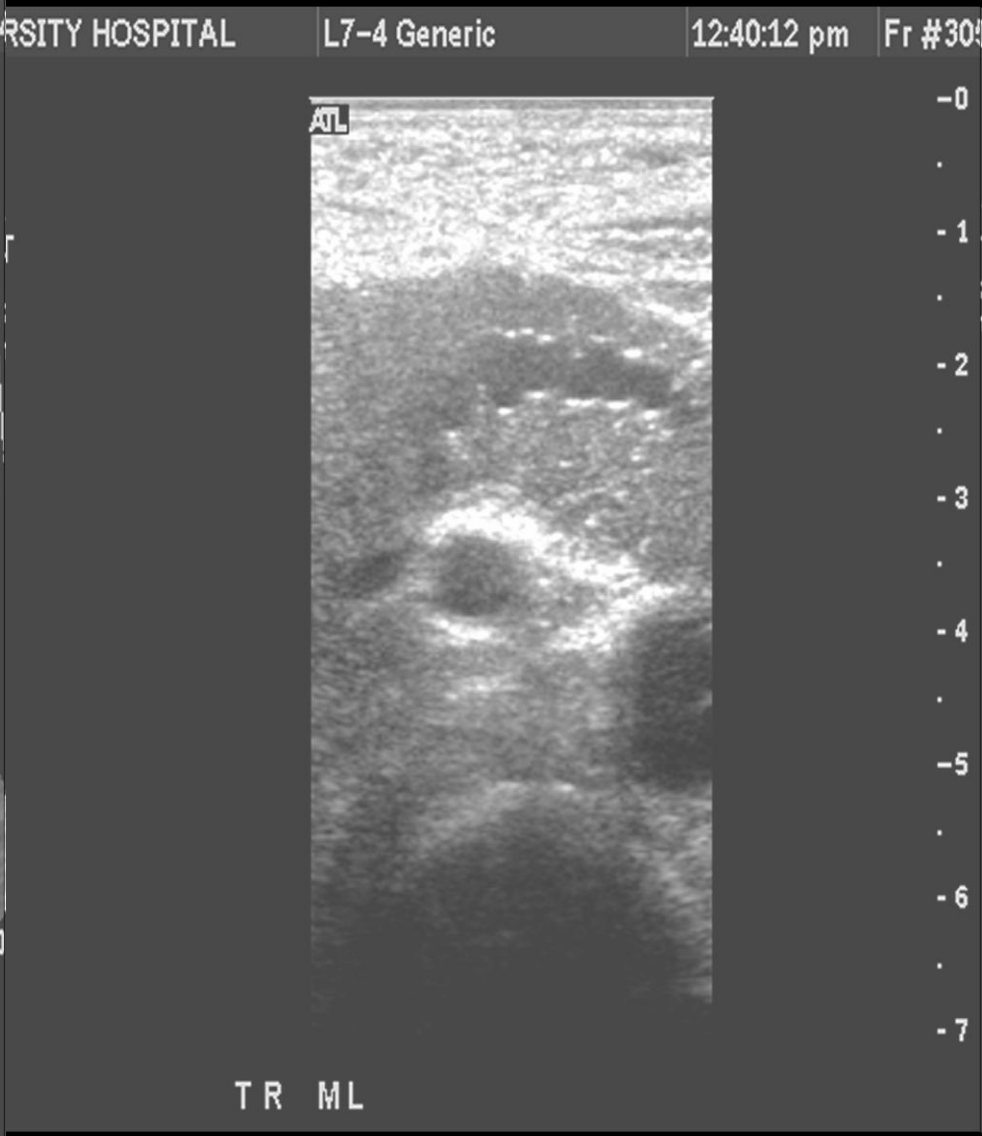
Frequency and curve differences

About 3.5 MHz

about 10 MHz

This med res, TR ML

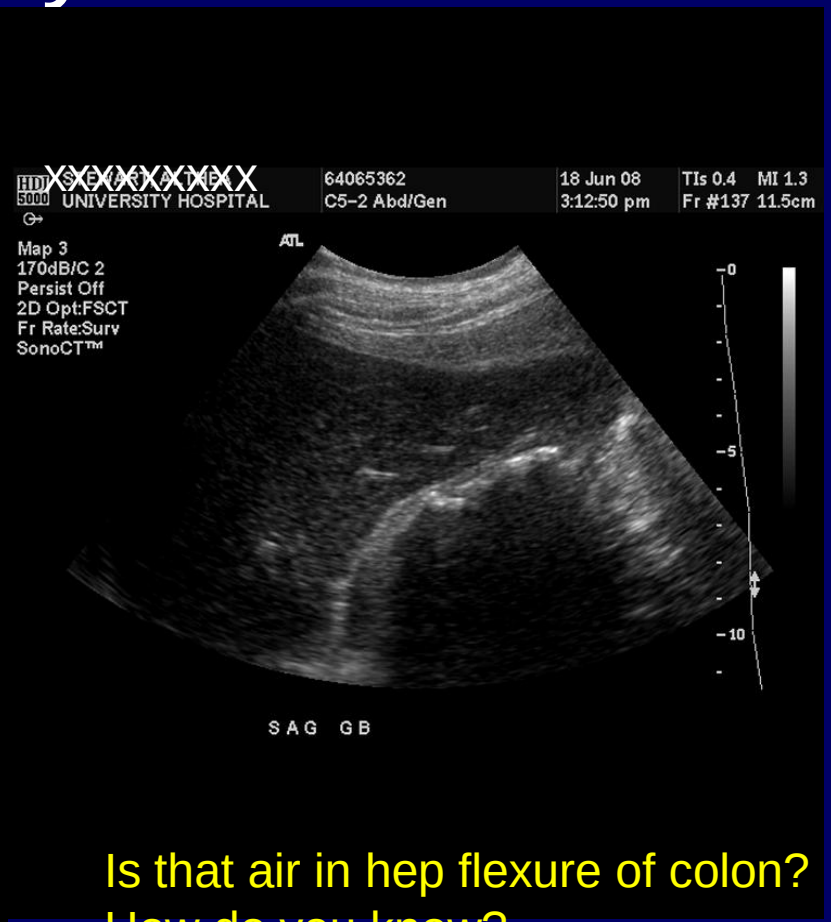
Panc head mass and duct obst.
This mid panc hi res.



- ULS --- FLUID TRANSMITS—ULS LIKES FLUID…….and smooth soft tissues (pretty good transmitters/ not too much scatter).
- AIR reflects and scatters==so it is NOT GOOD FOR ULS --to uls like kryptonite to Superman
- Calcium—reflects and absorbs
  –CAN SEE IT'S PRESENTING PART, SEE TO IT, not thru it!

So what this an image of??

Sag GB's -- 2 Patients, stones but not as easy as last slide



Is that air in hep flexure of colon?
How do you know?
WES visible here.


HDI 5000
XXXXXXXXXXXXXXX
UNIVERSITY HOSPITAL
64065362
C5-2 Abd/Gen
18 Jun 08
3:12:50 pm
TIs 0.4 MI 1.3
Fr #137 11.5cm
Map 3
170dB/C 2
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT™
ATL
0
5
10
wes
SAG GB

- Do ALL Gallstones shadow?
- (you know that answer just from test taking skills you possess.)
- Upper levels---which ones don’t shadow?

- Spatial Compounding (SonoCT)
- XRES
- Harmonics
- These used to help image smoothness and detail, but can limit shadowing or thru transmission.
- Becoming less important as transducers improve and as you get into HIGH Freq transducers.


06/20/13 02:51:10PM TWT 1001203386
08w5d:LMP
OB-1
FR 33
LOGIQ E9
CHI
Frq 8.0
Gn 27
S/A 1/3
Map F/0
D 6.0
DR 69
AO% 95
50 pixels
1 CRL 1.86 cm 8w3d
50 pixels
W: 256
L: 127


06/20/13 02:36:08PM TWT 1001203386
08w5d:LMP
OB-1
CHI
Frq 7.0
Gn 37
S/A 1/0
Map F/1
DR 69
AO% 95
Vol
BQ Hi1
A 60
VR 0.0
50 pixels
50 pixels
W: 256
L: 127

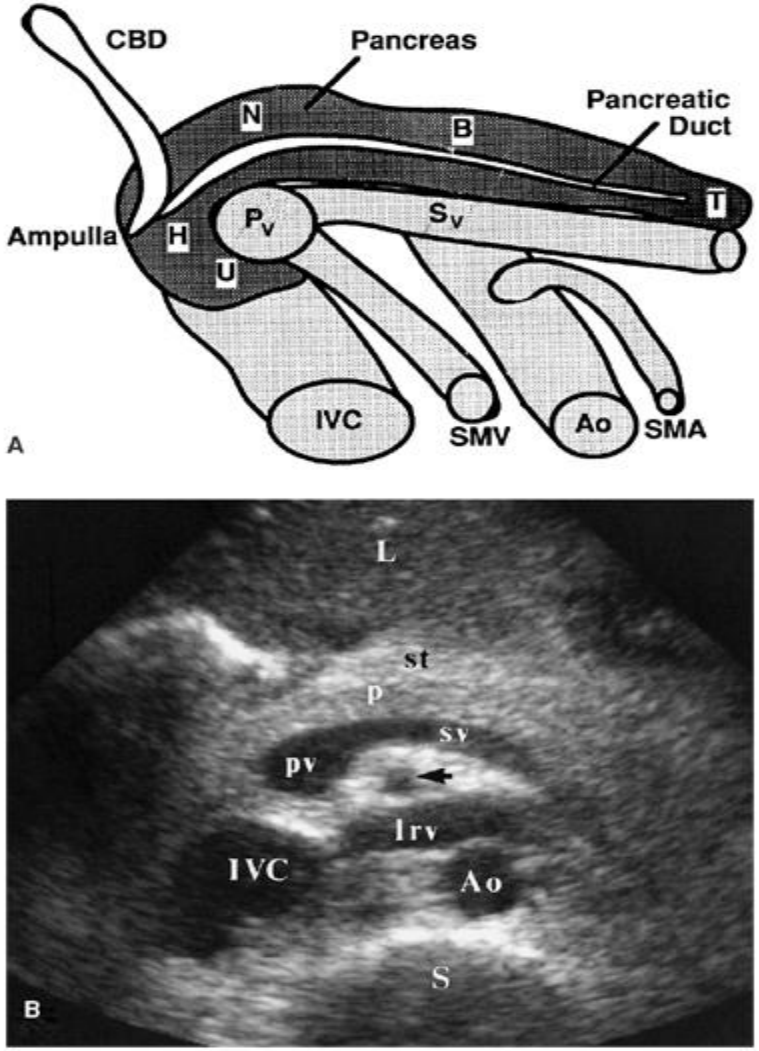


FIGURE 36.30. **Normal Pancreas Anatomy.** A diagram **(A)** and an US in transverse plane **(B)** demonstrate the normal US anatomy of the pancreas. The majority of the pancreas lies anterior to the splenic vein (sv) and its junction with the superior mesenteric vein (SMV), which forms the portal vein (pv). The head (H) and uncinate process (U) of the pancreas cradle the origin of the portal vein. The pancreatic neck (N) is anterior to the sv-SMV confluence, and the uncinate process and inferior vena cava (IVC) are posterior to the confluence. The superior mesenteric artery (SMA, *arrow*) arises from the aorta (Ao) dorsal to the splenic vein. The left renal vein (lrv) passes between the SMA and aorta to the IVC. The left lobe of the liver (L) offers a good sonographic window to the pancreas. The stomach (st) and lesser sac (collapsed) are anterior to the pancreas. CBD, common bile duct; S, spine; B, body of the pancreas; T, tail of the pancreas; p, pancreas.

They don't come labeled
Like this

IN UTERO Fetal brain

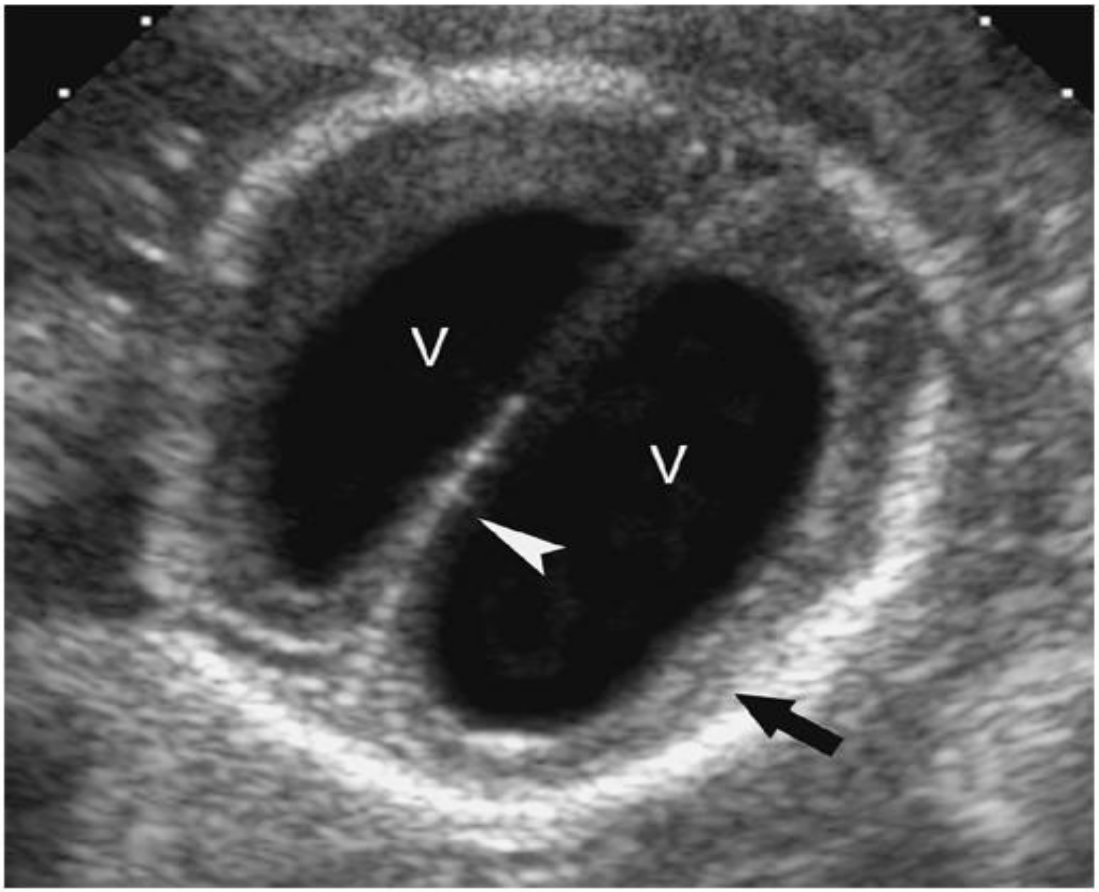
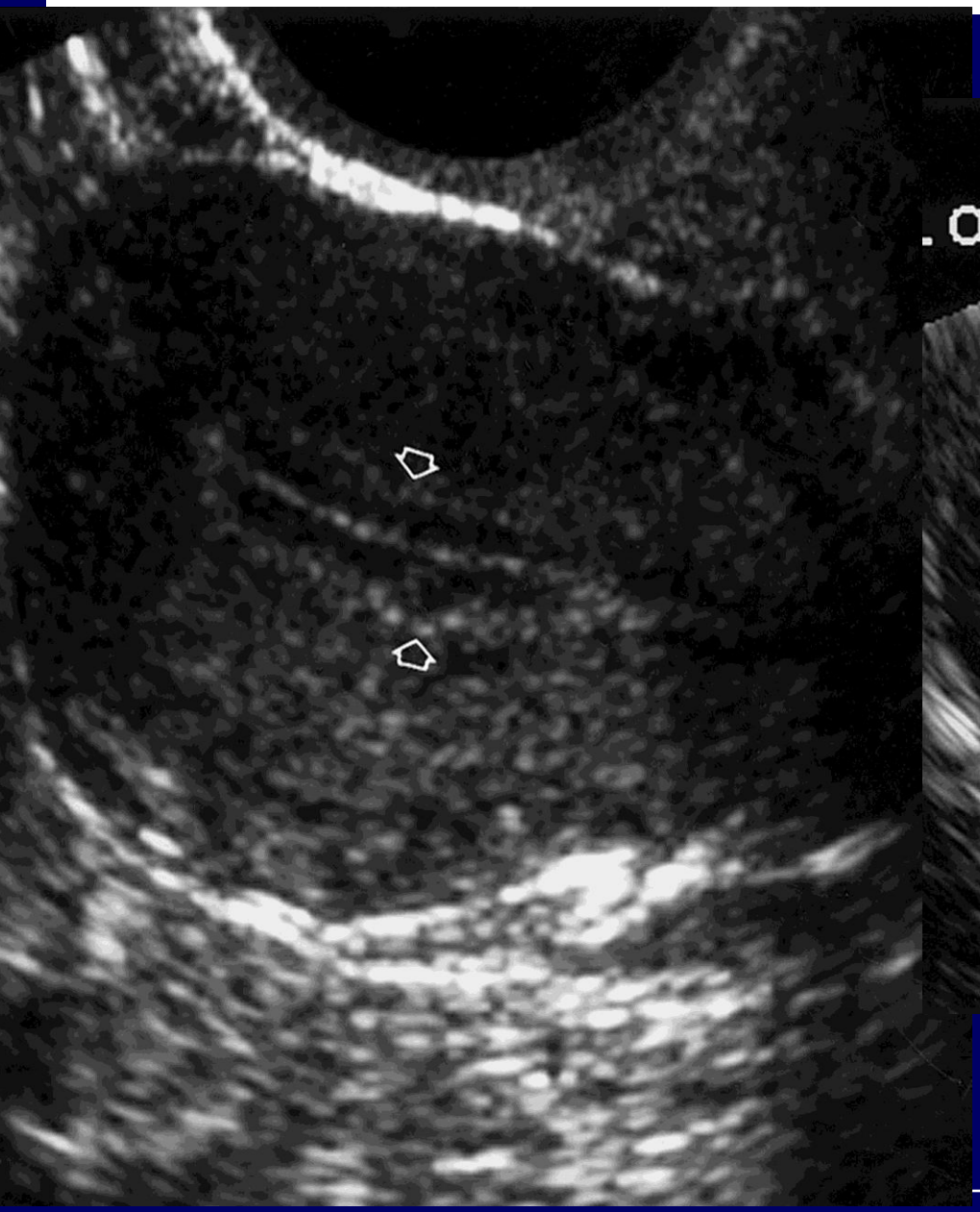
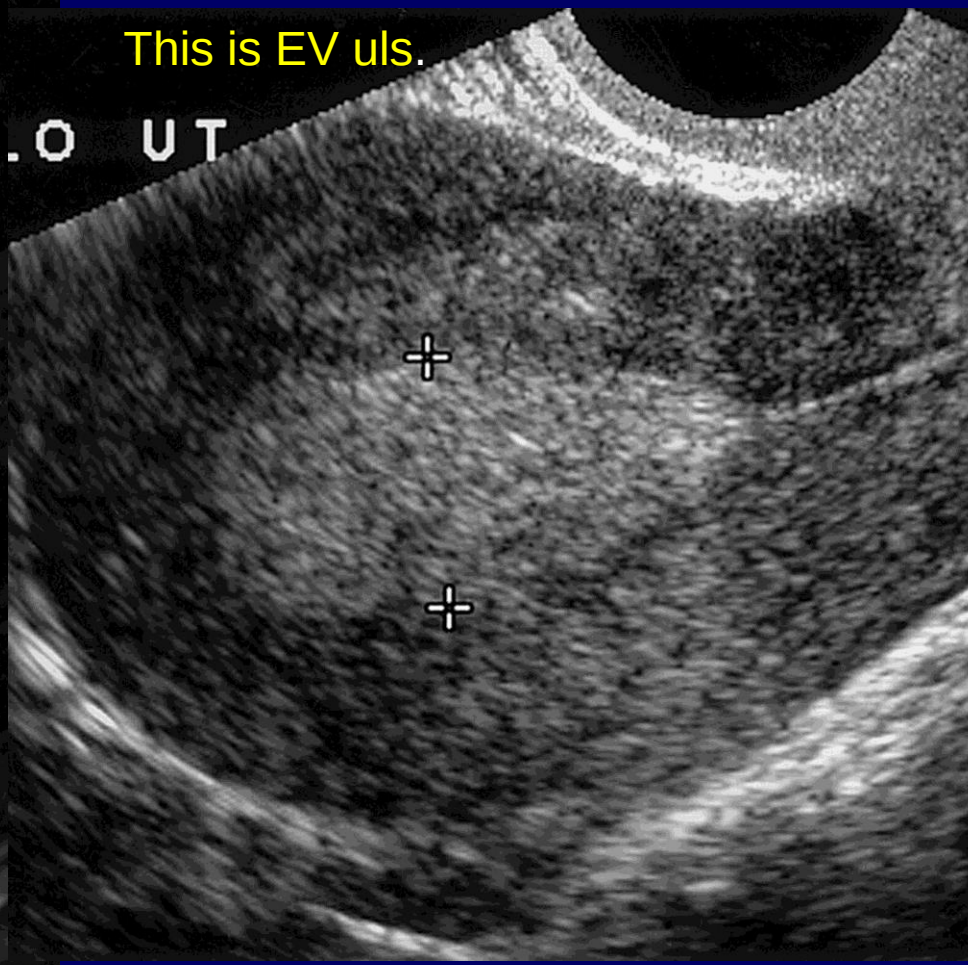


FIGURE 38.25. **Ventriculomegaly.** An axial image of the fetal brain in fetus with aqueduct stenosis demonstrates marked enlargement of the lateral ventricles (V). The falx (*arrowhead*) is seen as an echogenic stripe in the midline. A rind of cortex (*arrow*) is present. These latter two findings differentiate ventriculomegaly from hydranencephaly and holoprosencephaly.





Which phase you want to scan in?
Does it matter?

2 Uterus' --Nl late prolif, or periovularory, / and late post ov / secretory premeno


VOLUSON 730 EXPERT


RAB 4-8PIObstetric
3.4/9.2cm/2Hz
17.02.2004
16:40:54

Ultrasound discovered ? 2

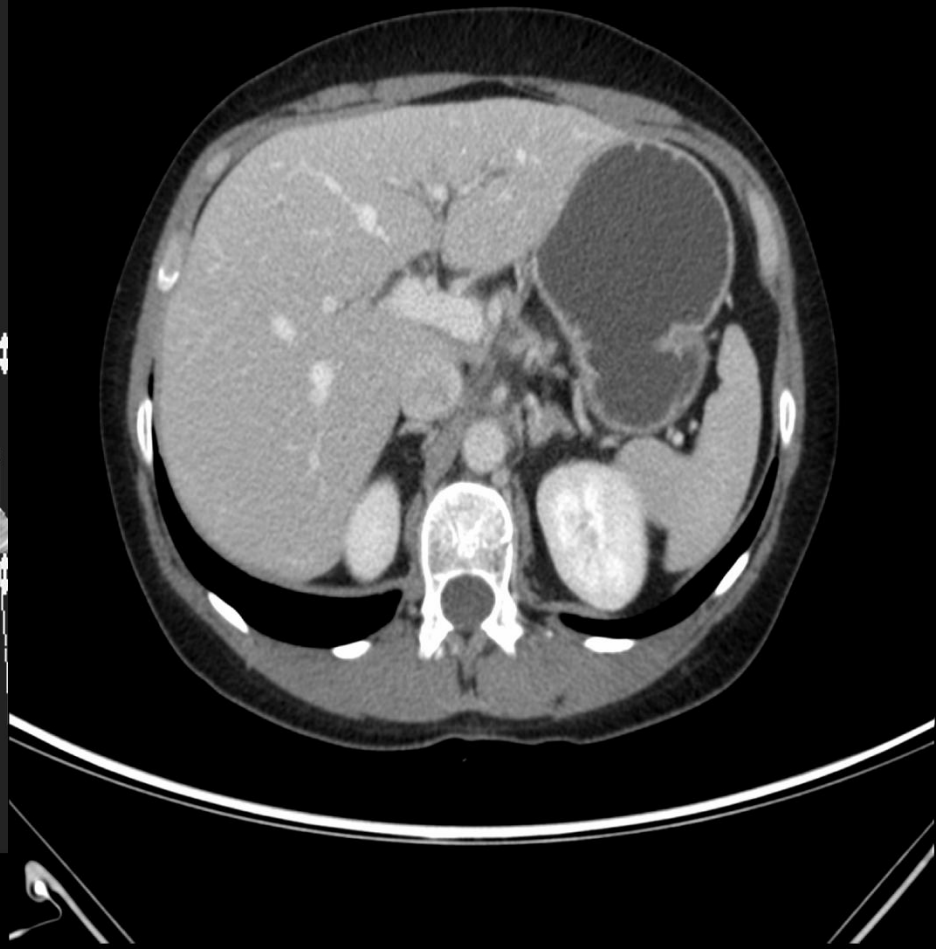
- In 1953, **Inge Edler** was in charge of the **Cardiology Department** at the **University Hospital, Lund, Sweden** and was in the position responsible for the preoperative diagnosis of heart disease. At that time, cardiac catheterization and contrast x-rays of the heart failed to give enough data for a correct appraisal of the status of the mitral valve. Since a correct diagnosis is of great importance before an operation, Edler felt strongly that the inadequacy of the existing methods. This concern caused him to look for a new non-invasive alternative which he thought might resemble some kind of a radar.

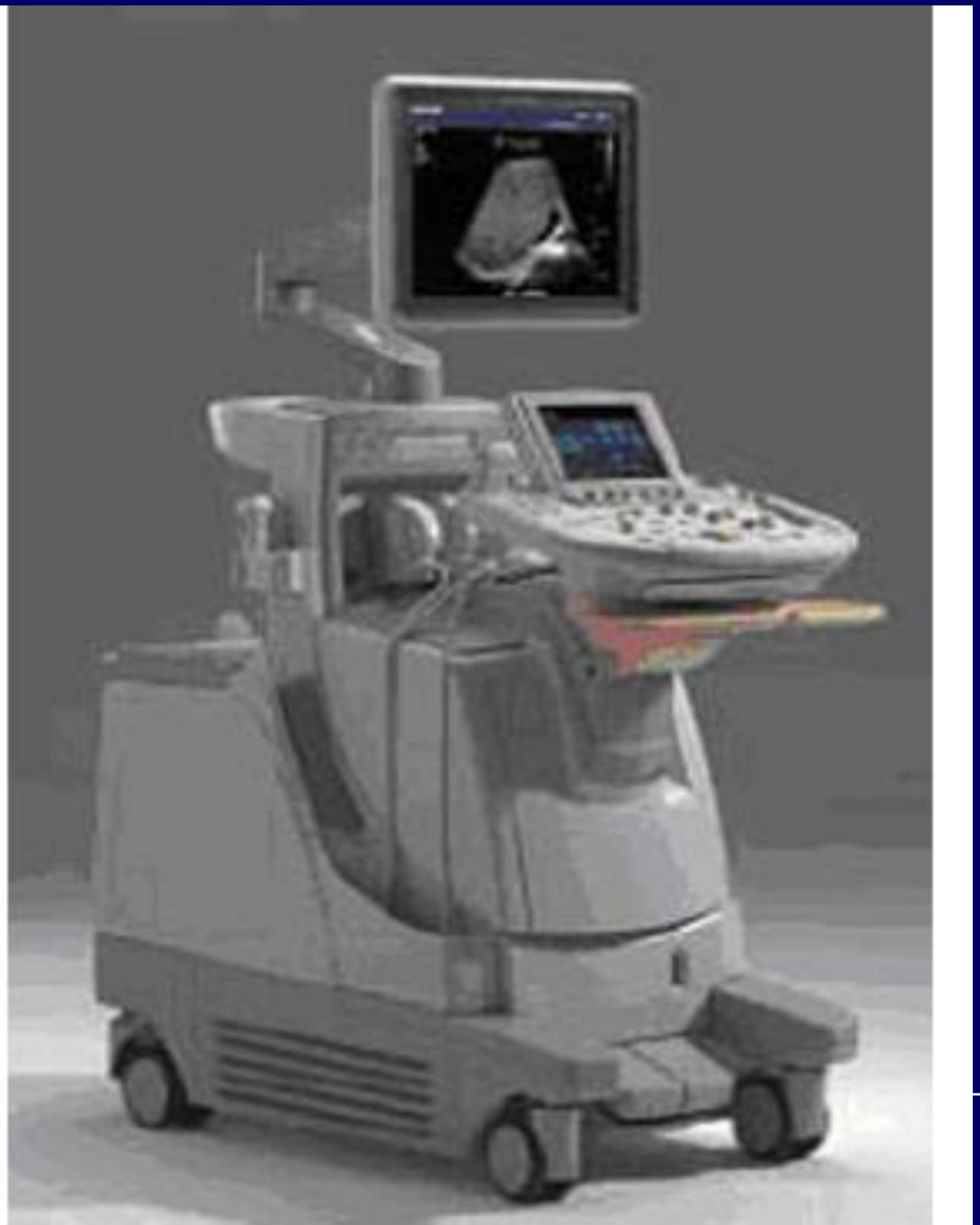
Ultrasound – discovered?

- **"Taking Pictures with Sound"** Article appeared in Science, page 10, December 9, 1957.
- Xray pictures with sound waves? Argonne National Laboratory is demonstrating it can be done, though the "pictures" aren't yet of standard quality. **W.N. Beck** of Argonne's Metallurgy Division pioneered the technique when he needed ultrasonic inspection of reactor fuel elements to detect discontinuities in the bond between the fuel and its cladding. Then he turned the device on himself and showed that a usable "X-ray" of the hand could be made.

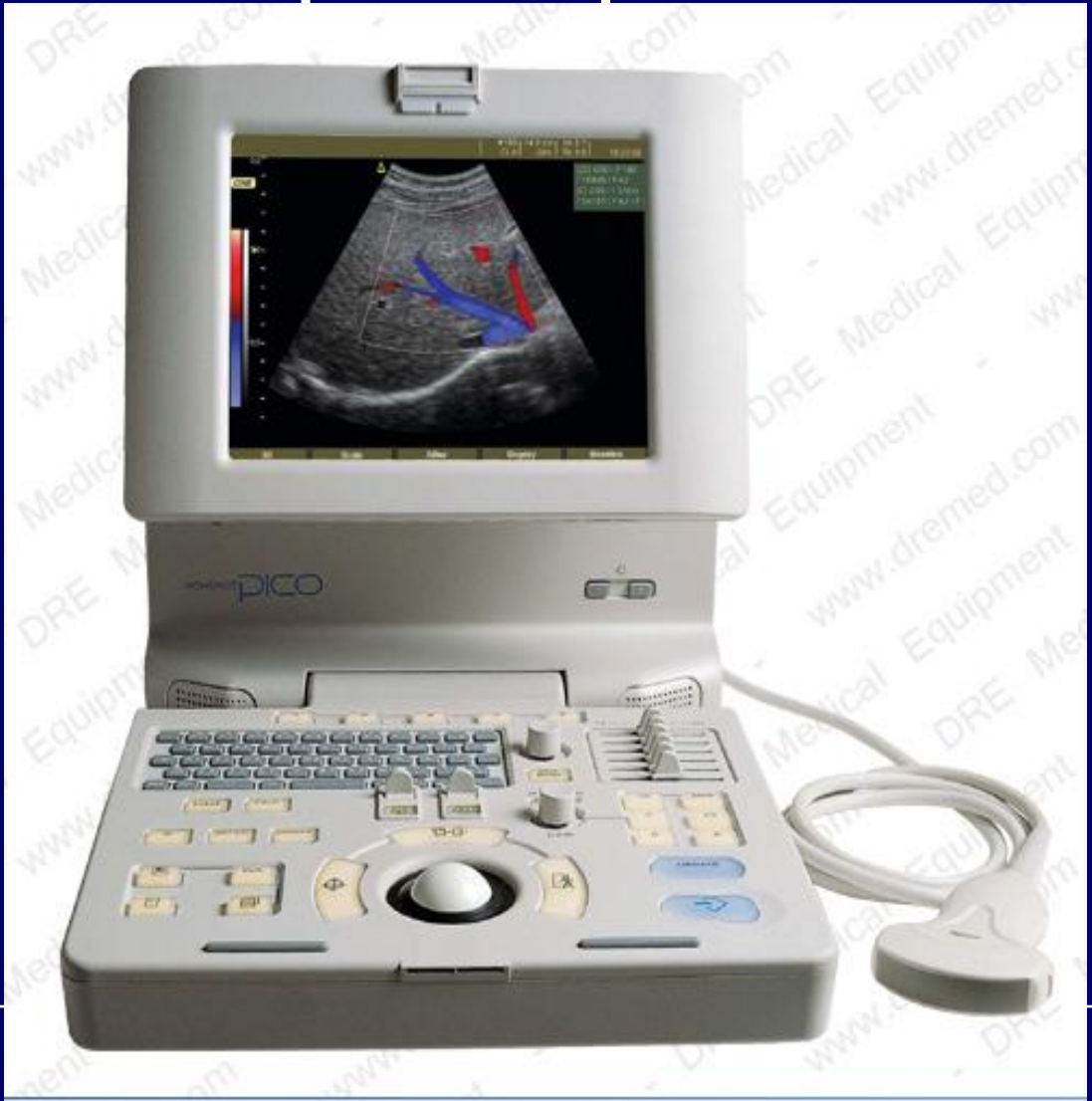
- SENDING AND RECEIVING ---Standard ultrasonic equipment is used, with two crystals - one to transmit, one to receive the vibrations. When one scanner encounters a flaw in the fuel element (or a bone in the hand), reception is interupted and a white space appears on the electrosensitive recording sheet…

Uls and ct (diff pt's) 9909
This an uls image.
Know your anat.





Desk top size port uls



Portable uls

All these uls instruments do not have the same capabilities…like cars, computers, etc.

Some larger, with more transducers,

And higher res.

Some smaller, with good res /not so good res,

SOME HAVE 1 or few transducers.

Some expensive / $200k

(CT's maybe $1 -1.5 mill)

Some cheap / $10k-$20k

SO what about hearing this??

- "We have an ultrasound unit in our department (or clinic office)"
- (Just as variable as "We have a car in our garage")
- What kind? How old? Performances will differ mucho, on these.

Where is ULS happening now?

- Many tryin to be involved with uls now.
- Old days/ my training days, was Radiology, and some Cardiology for ECHO, and ObGyn for babies.
- Nowadays …….limited uls done in ER by ER, some places. ICU MD's. ENT. Endocrine. Phys Med / Ortho / Rheum., Surgery (intraop uls / placement of central lines). GU / prostate.
- Surgery, GI, Pulm / some endoscopic uls.
- --some places / nurses using to help start IV lines.

- -- almost everybody tryin to use it a little, to some degree.
- Many Residency and Fellowship BOARDS tryin to mandate it as part of their training needs. Why?

Where is ultrasound being done / why?

- (Cheap. Doc's might buy it and use it in their offices some. Hopefully helpful and not hurtful. Needed technology not offered otherwise? Ex: IJV punctures. ?revenue? ? Med legal?)
- Who? Where? How much training needed?
- You will be answering these questions in your life.
- **Why does someone need an ultrasound?**
- Answers different in an office / clinic than a hospital sometimes. (Credentialling??)
- ~~SELF REFERRAL --- BEWARE.~~

Where is ultrasound being done / why?

Who? Where? How much training needed?

You will be answering these questions in your life.

Why does someone need an ultrasound?

Answers different in an office / clinic than a hospital sometimes. (Credentialling??)

SELF REFERRAL --- BEWARE.

- Some tout that ultrasound is a ‘right’ of any MD, like a stethoscope.

- I’d say IF ultrasound is a ‘right’ of any MD, **its more like a scalpel**, than a stethoscope.

- **NOTE:**

- **1.Everybody doin' uls is not doin it well, or with good equipment, or offering it at the times when certain MD's may want to order it for whatever reason.**
- 2. If a Non Radiology MD has and does uls in office, has question, and then orders it thru Radiology, who pays for that? Pay twice for same exam??
- 3. ULS techs are specially trained XRAY techs, generally.

How is uls done? By whom?

- Some places / times, tech does scan and MD reads it.
- Some --- MD does scan.
- Some—tech does scan, then video clips any questions.
- Some places / times, tech does scan, and Radiologist MD involved with scan performance—NEEDS to be at times / my opinion.
- **These lead to QUALITY and QUANTITY variations with doing uls exams.**

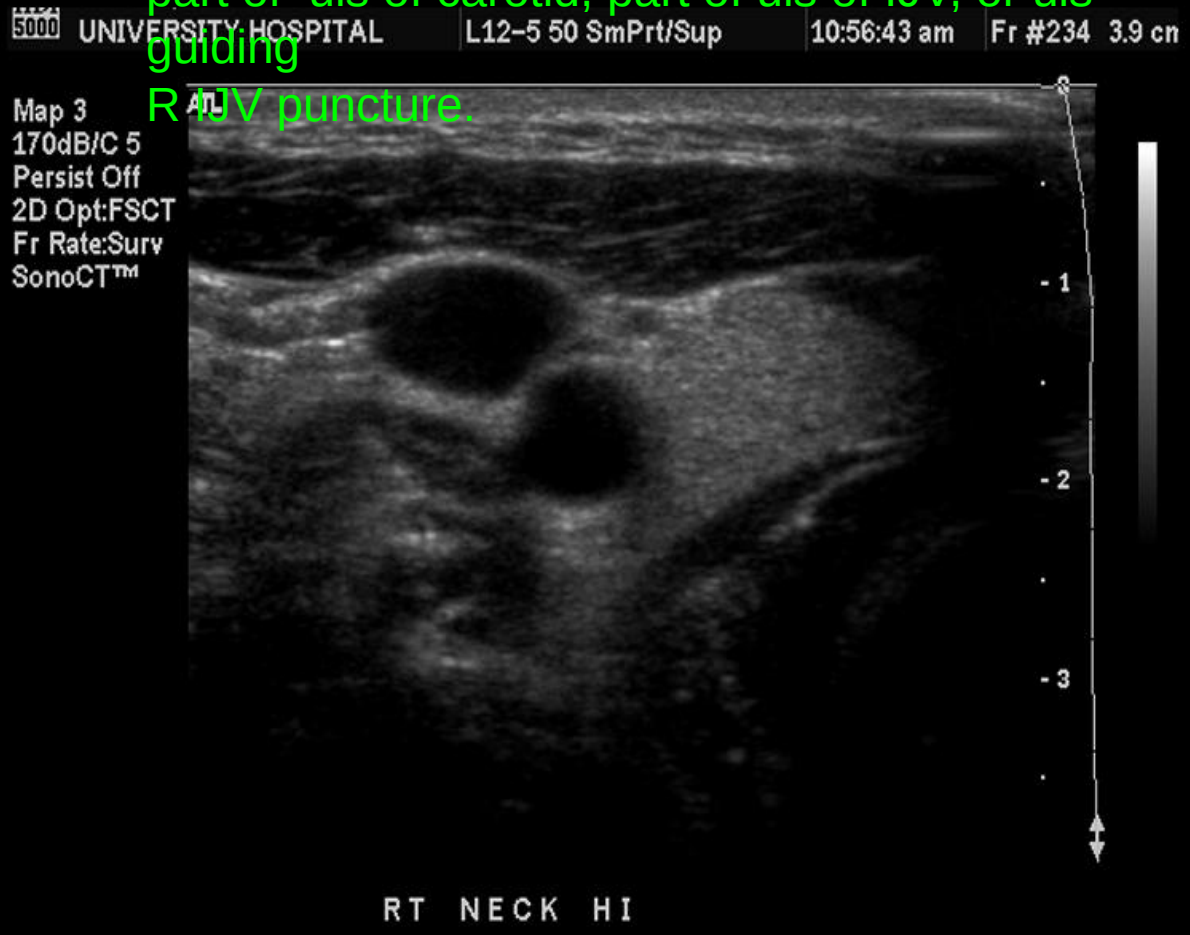
- For ex: Why do this uls??
- How hard is phys exam for the thyroid? (For many, it is hard.)
- Should everyone just get a thyroid ultrasound instead?
- NO! No med data to support such at this time.

  Thyroid nodules are abundant particularly in women. Thyroid cancer is rare…. Thyroid cancer not usually very aggressive/ rarely aggressive if <50 yo's. Those things do not lend to 'screening'. **Finding incidental thyroid nodules in young women may hurt med management more than help it.**

- THEREFORE: ----Ultrasound powers at be recommend ----**DON'T JUST START SCANNING SOMETHING WITHOUT A MEDICAL NEED FOR SCANNING IT**.

- But, if there is a med need, go ahead on.
- Now……what else……

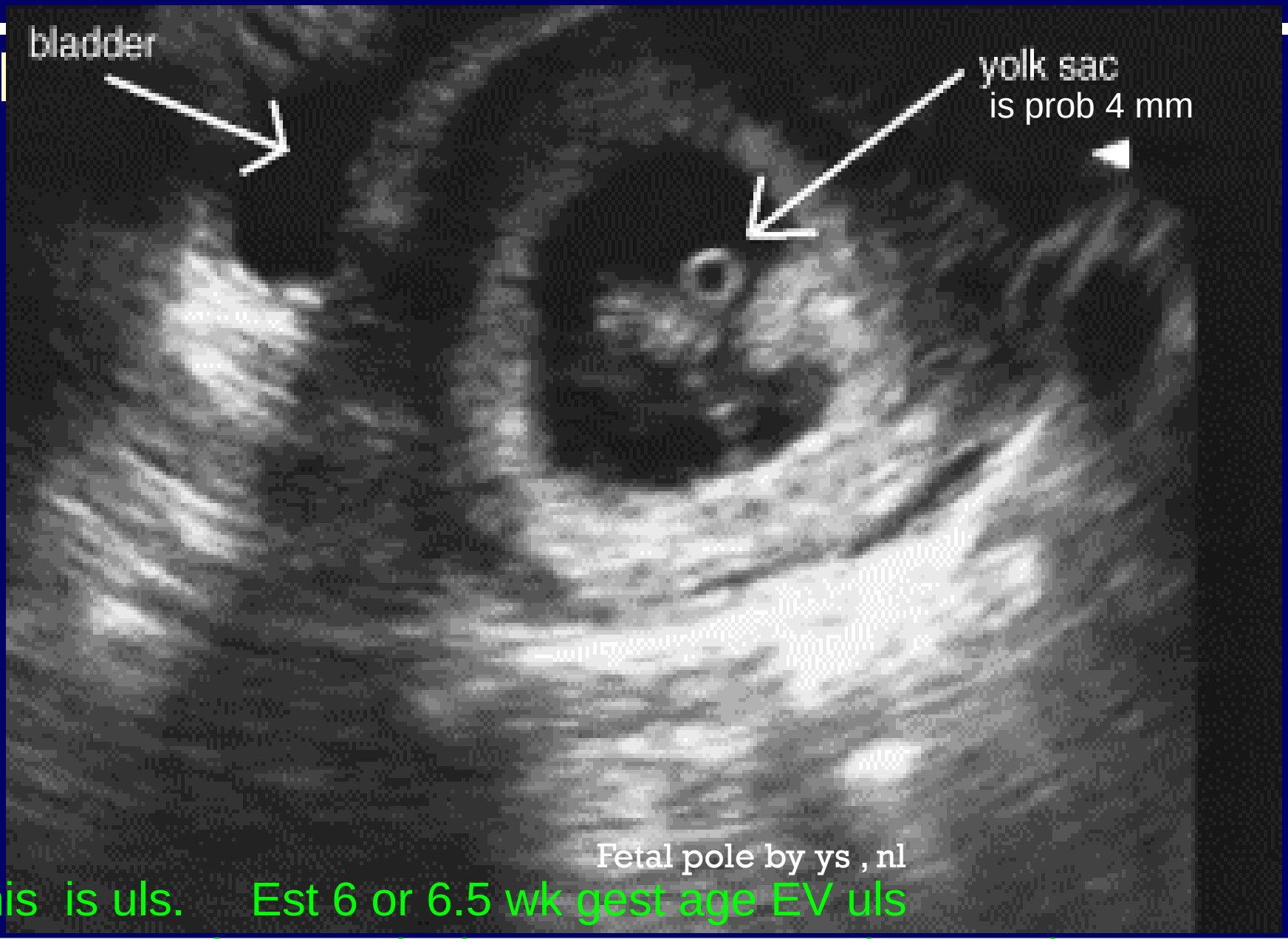
This is uls. This could be part of uls of thyroid, part of uls of carotid, part of uls of IJV, or uls guiding
R IJV puncture.



Trans

Should Ultrasound Guidance be new Standard of care for Any placement of Internal jugular Catheters?

Some say yes!

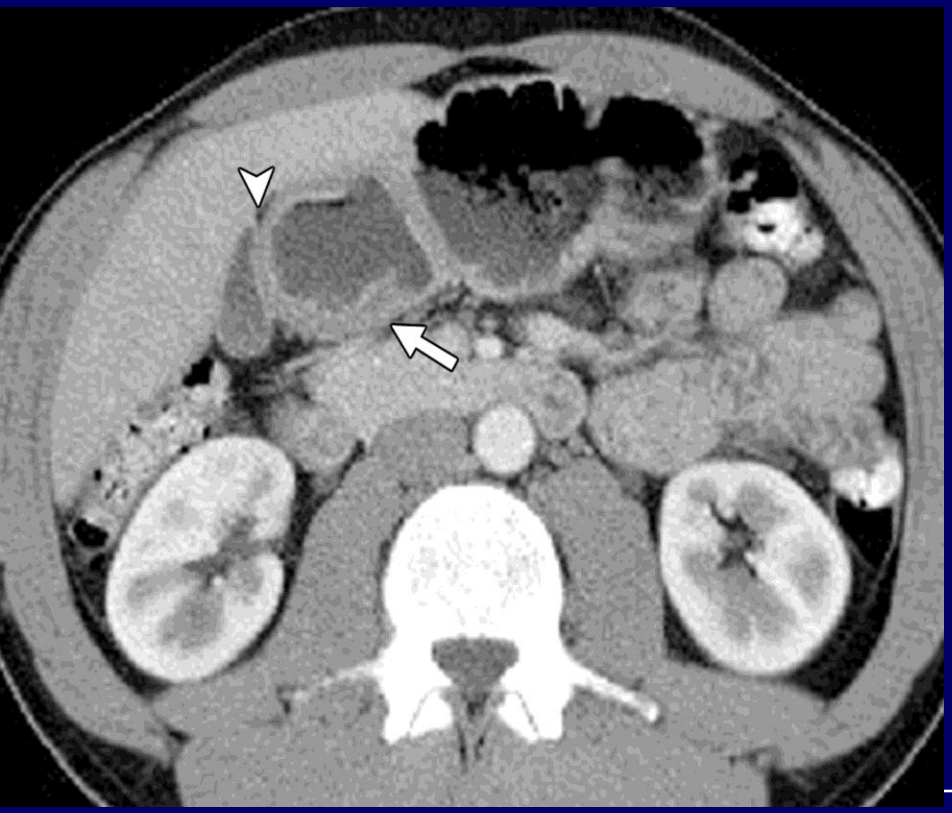


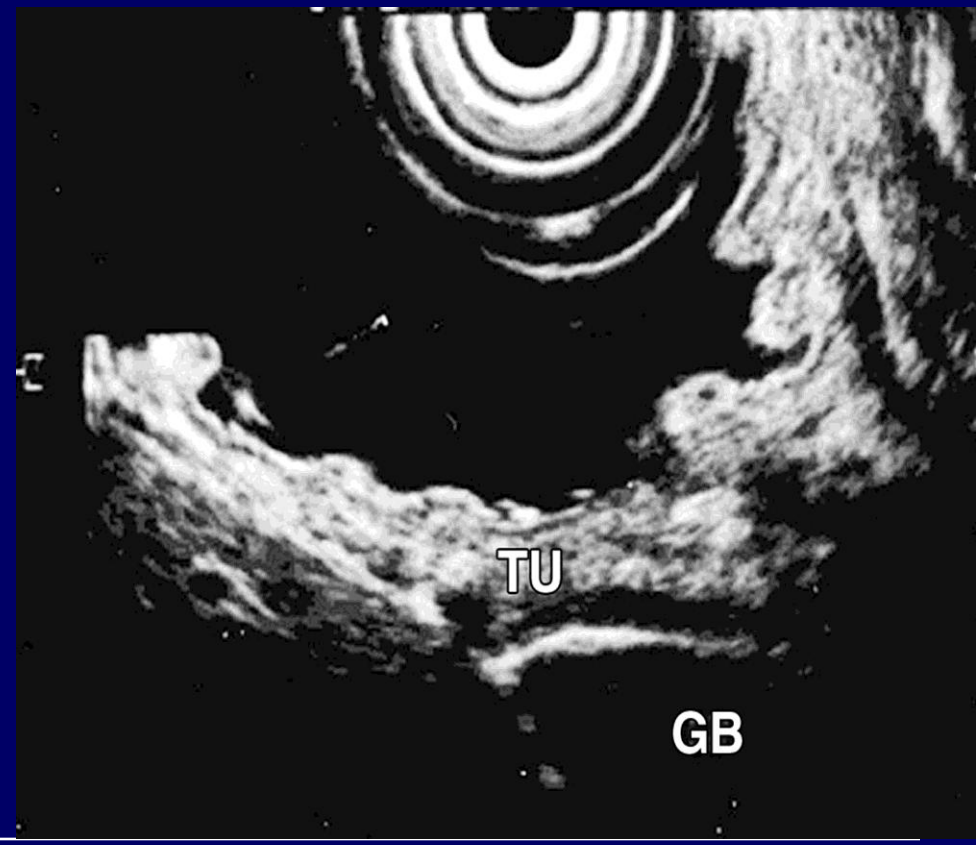
This is uls. Est 6 or 6.5 wk gest age EV uls

How many ultrasounds does a pregnant patient need? Want?
Who then pays for them?

Habermann C R et al. Radiology 2004;230:465-471

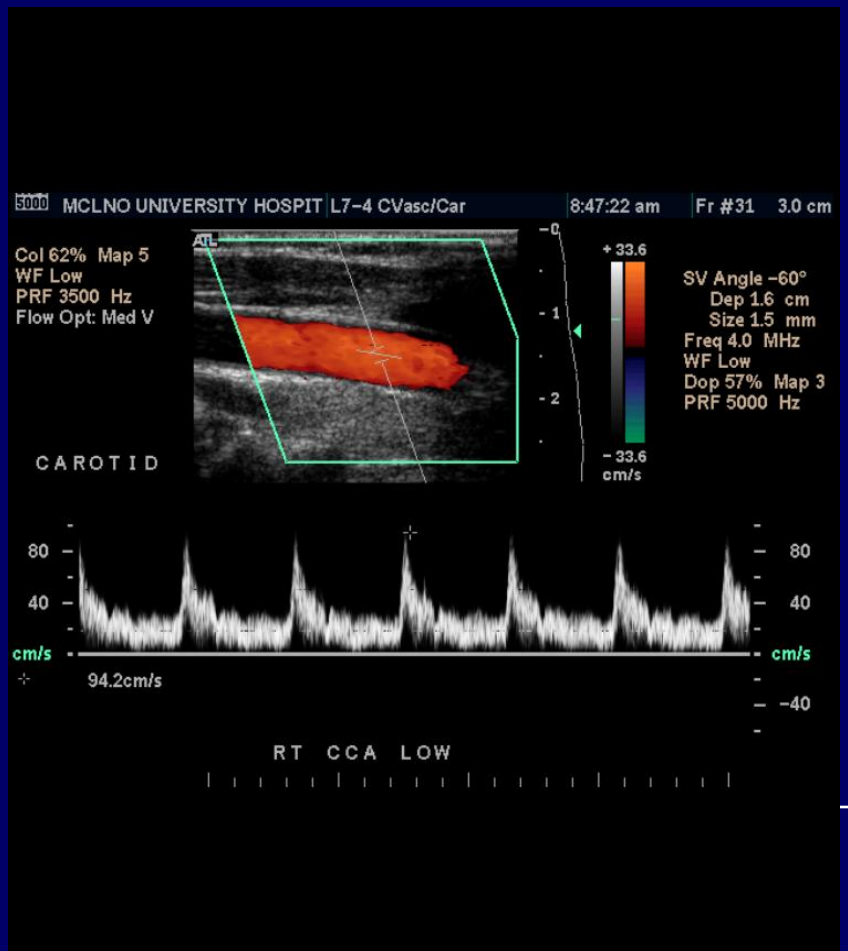
CT abd +C, and this too, is uls -- Endoscopic uls of Distal stomach ca near GB

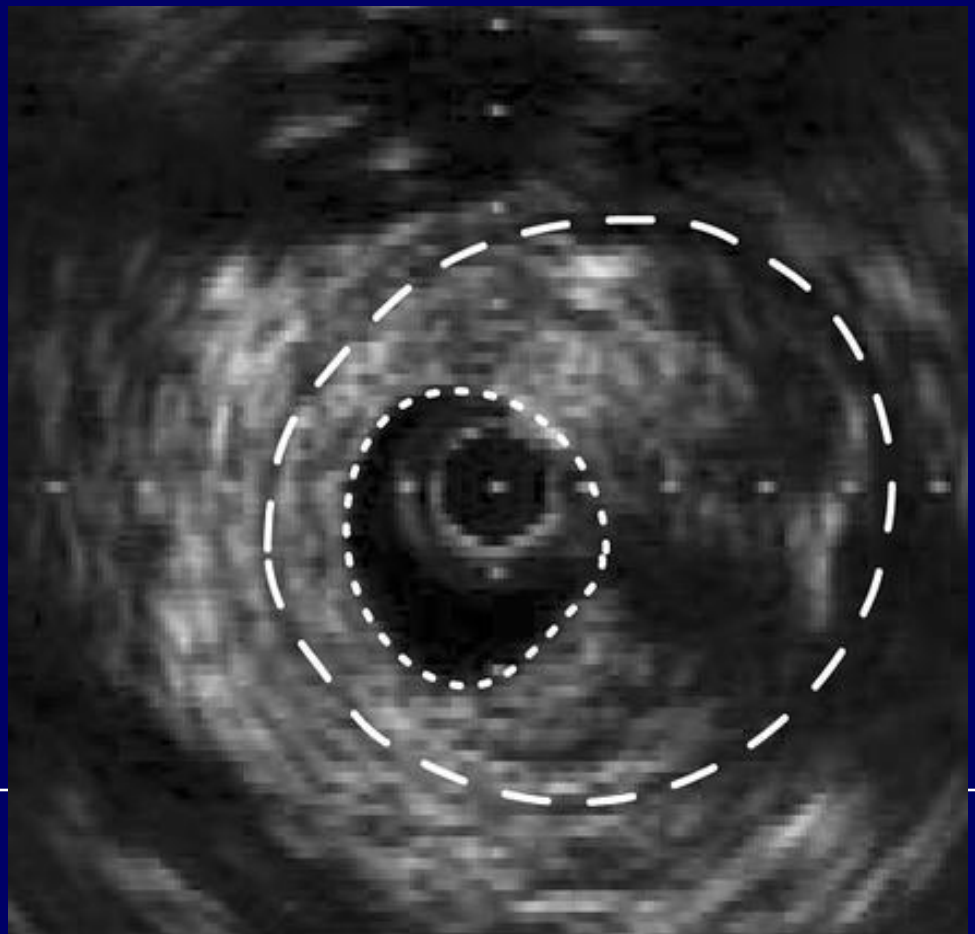




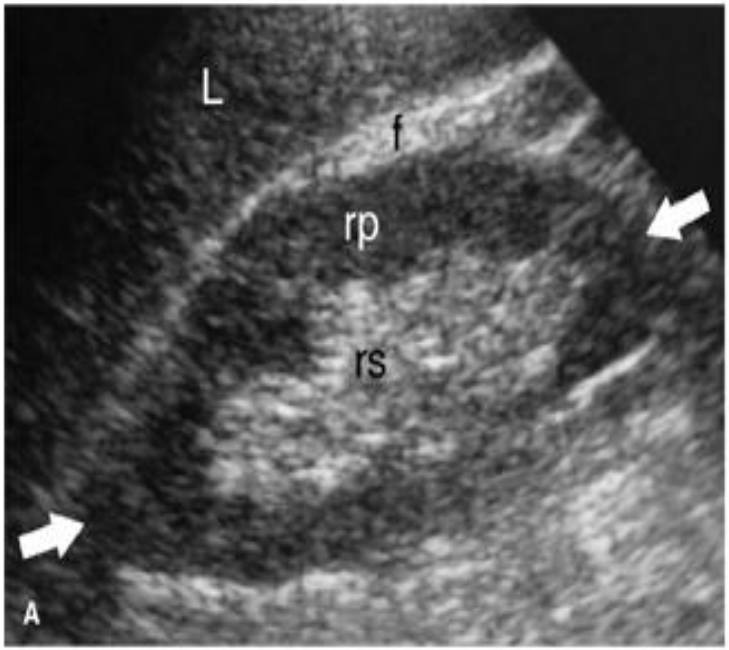
This also uls ----A reg carotid uls, and ex of IVUS (intravascular ultrasound—hi freq probes---not same artery.)

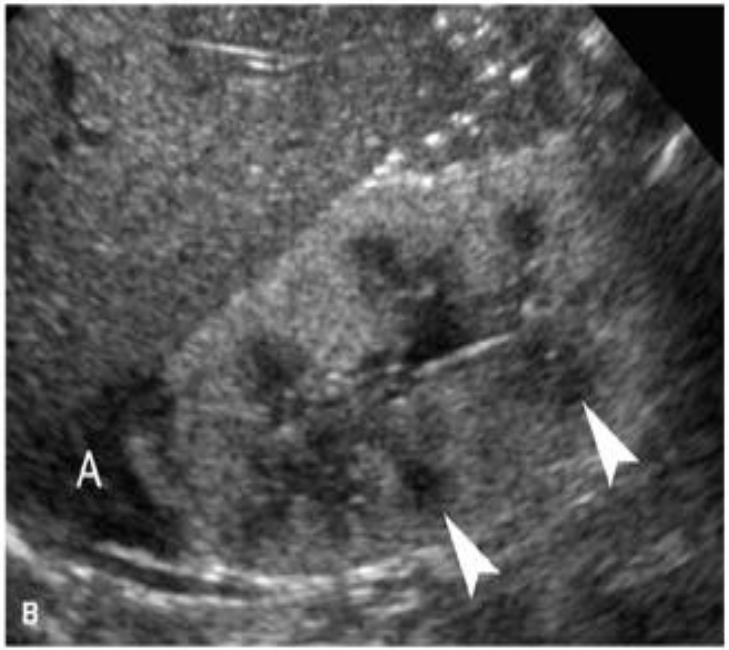
Carotid neg. IVUS of diff pt --This an artery, with lumen, probe and plaque





THIS IS A GENERAL GOOD USE OF ULTRASOUND!





Not Hydro

Normal adult kidney Normal premature infant kidney
From Brandt and Helms Ch 40.

- Is ultrasound user dependant?
- Absolutely. What isn't. Some things more than others.
- Ultrasound quite user dependant.
- If you do it, get good training to do what you do…….should go without saying.

General life sayings apply to uls--

1. **A FOOL with A TOOL is STILL a _____.**
2. **It is often good to ask for help.**

What about--------

- Risks / benefits?
- AT THIS TIME, ULTRASOUND HAS
- **NO KNOWN** RISKS,
- **BUT, what does that really mean??**

ULTRASOUND / XRAY IDEA

- ALARA ALARA ALARA ALARA
- There is absorption of these sound waves, leads to heating of some degree.

ALARA !

- As Low As Reasonably Achievable

- Who is listening to / heeding ALARA?
- WHO ISN'T and WHY?
- Who should be?

Uls In Physical Therapy

Therapeutic ultrasound frequency used is 0.7 to 3.3.MHz.
Includes some of diag uls range.

Maximum energy absorption in soft tissue is 2 to 5 cm. Intensity decreases as the waves penetrate deeper. They are absorbed primarily by connective tissue: ligaments, tendons, and fascia (and also by scar tissue.)

Therapeutic ultrasound may have two types of benefit: Thermal effects and non thermal effects. Thermal effects are due to the absorption of the sound waves. Non thermal effects are from cavitation, microstreaming and acoustic streaming. Cavitational effects result from the vibration of the tissue causing microscopic air bubbles to form, which transmit the vibrations in a way that directly stimulates cell membranes.

This physical stimulation appears to enhance the cell-repair effects of the inflammatory response.[

THE JOURNAL OF BONE & JOINT SURGERY · JBJS.ORG | VOLUME 83-A · NUMBER 2 · FEBRUARY 2001

CURRENT CONCEPTS REVIEW

THE USE OF LOW-INTENSITY ULTRASOUND TO ACCELERATE THE HEALING OF FRACTURES

BY CLINTON RUBIN, PHD, MARK BOLANDER, MD, JOHN P. RYABY, BS, AND MICHAEL HADJIARGYROU, PHD

1 – 2 MHz

Double-blind, prospective, placebo-controlled clinical trials demonstrate that healing times of fresh fractures of the radius and tibia are reduced by up to 40% with the use of low-intensity ultrasound.

Animal studies indicate that low-intensity ultrasound exposure results in stronger and stiffer callus formation and in acceleration of the endochondral ossification process.

Extensive clinical evidence demonstrates that ultrasound represents a safe, noninvasive method of accelerating the healing of fresh fractures of the tibia, the distal aspect of the radius, the scaphoid, and the metatarsals.

- What are we assuming that we know about ultrasound and “risks” if any???

NOTE

- Past issues in medicine caution us about doing this (Thalidomide, DES, Gadolinium for MRI Contrast, fen fen, blood transfusions, etc), ……..but its still being done….and may or may not be an issue in the years / decades in the future. We don't know.
- ULS has been around for only about 50 years, and cancer, ADD, autism, whatever else are increasing and folk don't know why ---should have nothing to do with uls, but do we know for sure??
- Most MD's and patients not practicing ALARA with ultrasound…….people and MD's just assuming that it is safe……..
- And yes, I guilty of this too.

I said……

- Most MD's and patients not practicing ALARA with ultrasound…….people and MD's just assuming that it is safe…….

- And yes, I, at times, am guilty of this too.

- CURRENT THOUGHT ON ULS that authorities recommend–

- IF YOU NEED IT, GET IT! IF YOU DON'T NEED IT, DON'T GET IT.
- THAT IS ALARA!

WHO WROTE THIS and WHEN?

- *"We accept an interest in people's health as a basic responsibility, paramount to every other consideration in our business.*

  "We believe the products we make are not injurious to health," "We always have and always will cooperate with those whose task it is to safeguard the public health."

WHO WROTE THIS and WHEN?

- *"We accept an interest in people's health as a basic responsibility, paramount to every other consideration in our business.*

  "We believe the products we make are not injurious to health," "We always have and always will cooperate with those whose task it is to safeguard the public health."

- *(1954, from Alliance of Cigarette companies, as a response to medical reports now out that smoking was hazardous to health.)*

- *WHAT IS THE TRUTH about cigarettes? When did it become truth?*

1954? What preceded that?

- As early as 1 B.C., American Indians began using tobacco in many different ways, such as in religious and medicinal practices.
- In the pre Columbus / America era, Tobacco was believed to be a cure-all, and was used to dress wounds, as well as a pain killer. Chewing tobacco was believed to relieve the pain of a toothache!

- On October 15, 1492, Christopher Columbus was offered dried tobacco leaves as a gift from the American Indians that he encountered. Soon after, sailors brought tobacco back to Europe, and the plant was being grown all over Europe.
- The major reason for tobacco's growing popularity in 1500’s Europe was its supposed healing properties. Europeans believed that tobacco could cure almost anything, from bad breath to cancer!
- In 1571, A Spanish doctor named Nicolas Monardes wrote a book about the history of medicinal plants of the new world. In this he claimed that tobacco could cure 36 health problems.

- In 1588, A Virginian named Thomas Harriet promoted smoking tobacco as a viable way to get one's daily dose of tobacco. Unfortunately, he died of nose cancer (because it was popular then to breathe the smoke out through the nose).

- During the 1600's, tobacco was so popular that it was frequently used as money! Tobacco was literally "as good as gold!"
- This was also a time when some of the dangerous effects of smoking tobacco were being realized by some individuals. In 1610 Sir Francis Bacon noted that trying to quit the bad habit was really hard!
- In 1826, the pure form of nicotine is finally discovered. Soon after, scientists conclude that nicotine is a dangerous poison.
- In 1836, New Englander Samuel Green stated that tobacco is an insecticide, a poison, and can kill a man.

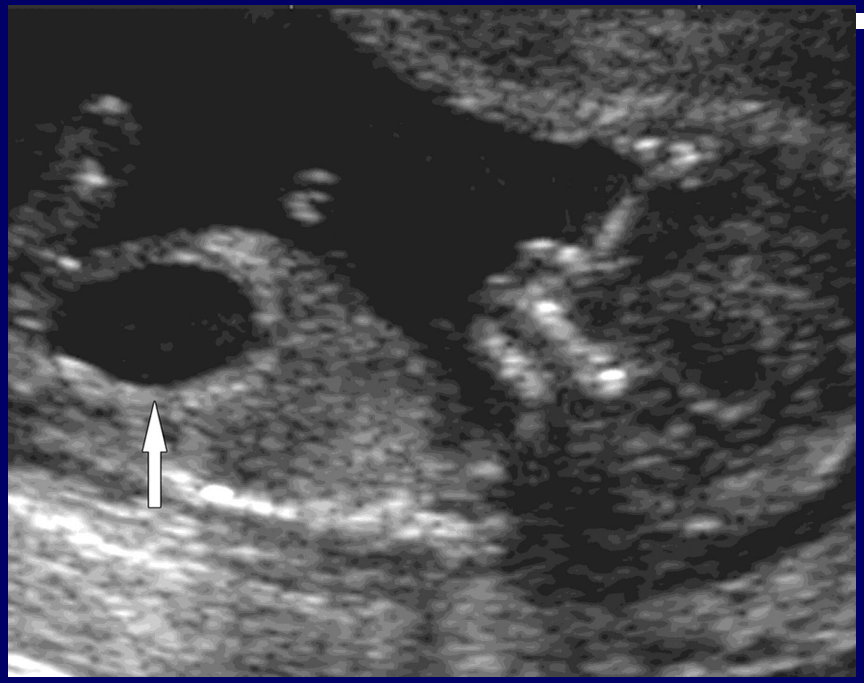
- During World War II (1939-1945), cigarette sales are at an all time high. Cigarettes were included in a soldier's C-Rations (like food!). Tobacco companies sent millions of cigarettes to the soldiers for free (and when these soldiers came home, the companies had a steady stream of loyal customers.)

- During the 1950's, more and more evidence was surfacing that smoking was linked to lung cancer. Although the tobacco industry denied such health hazards, they promoted new products which were "safer", such as those with lower tar and filtered cigarettes.

- **On January 11, 1964**, the first Surgeon General's Report on Smoking and Health was published. It created an instant-and justified---worldwide reaction. The report, a document of impeccable scientific authority, established a frightening link between cigarette smoking and several disabling or fatal diseases.

  - The report established that cigarette smoking is causally related to lung cancer in men.
  - It revealed that cigarette smoking is directly related to illness and death from heart disease and other ailments; that cigarette smoking is the leading contributory cause of death from chronic bronchitis and other lung disorders.
  - The report, in short, pronounced cigarette smoking a health hazard of sufficient importance in the United States to warrant remedial action.

- ULTRASOUND was ‘DISCOVERED’ about 50 years ago. Not 1900.
- What do we really know about ultrasound and safety?



Approx 14 wk Preg. Big bladder / no hydro. And At 3mo's of life, was ok. **If you have a need, do the scan. If you don't, why would you do the scan?**

- **"Ultrasound baby photos tickle parents — but FDA not smiling"**

Fong K W et al. Radiographics 2004;24:157-174

RadioGraphics

- A new 3D/4D ultrasound studio located in the beautiful Northwest Las Vegas. Featuring the largest ultrasound studio in Las Vegas with enough theater style seating for 13 of your guests. Our studio offers a 100" view screen so everyone will have a great view of the session. In addition, **we feature a memory foam bed so you will have a very relaxing, comfortable session and be able to enjoy watching your little "Miracle In Progress" that much more.** We use the most advanced technology available, the GE Voluson 730 Expert, to get the clearest and best pictures and video possible. Prices start at $90. Visit our website for discounts and specials. We have very flexible times and days to work around your schedule. If you have any questions please visit our website or call us at 702-255-4387.

- Miracle In Progress 3D/4D Ultrasound Studio
  7501 N. Cimarron Rd. Ste. 107
  Las Vegas, NV 89131
  contactus@miracleinprogress.com

- **View larger image**
- **View larger image**
- **View larger image**

- One ad plays the song, "The first time ever I saw your face, I thought the sun rose in your eyes" as a pair of tearful, excited parents watch their baby's image on a monitor.

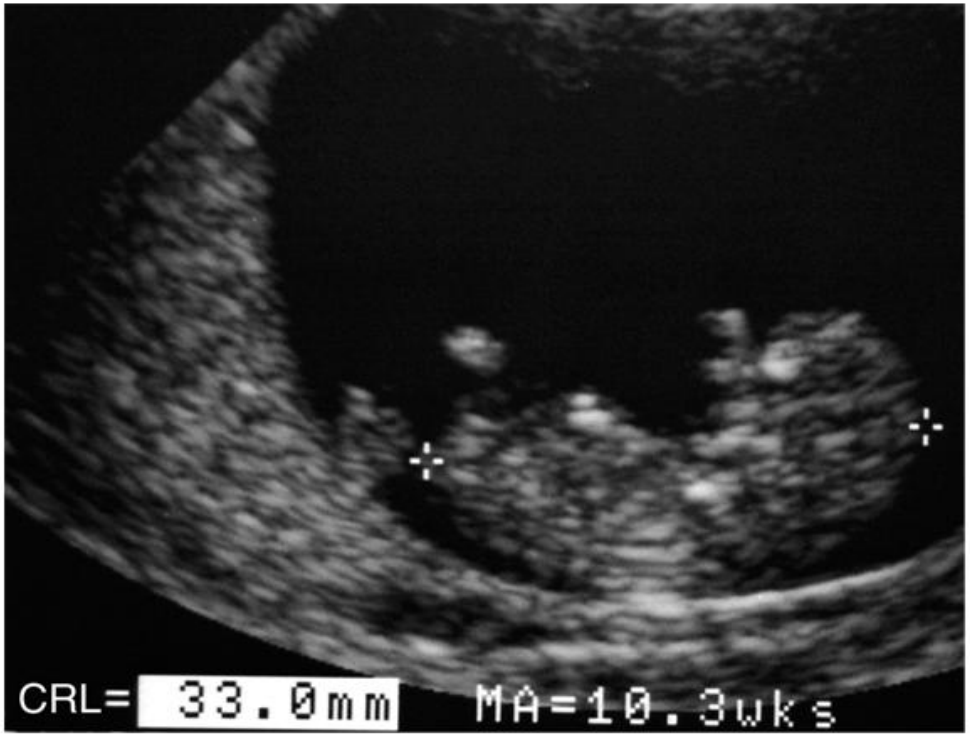
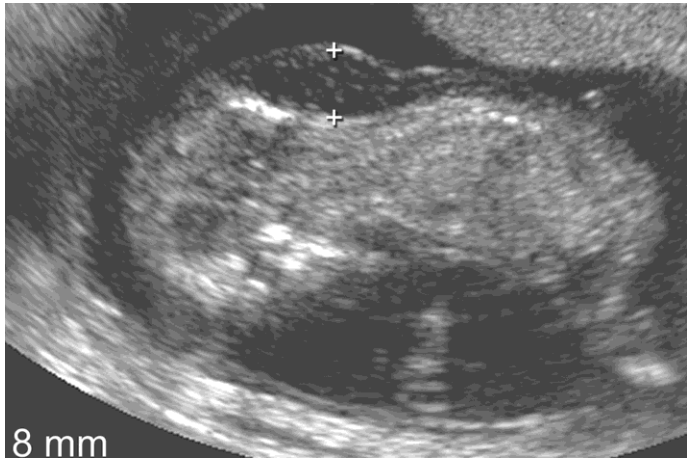


FIGURE 38.11. **Crown-Rump Length (CRL).** The CRL is measured from the top of the head to the bottom of the torso (between *cursors*).

HOW ARE YOU GOING TO PRACTICE MEDICINE?

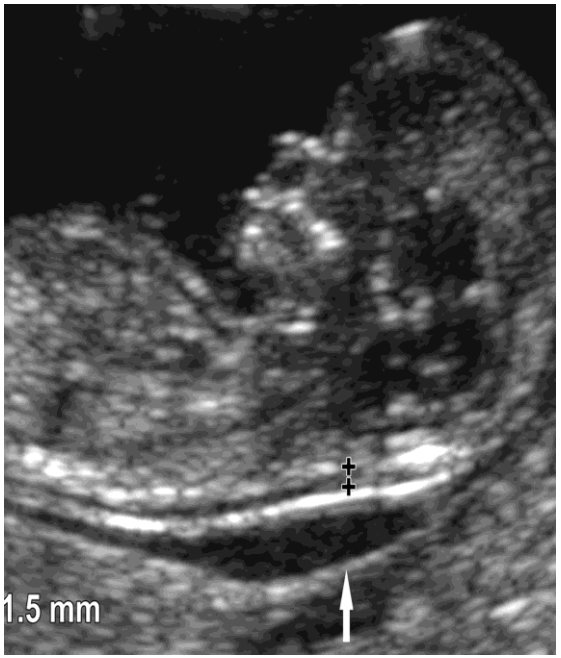
Figure 13a. Increased NT thickness at 12 weeks gestation associated with trisomy 21



Fong K W et al. Radiographics 2004;24:157-174

RadioGraphics

Figure 12. Normal NT thickness at 12 weeks gestation



Fong K W et al. Radiographics 2004;24:157-174

RadioGraphics

THERE ARE MORAL ISSUES TOO!
If uls can find Down's Synd, what should then occur?? A debated question.

There are MORAL issues too!

- If uls can find Down's Synd, what should
- then occur?? A debated question. (and what if uls said it was Down's but was wrong, and no one checks?

What about male / female?
What if pt wants to abort b/c it's a male/ female?

- You are finding out information that is going to need to be processed, and it is obtained without true knowledge of the amount of risks involved…..

- NO KNOWN RISKS ---how safe is that??? How much do we really know???

J of Uls in Med 2010

- **VIII. Fetal Safety**
- Diagnostic ultrasound studies of the fetus are generally considered safe during pregnancy. **This diagnostic procedure should be performed only when there is a valid medical indication, and the lowest possible ultrasonic exposure setting should be used to gain the necessary diagnostic information under the as low as reasonably achievable (ALARA) principle**.
- The promotion, selling, or leasing of ultrasound equipment for making "keepsake fetal videos" is considered by the US Food and Drug Administration to be an unapproved use of a medical device. Use of a diagnostic ultrasound system for these purposes, without a physician's order, may be in violation of state laws or regulations.

- AT LSUHSC, I may be the only MD you come in contact with that tells you this, re: ultrasound.

- Do I have a clue?

NOTE

- Past issues in medicine caution us about doing this (Thalidomide, DES, Gadolinium for MRI Contrast, fen fen, blood transfusions, etc), ……..but its still being done….and may or may not be an issue in the years / decades in the future. We don't know.
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- And yes, I guilty of this too.

(Cell phones???)

- Most **MD's AND PATIENTS not practicing ALARA with ultrasound**…….people and MD's just assuming that it is safe……..
- And yes, I at times, guilty of this too.

FDA note---

- "Ultrasound is a form of energy, and even at low levels, laboratory studies have shown it can produce physical effects in tissue, such as jarring vibrations and a rise in temperature," the FDA said. **Because of this, "prenatal ultrasounds can't be considered completely innocuous.“**

- **TRANSLATED, We might ought to assume that there may be effect from the uls.**

ULTRASOUND PEARLS

- RISKS? ---do we really know? ?thermal?

J Ultrasound Med 27:517-535 • 0278-4297

AIUM Bioeffects Consensus Report

The Risk of Exposure to Diagnostic Ultrasound in Postnatal Subjects

Thermal Effects

William D. O'Brien, Jr, PhD, Cheri X. Deng, PhD, Gerald R. Harris, PhD, Bruce A. Herman, MS, Christopher R. Merritt, MD

Types of uls used for Treatment

- **High-intensity focused ultrasound**
- Using extracorporeal high-intensity focused ultrasound (HIFU), temperatures of greater than 60°C can be achieved in the target tissue. -- The prostate can be easily treated with this modality via a transrectal probe.
- This not diagnostic ultrasound, but temperature changes of up to 1 degree C are questioned to occur with diag uls.

ULTRASOUND PEARLS

- Boast about weaknesses
- (don’t try and DO IT ALL yourself.)
- “If I must boast, I will boast of the things that show my weakness. …… “ For when I am weak, then I am strong.”

- (1 Cor 11:30, 12:10b)

ULTRASOUND PEARLS

- People,
  People who need people,
  Are the luckiest people in the world
  We're children, needing other children
  And yet letting a grownup pride
  Hide all the need inside
  Acting more like children than children…

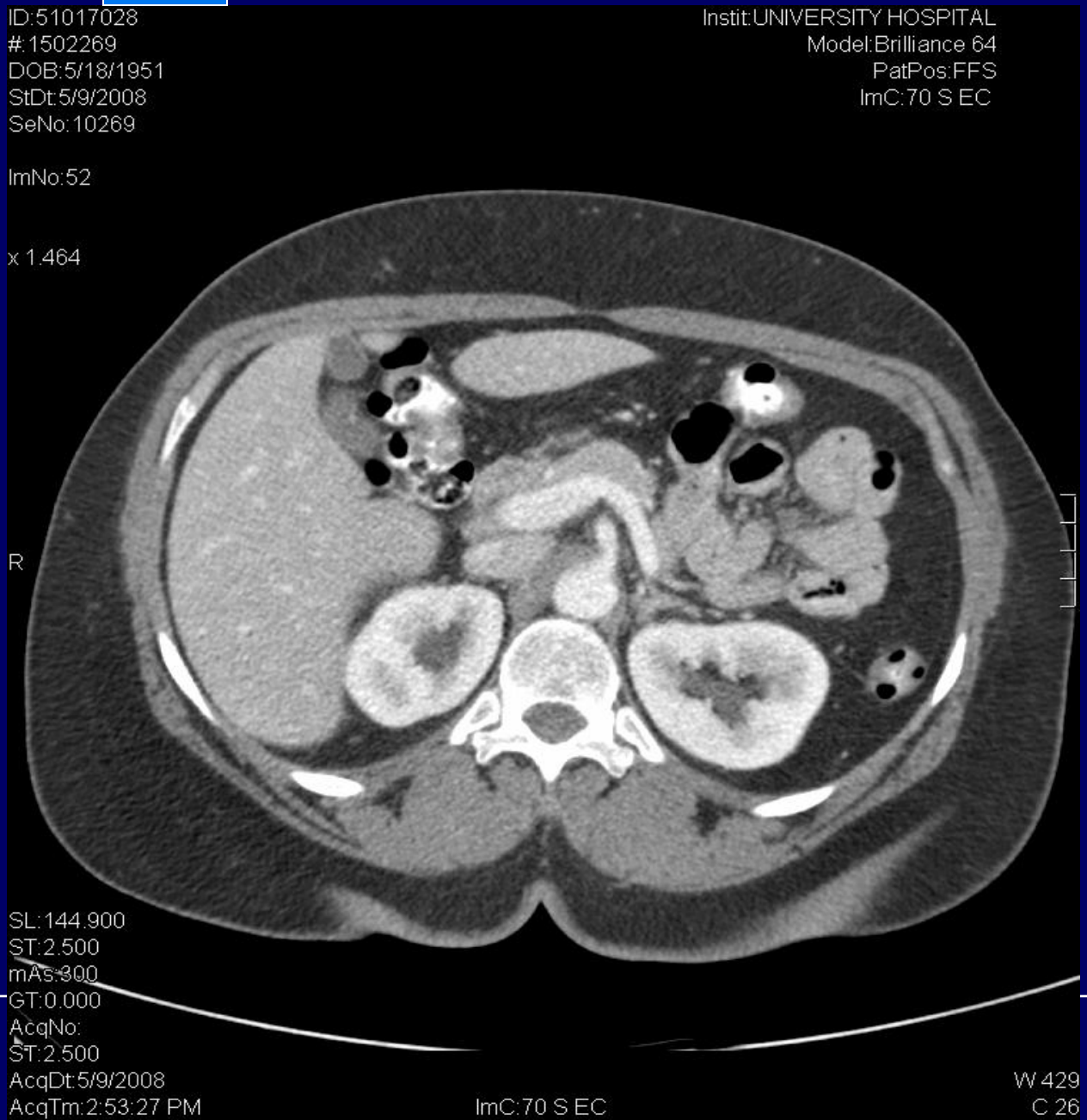
- ---Barbara Streisand

- OK, what about IMAGING THAT GETS DONE with ultrasound??

ULTRASOUND PEARLS

- Uls image is made to show a specific **SOMETHING**, not everything, unlike CT, which shows a whole slice.

CT here
GB by Hep flex
And anat.



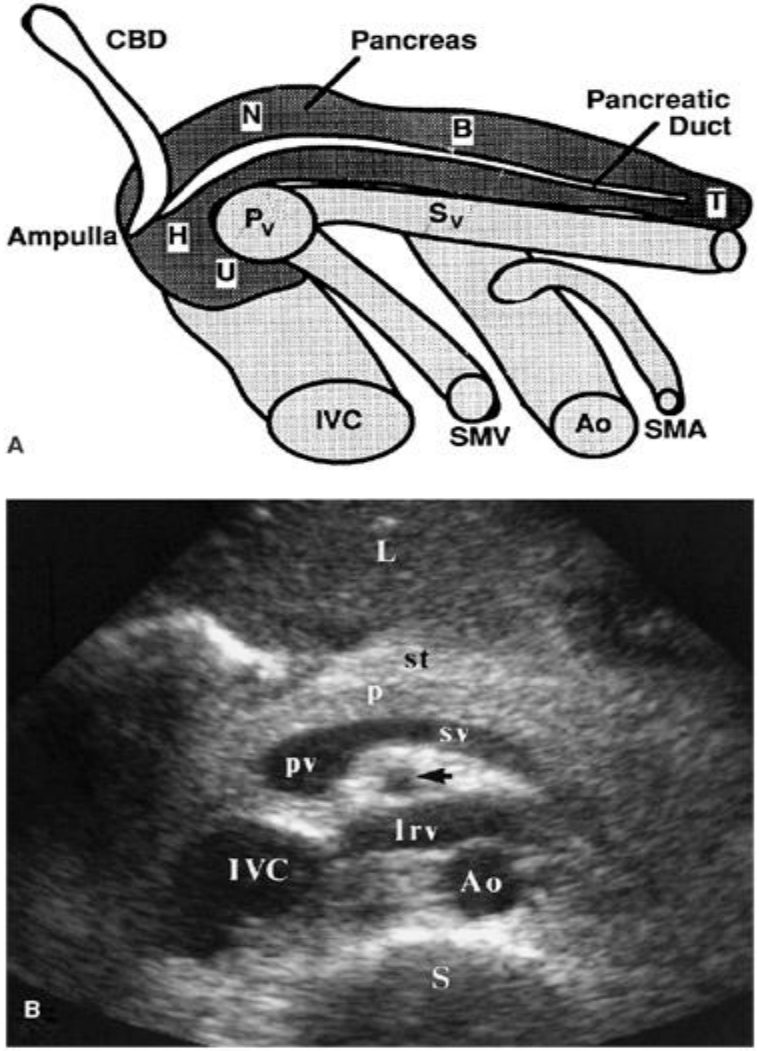


FIGURE 36.30. **Normal Pancreas Anatomy.** A diagram **(A)** and an US in transverse plane **(B)** demonstrate the normal US anatomy of the pancreas. The majority of the pancreas lies anterior to the splenic vein (sv) and its junction with the superior mesenteric vein (SMV), which forms the portal vein (pv). The head (H) and uncinate process (U) of the pancreas cradle the origin of the portal vein. The pancreatic neck (N) is anterior to the sv-SMV confluence, and the uncinate process and inferior vena cava (IVC) are posterior to the confluence. The superior mesenteric artery (SMA, *arrow*) arises from the aorta (Ao) dorsal to the splenic vein. The left renal vein (lrv) passes between the SMA and aorta to the IVC. The left lobe of the liver (L) offers a good sonographic window to the pancreas. The stomach (st) and lesser sac (collapsed) are anterior to the pancreas. CBD, common bile duct; S, spine; B, body of the pancreas; T, tail of the pancreas; p, pancreas.

They don't come labeled
Like this

- Got thru slide # 100 w 1st year residents
- 7/12/2012

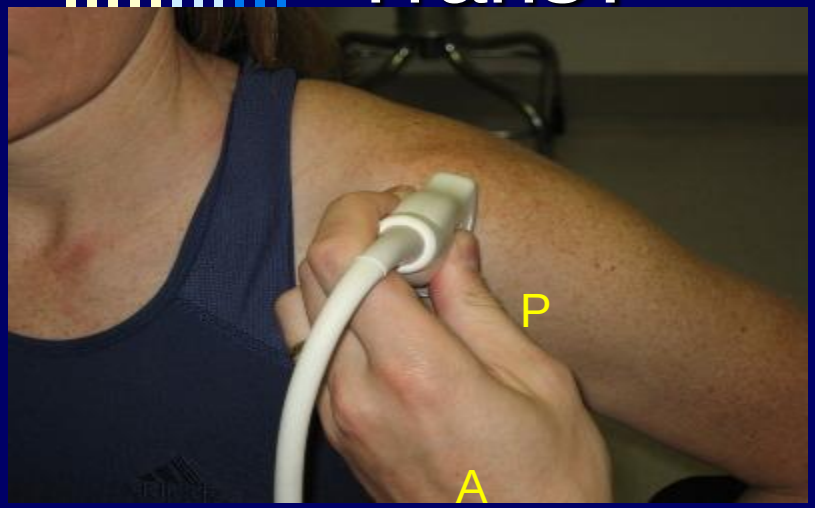
Same spot, but
Can't see all the
Same structures
All the time w uls.

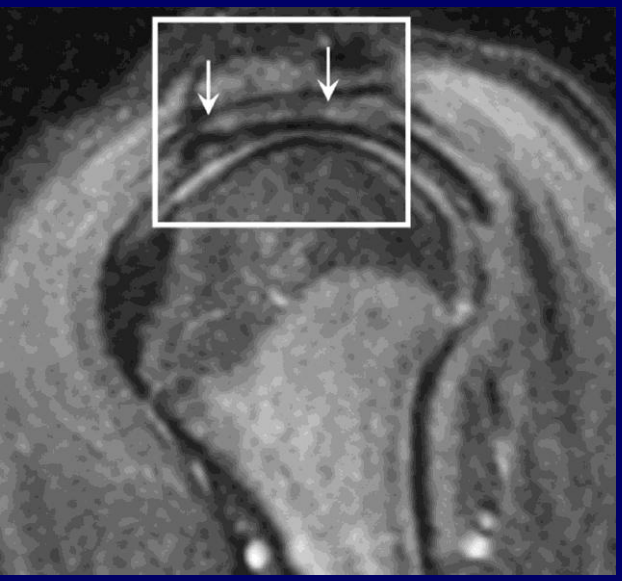
Anat ---TR ML Panc
waves reflected, refracted, absorbed, transmitted, scattered

Trans/ ax, like CT

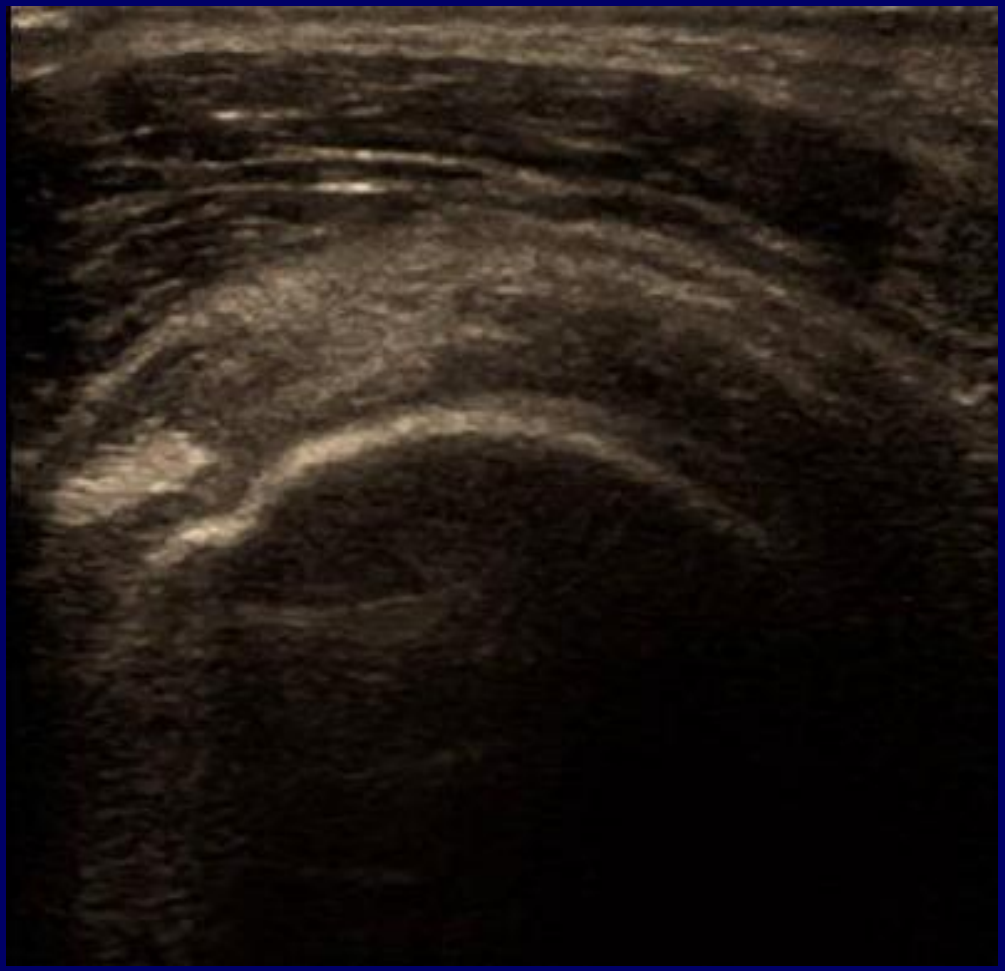
Sag Head feet

Trans?





This would be SAG by MRI



Sag ish Lt / short axis ok, at times they call trans, but its not really trans by gen uls,

But is trans / short axis of RCT/ SST.

Where ant? A LHbiceps P

Where ant goes on a sag image not as classical w uls, or plain xrays

MSK uls

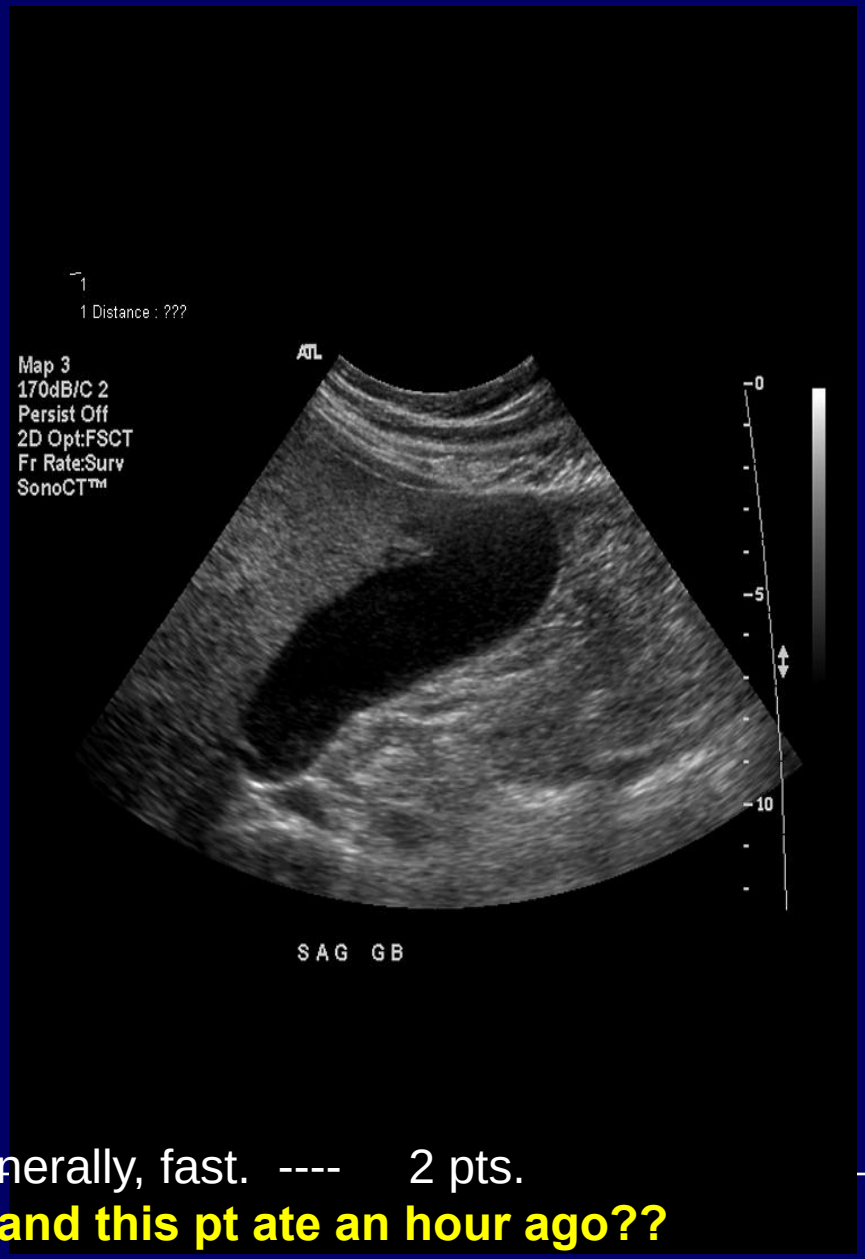
- New, more in Europe where fewer MRI scanners.
- Labeling harder---maybe short axis, long axis of muscle/ tendon, rather than trans/ sag.

Uls of brain
--How old is
This patient?
<2
5
15
35
75

This is TRANS / Gen uls
Can't see past trachea or bone really.

Look at labeling of the image,
And traits of what on image—what
You can or can't see. Notice.

TM 908



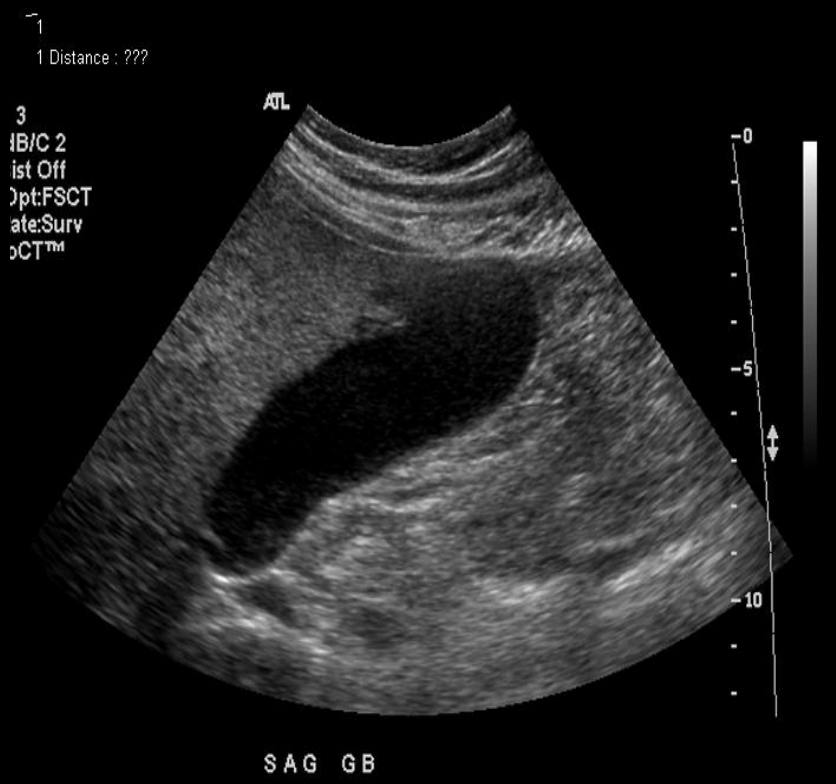
YOU need to know fasting status! Generally, fast. ---- 2 pts.

What if this pt fasting ……and this pt ate an hour ago??


LNO UNIVERSITY HOSPIT
C5-2 Abd/Gen
1:17:28 pm
Fr #23
TRV GB PT.ATE


LNO UNIVERSITY HOSPIT
C5-2 Abd/Gen
1:17:35 pm
SAG GB PT.ATE


LNO UNIVERSITY HOSPIT
C5-2 Abd/Gen
1:17:35 pm
Fr #13
SAG GB PT.ATE


1 Distance : ???
ATL
SAG GB

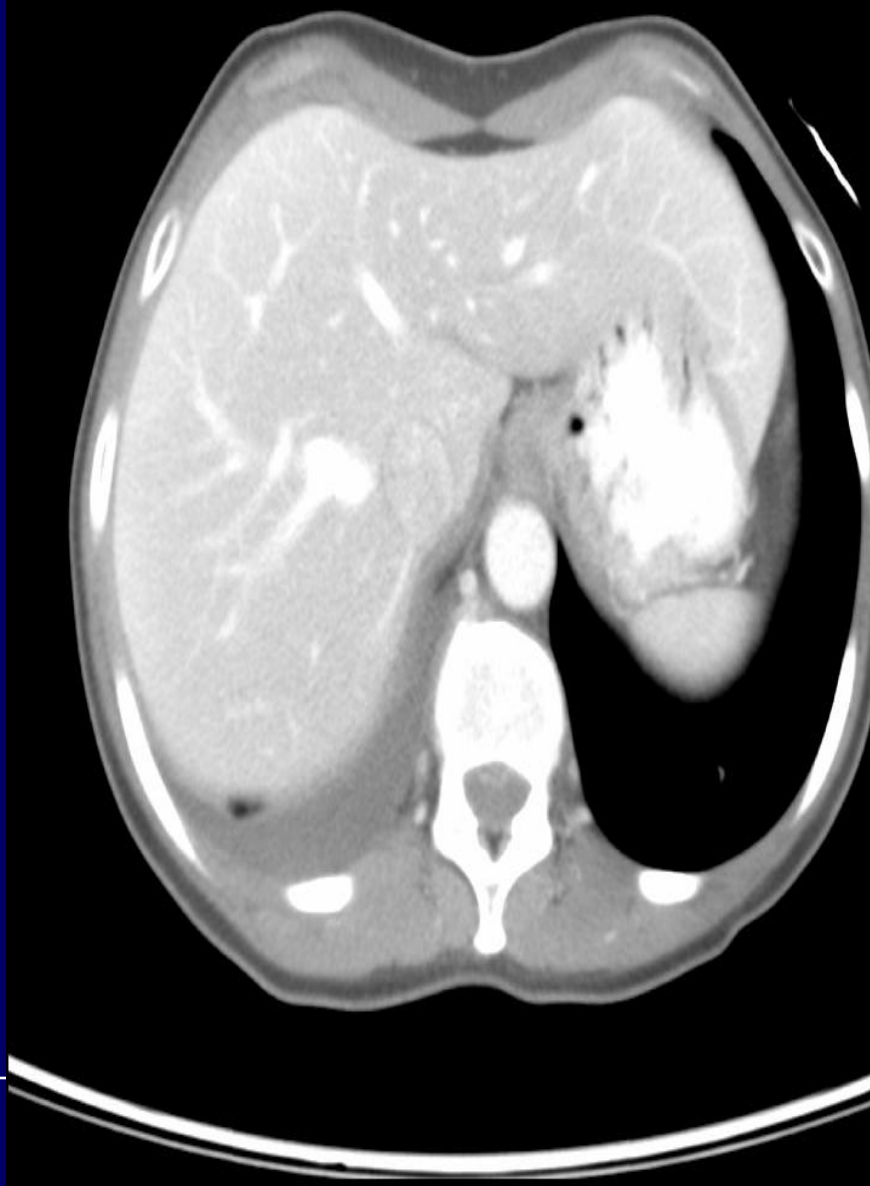
Uls not so good for masses, here CT saw the stones, but doesn't see gallstones as well as uls, generally.

MW 1108 uls 108 CT stones

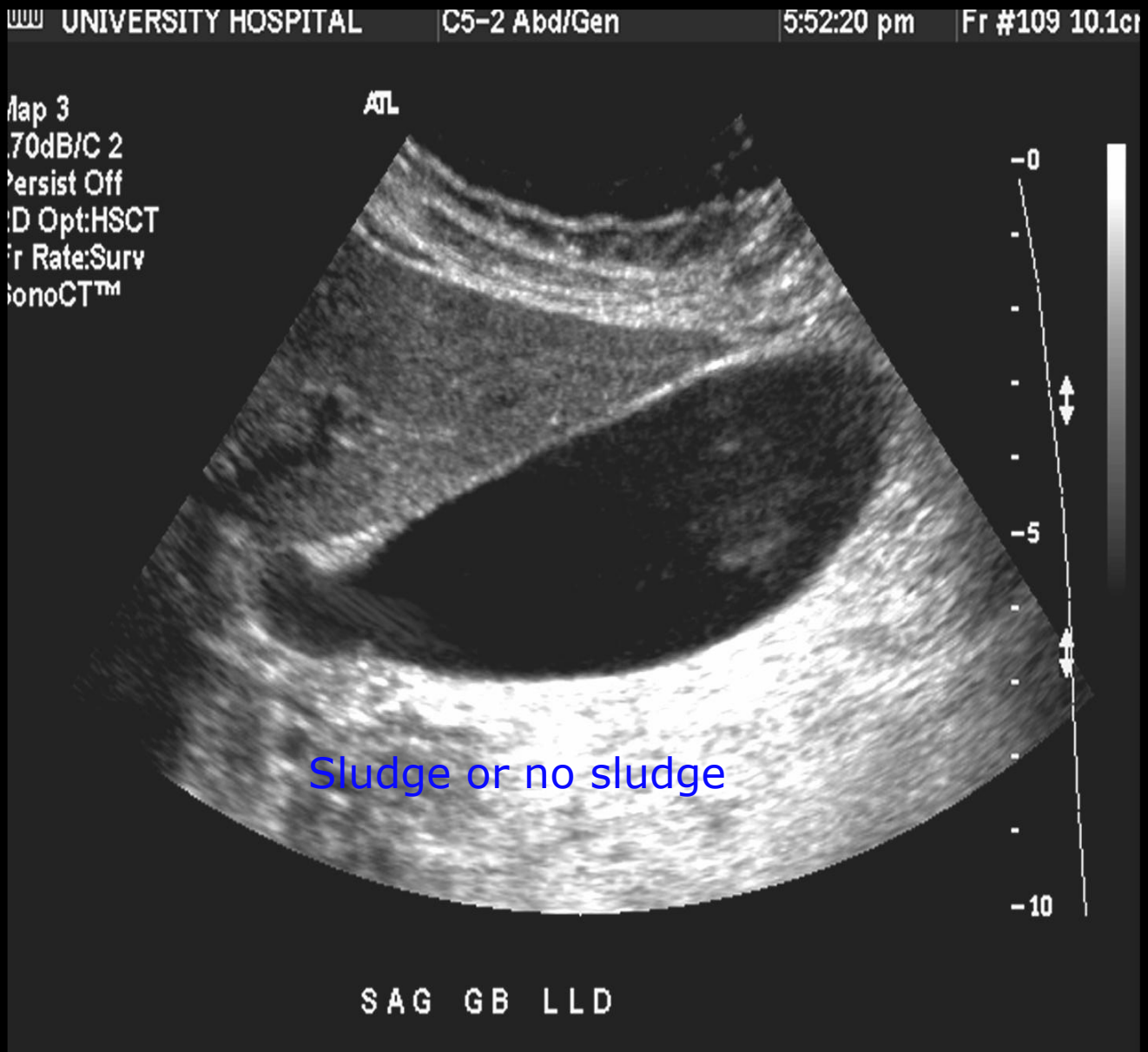
- ULS better for gallstones than any CT.
- ULS worse for liver masses than good CT –CT using IV contrast.

Jv 608

R pleural effusion post to liver




RSITY HOSPITAL
P4-2 Abd/Gen
7:58:12 am
Fr #
ATL
RUQ
STONE IN D
SAG RT

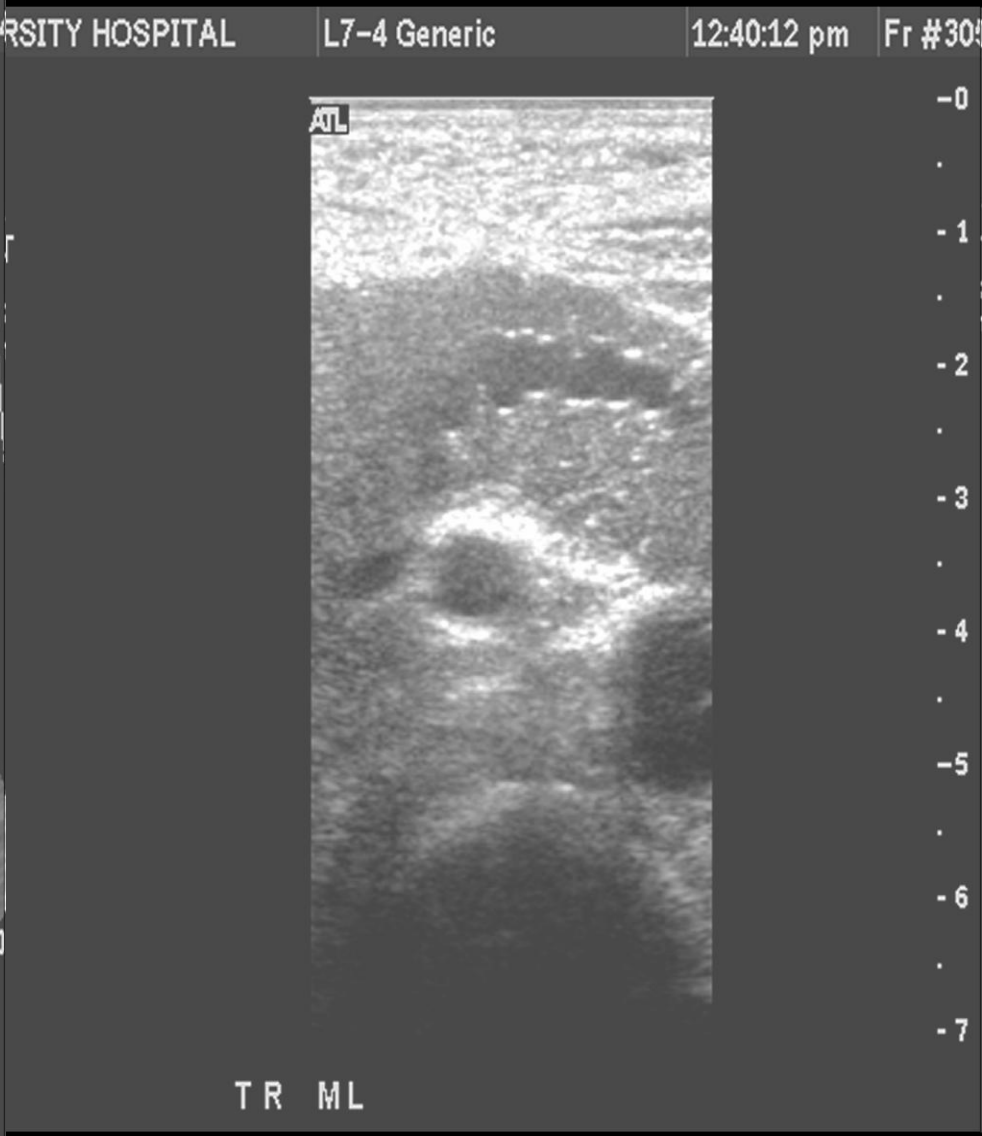


FIND SOMETHING YOU KNOW WHAT IT IS, TO HELP YOU WITH ANYTHING ELSE YOU SEE—
More Next slide..

NOT SHOWN-Abd. What can you identify?

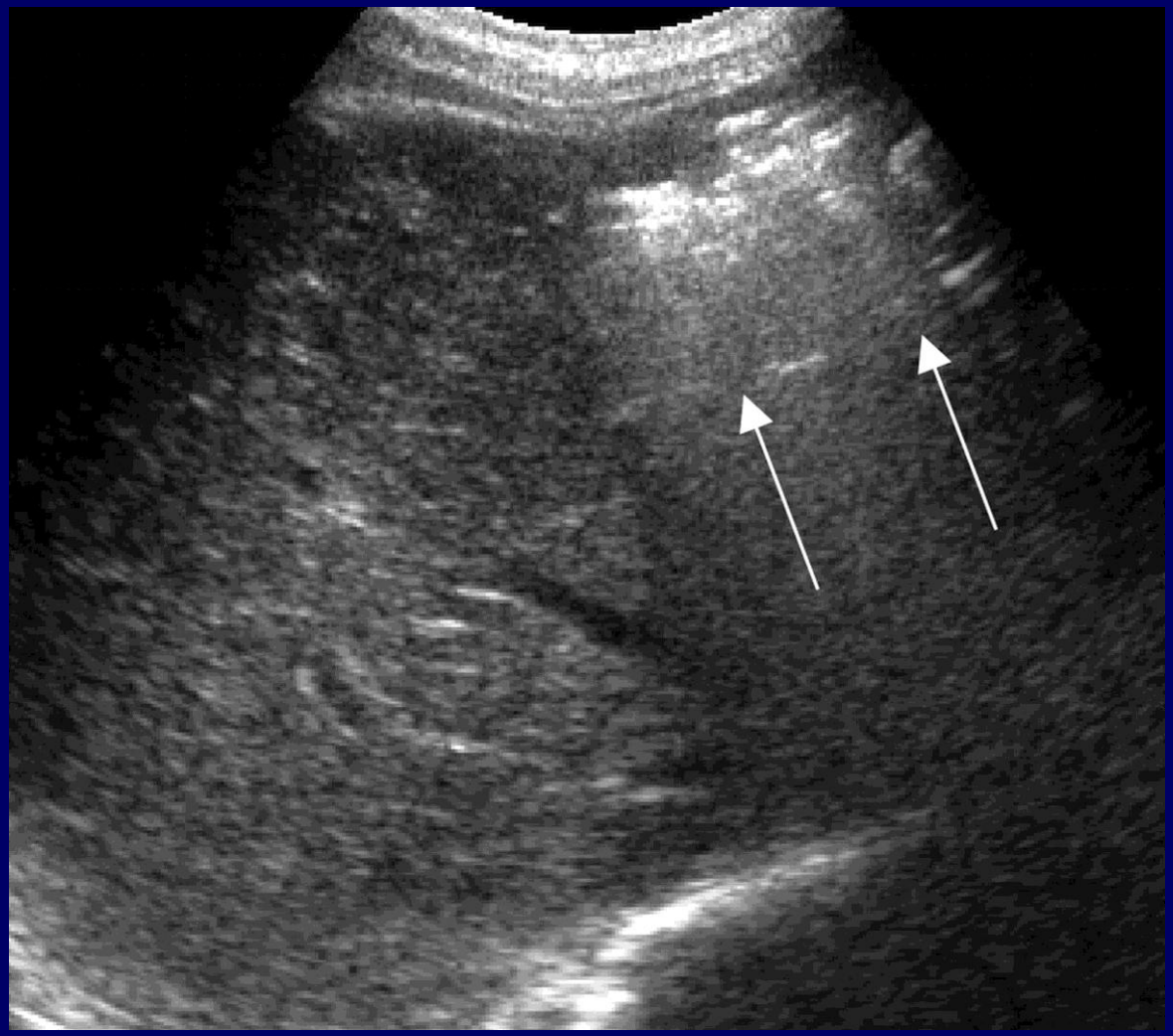
This med res, TR ML

Panc head mass and duct obst.
This mid panc hi res.



57 ish yo

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

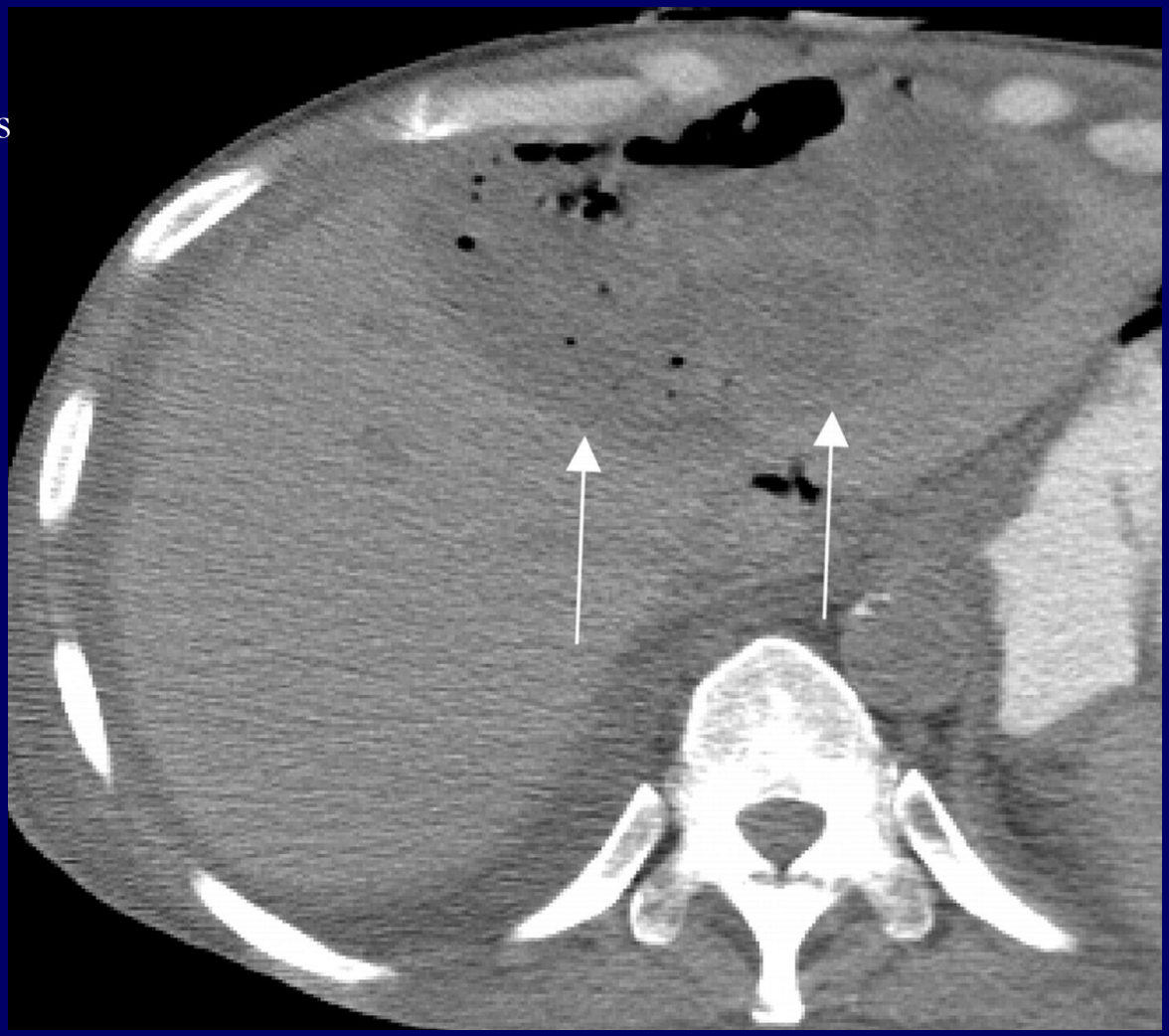


Crossin J D et al. Radiographics 2003;23:1093-1114

RadioGraphics

Figure 19b. Abscess in a 57-year-old man with fever and rigor 6 months after orthotopic liver transplantation for primary sclerosing cholangitis

57 yo same as uls
Abscess, liver tx.

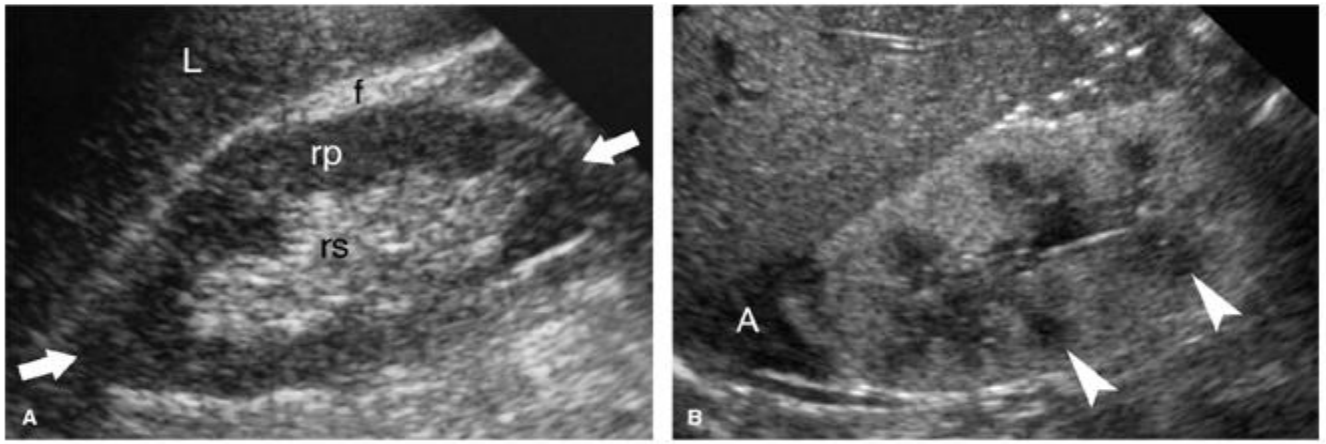


Crossin J D et al. Radiographics 2003;23:1093-1114

RadioGraphics

R Kid hydro


UNIVERSITY HOSPITAL
C5-2 Abd/Gen
2:03:38 am
Fr #204 13.8cm
Map 3
170dB/C 2
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT™
ATL
0
5
10
SAG RT KIDN

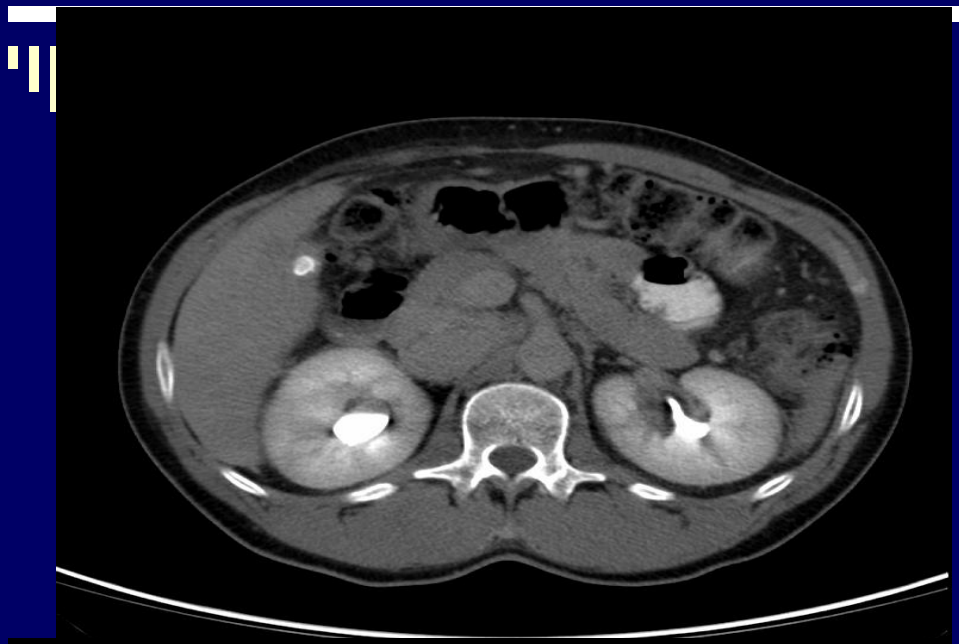


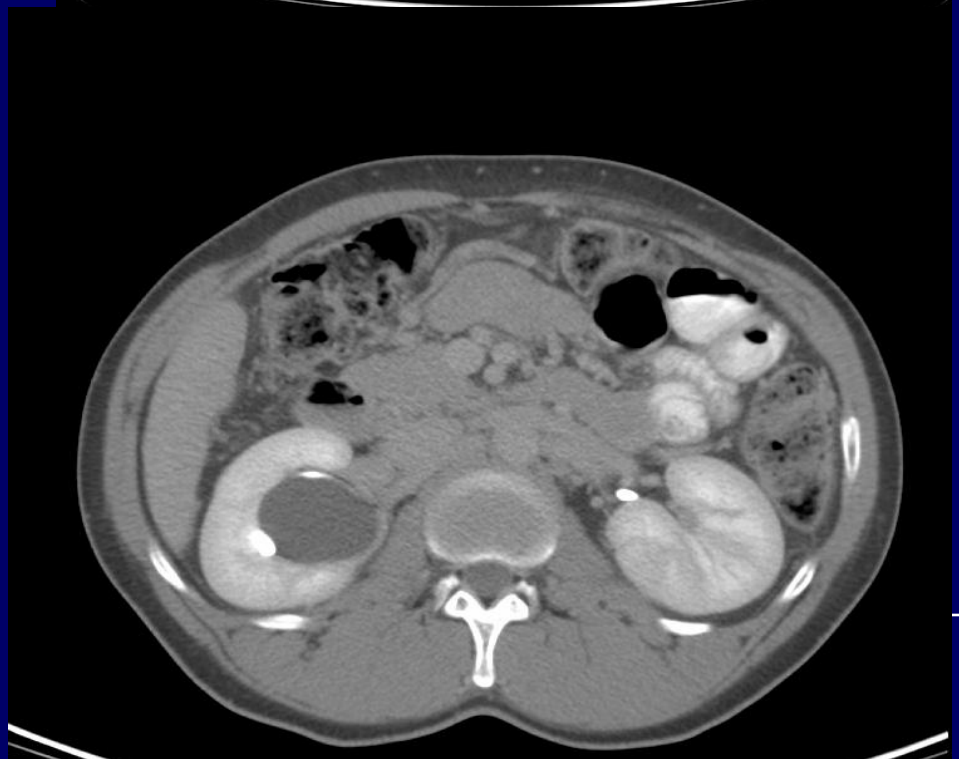
Not Hydro

FIGURE 36.40. **Normal Kidneys. A.** Adult kidney. A long-axis US view of the right kidney (between *arrows*) obtained through the liver (L) demonstrates echogenicity of the normal renal parenchyma, which is approximately equal to the echogenicity of the normal liver. The renal sinus (rs), which contains vessels, the collecting system, and fat, is hyperechoic compared to the renal parenchyma (rp). The margins of the kidney are outlined by echogenic perirenal fat (f). Morison pouch is a recess of the peritoneal cavity between the kidney and the liver that usually fills with fluid when ascites is present. **B.** Newborn kidney. In newborns and infants, the renal cortex is more echogenic than in older children and adults, causing the medullary pyramids (*arrowheads*) to appear more lucent and resemble hydronephrosis. Note that the lucent pyramids correspond anatomically to the location of the renalmedulla, that the pyramids do not interconnect, and that the renal pelvis is not dilated. The adrenal gland (A) is normally prominent in size in the newborn.

TM 908 R kid

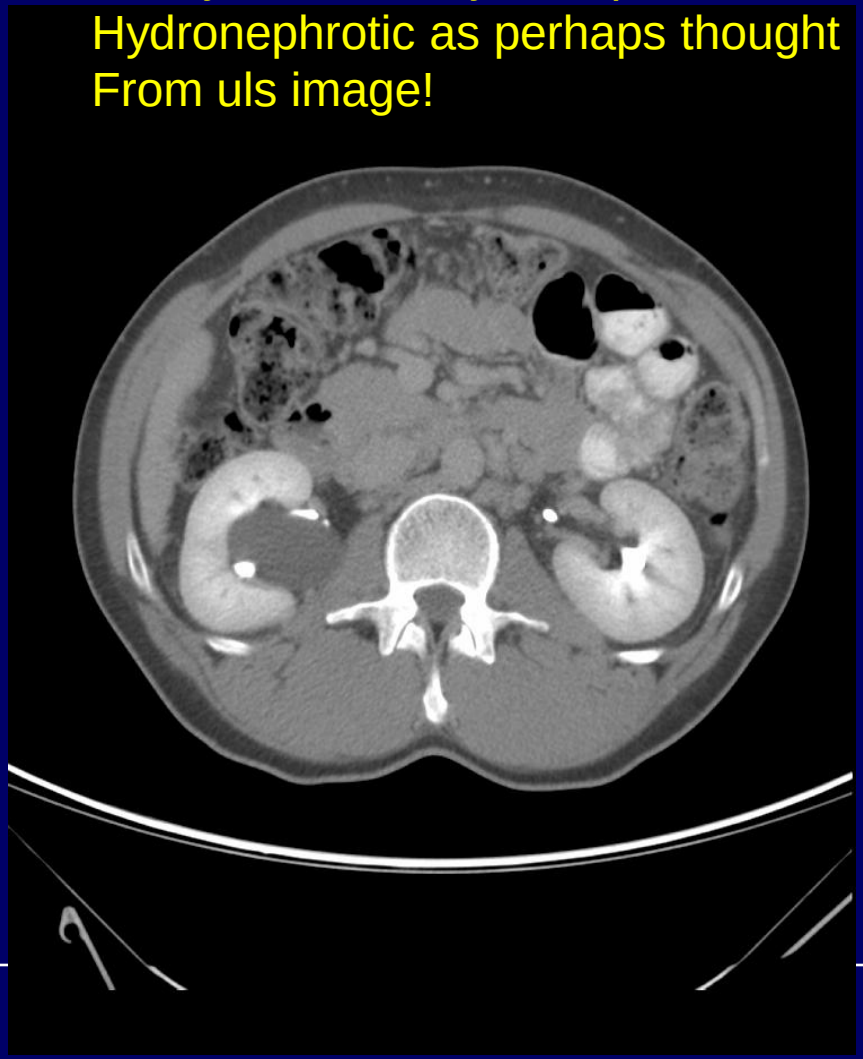
HYDRO??





TM

Same pt as prev uls –parapelvic cyst, w only trace coll system prom/ not as Hydronephrotic as perhaps thought From uls image!




UNIVERSITY HOSPIT
C5-2 Abd/Renal
7:52:02 am
ATL
Both hydro and +cysts MA 111309 LEFT
SAG LT

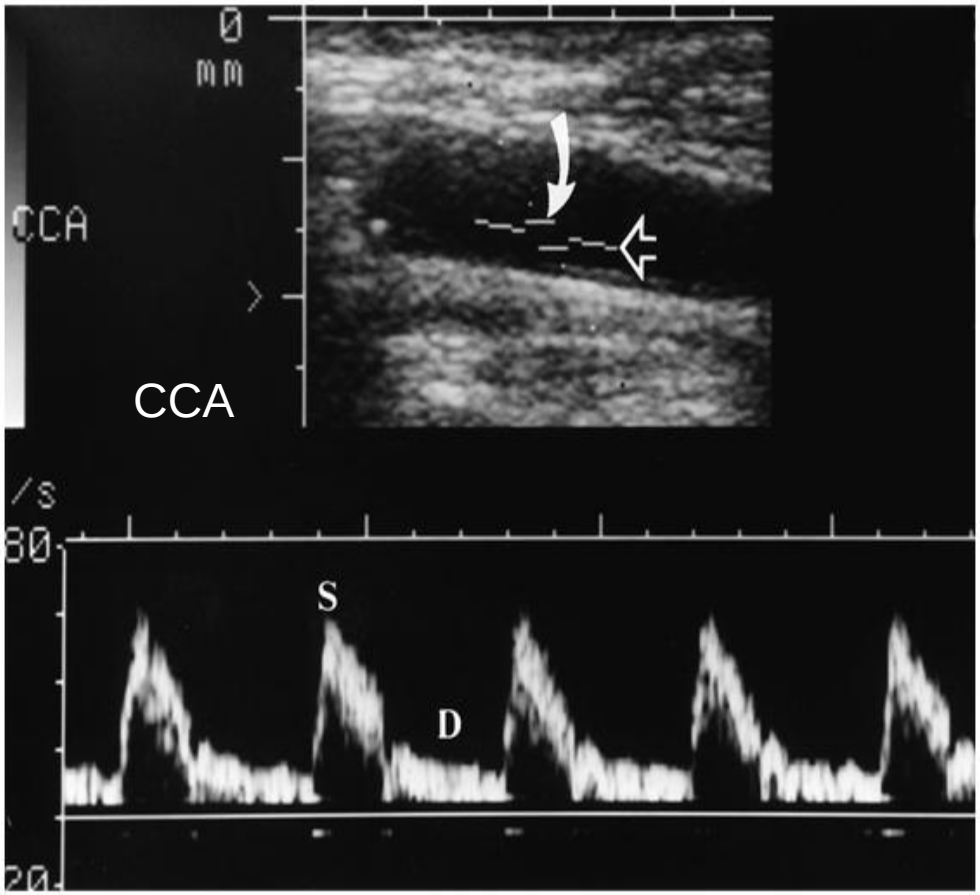


***FIGURE 40.3.* Duplex Doppler US.** US image shows the Doppler spectrum of the common carotid artery. The vertical scale shows blood flow velocity in meters per second. The horizontal scale shows time in seconds. The Doppler trace demonstrates peak velocities in systole (S) and low flow velocities in diastole (D). A 2-mm Doppler sample volume (*curved arrow*) is placed by the sonographer in the midportion of the artery visualized by real-time US. Only Doppler shifts originating from this sample volume are analyzed for display. An estimated Doppler angle of 50° is communicated to the US unit computer by aligning the angle indicator (*open arrow*) parallel to the vessel walls.

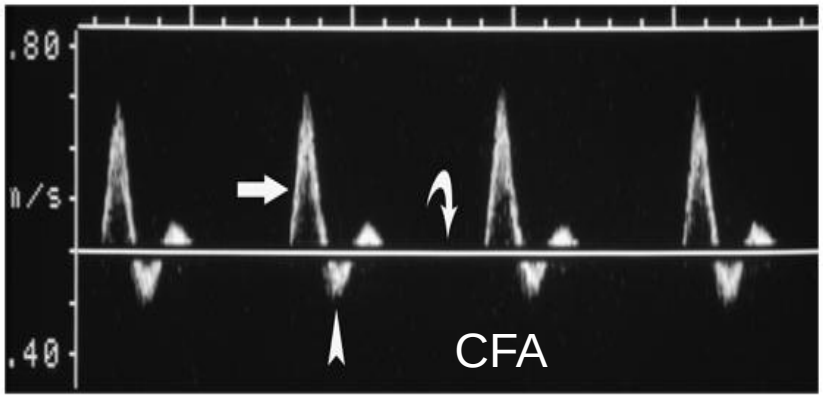


***FIGURE 40.4.* High-Resistance Doppler Spectrum.** A highresistance waveform is characterized by rapid systolic upstroke (*straight arrow*), low flow velocities during diastole (*curved arrow*), and, commonly, reversal of flow direction (*arrowhead*) in early diastole. This Doppler spectrum was obtained from the common femoral artery.

Rapid syst upstroke, inv in early diast,
And no flow in mid-late diast, CFA.

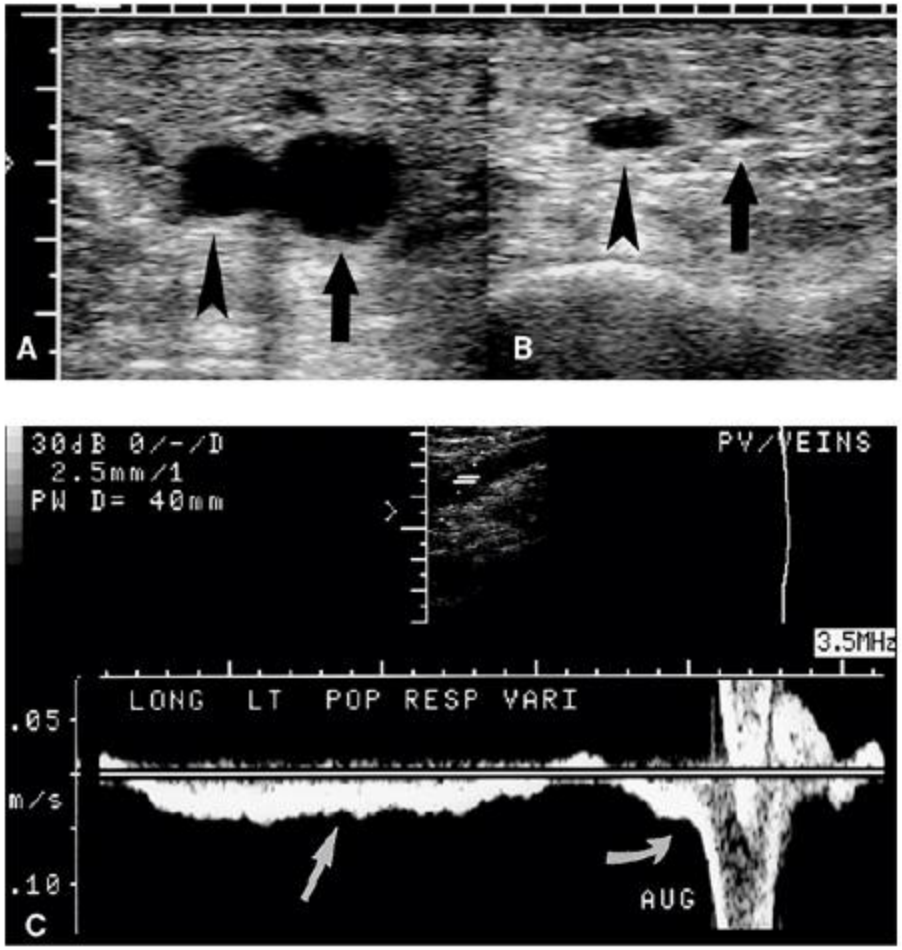


FIGURE 40.46. **Normal Venous Compressibility, Respiratory Phasicity, and Augmentation.** **A.** Transverse grayscale imaging demonstrates the normal common femoral artery (*arrowhead*) and vein (*arrow*). **B.** With compression, the normal vein (*arrow*) is obliterated and the arterial lumen (*arrowhead*) persists. Enough compression has been applied to deform the arterial lumen (making it more oval) but not obliterate it. **C.** Spectral Doppler shows the normal respiratory phasicity (*arrow*) and augmentation from squeezing the calf (*curved arrow*) in the normal popliteal vein.

Common
Fem Vein
Clear /
No thrombus.

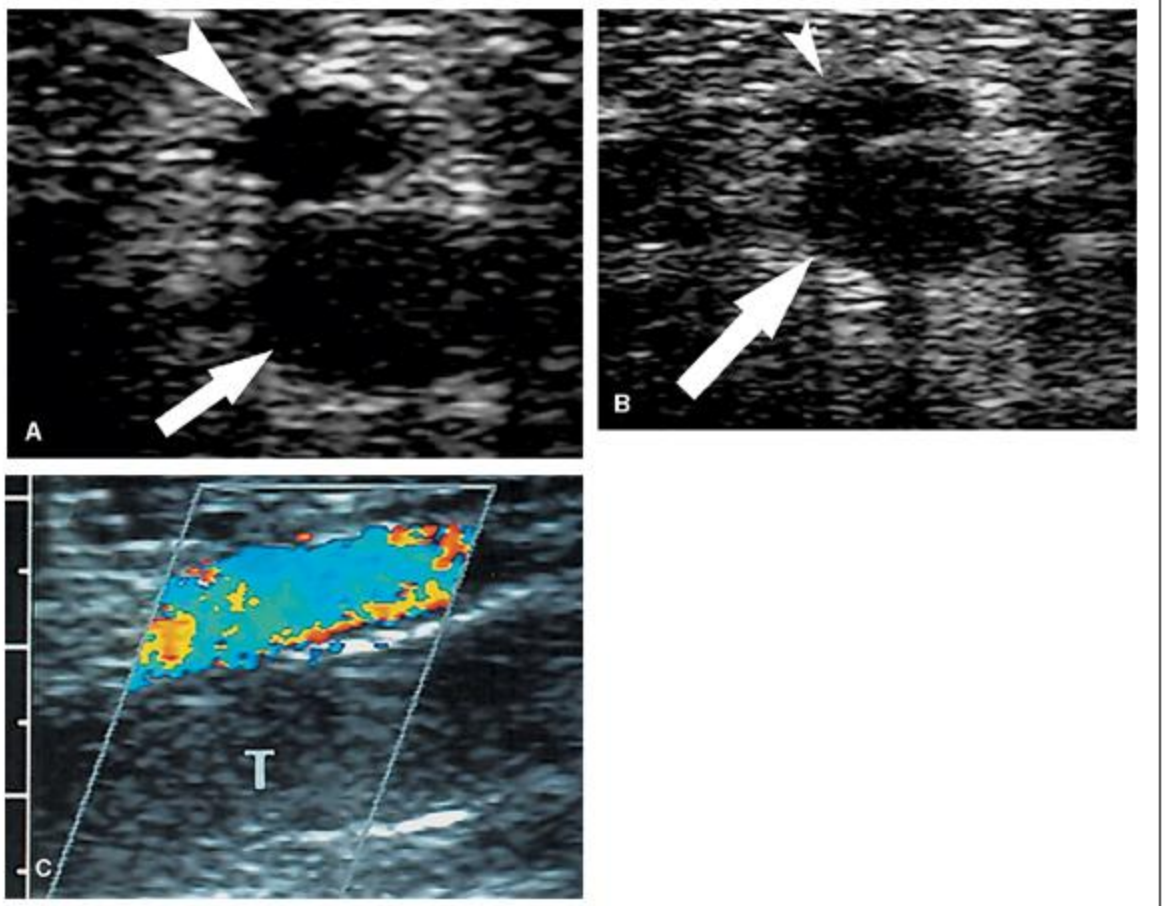


FIGURE 40.47. **Deep Venous Thrombosis.** Transverse images without **(A)** and with **(B)** compression demonstrate a noncompressible, distended superficial femoral vein (*arrow*) diagnostic of a DVT. Note that enough pressure has been applied to deform the artery (*arrowhead*) when compared to the adjacent image without compression. **C.** Longitudinal color Doppler image of the superficial femoral vein demonstrates echogenic thrombus (T) and no color flow. Flow is present in the superficial femoral artery anteriorly.

+ DVT – deep
Vein thrombosis
By uls.

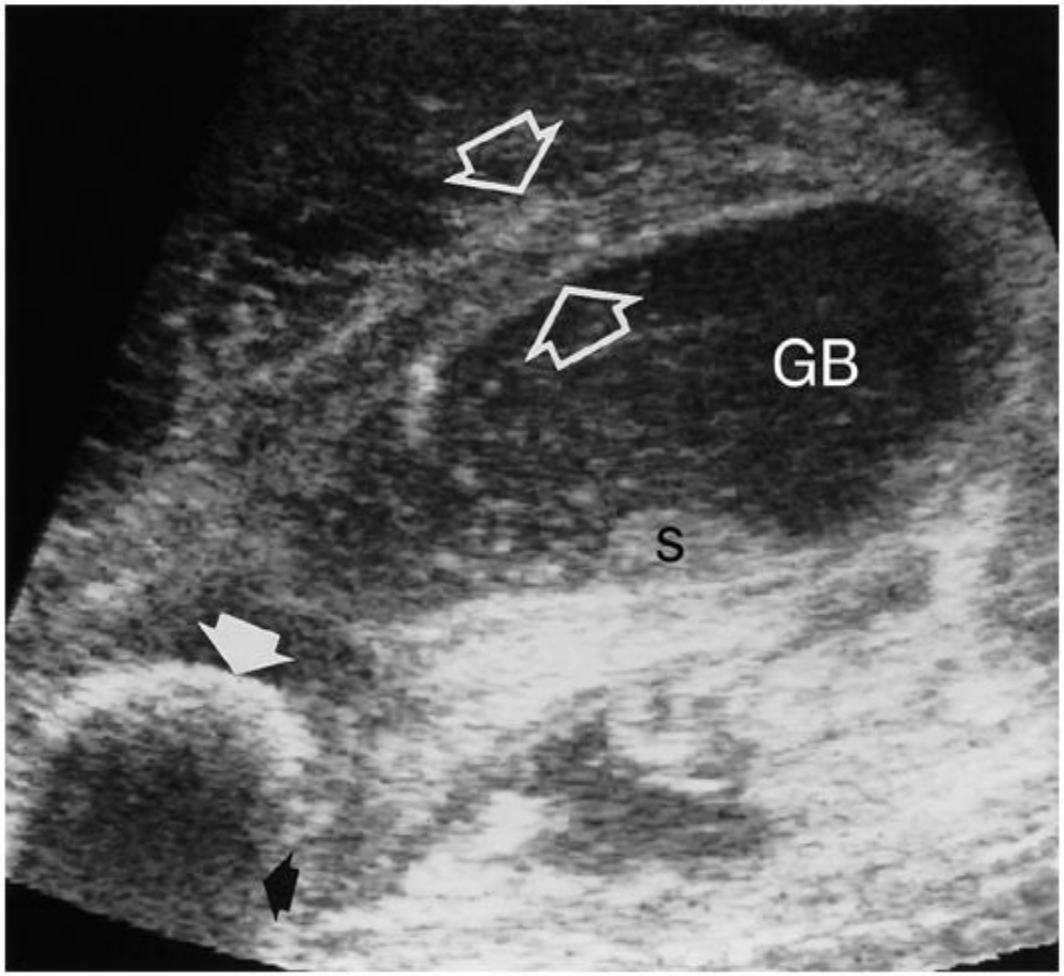
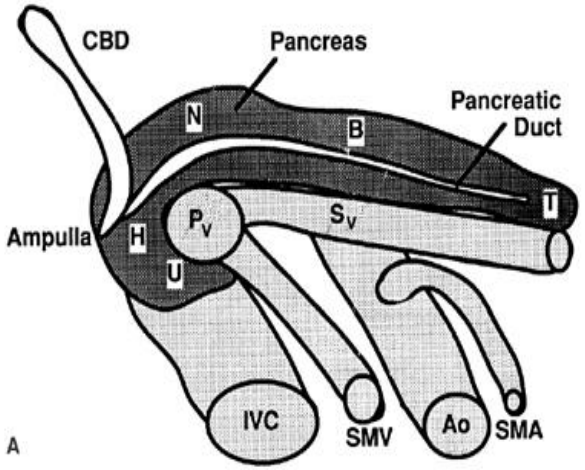


FIGURE 36.22. **Acute Cholecystitis.** US image through the long axis of the gallbladder (GB) demonstrates a large gallstone (*solid white arrow*) impacted in the neck of the gallbladder and casting an acoustic shadow (*black arrow*). The gallbladder wall is thickened (*open arrows*) and edematous. Echogenic sludge (s) is seen within the gallbladder lumen, giving evidence of bile stasis. A sonographic Murphy sign was present.



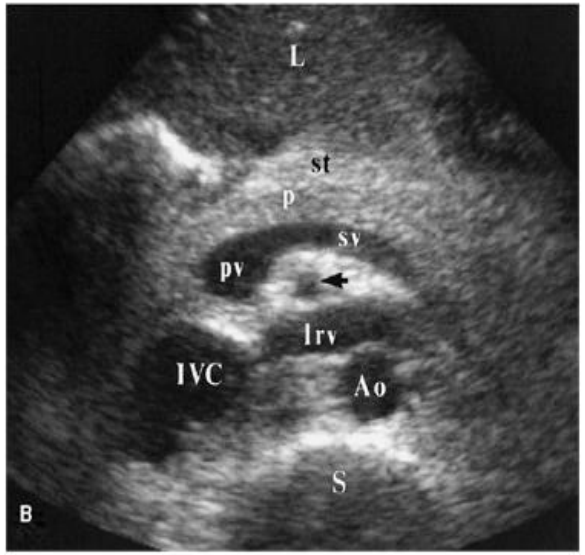


FIGURE 36.30. **Normal Pancreas Anatomy.** A diagram **(A)** and an US in transverse plane **(B)** demonstrate the norma anatomy of the pancreas. The majority of the pancreas lies anterior to the splenic vein (sv) and its junction with the supe mesenteric vein (SMV), which forms the portal vein (pv). The head (H) and uncinate process (U) of the pancreas cradle origin of the portal vein. The pancreatic neck (N) is anterior to the sv-SMV confluence, and the uncinate process and int vena cava (IVC) are posterior to the confluence. The superior mesenteric artery (SMA, *arrow*) arises from the aorta (Ao) dorsal to the splenic vein. The left renal vein (lrv) passes between the SMA and aorta to the IVC. The left lobe of the liver (L) offers a good sonographic window to the pancreas. The stomach (st) and lesser sac (collapsed) are anterior to the pancreas. CBD, common bile duct; S, spine; B, body of the pancreas; T, tail of the pancreas; p, pancreas.

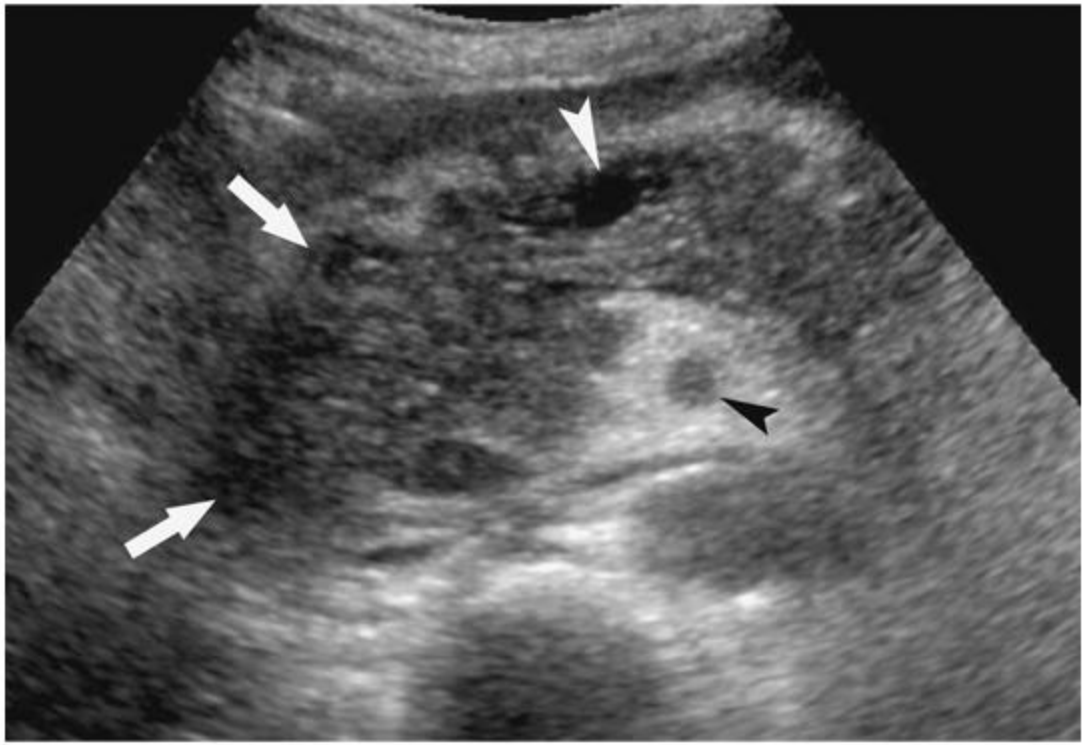
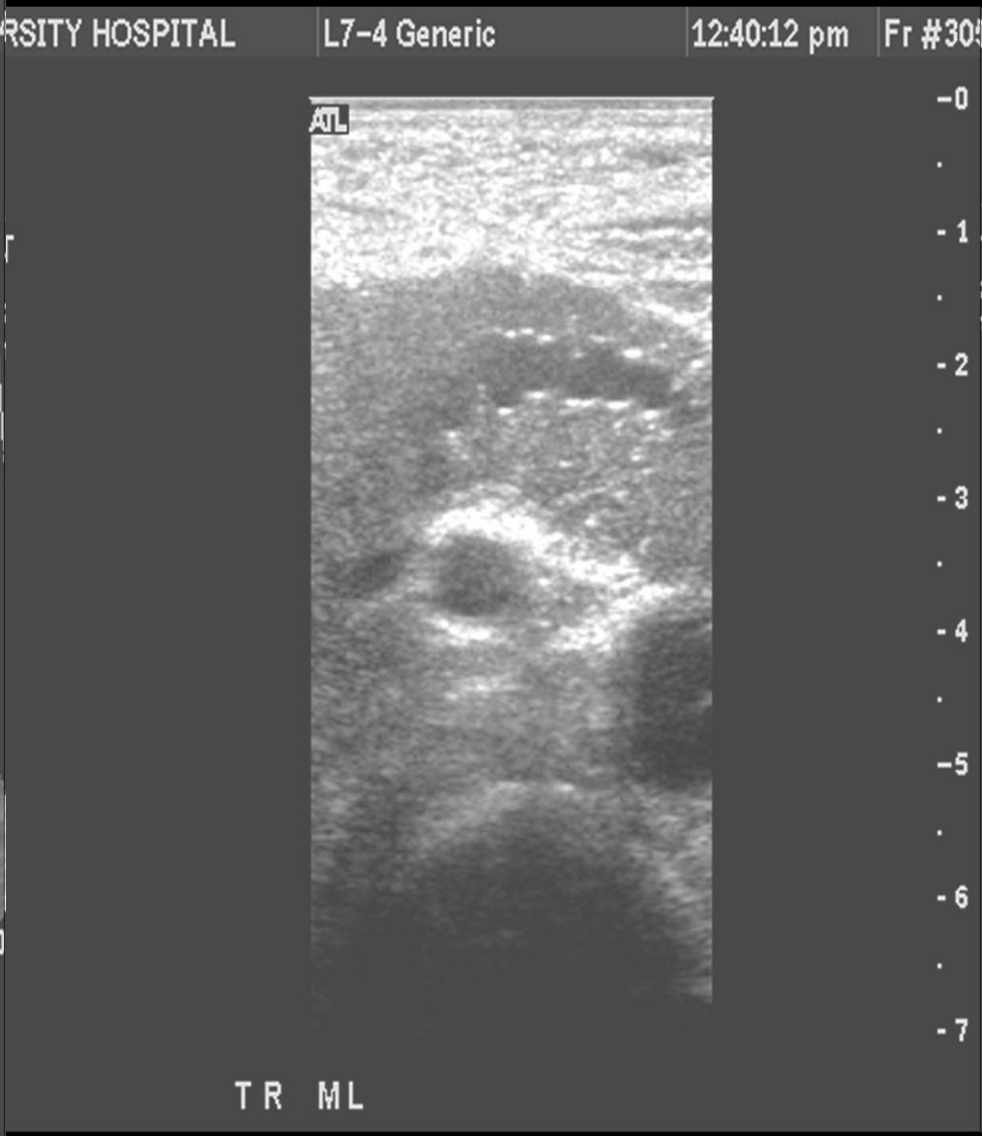


FIGURE 36.34. **Adenocarcinoma of the Pancreas.** The tumor is seen as a subtle hypoechoic mass (*arrows*) enlarging the head of the pancreas. The tumor margins are poorly defined. The pancreatic duct (*white arrowhead*) is dilated and terminates abruptly as it encounters the tumor. The superior mesenteric artery (*black arrowhead*) and its surrounding collar of echogenic fat are preserved.

NOT SHOWN

This med res, TR ML

Panc head mass and duct obst.
This mid panc hi res.



- What is a safer way to do an Int Jug Vein puncture?
  - A. Blindly, using phys exam landmarks?
  - B. Using ultrasound IF you have a clue how to use the ultrasound
  - C. Using ultrasound, **but you hardly have** a clue how to use the ultrasound

What is a safer way to do a Diagnostic thoracentesis?

- A. Phys exam assistance, 8F standard thoracentesis catheter used.
- B. Ultrasound assistance, IF you have a clue how to use the ultrasound, 22g needle.
- C. Ultrasound assistance, BUT YOU have little idea how to use uls, 22g needle.
- D. Phys exam assistance, after seeing a good CXR or CT that shows much pleural fluid. 22 g needle.
- E. Ultrasound assistance, IF you have a clue how to use the ultrasound. Std 8F thoracentesis catheter.

- OF ALL OF RADIOLOGIC PROCEDURES, ULTRASOUND IS PROBABLY WITH THE MOST VARIABLE RESULTS regarding image production and thus interpretation, depending on who is involved and how good are they with what is ordered and they do.
- (Not across the board, but generally. If one does few of ……, then ……)

Maybe end near here

ULTRASOUND PEARLS (not shown)

- Attenuation of beam = beam loss by scatter and absorption, and it increases with increasing frequency (10MHz more than 4 MHz).

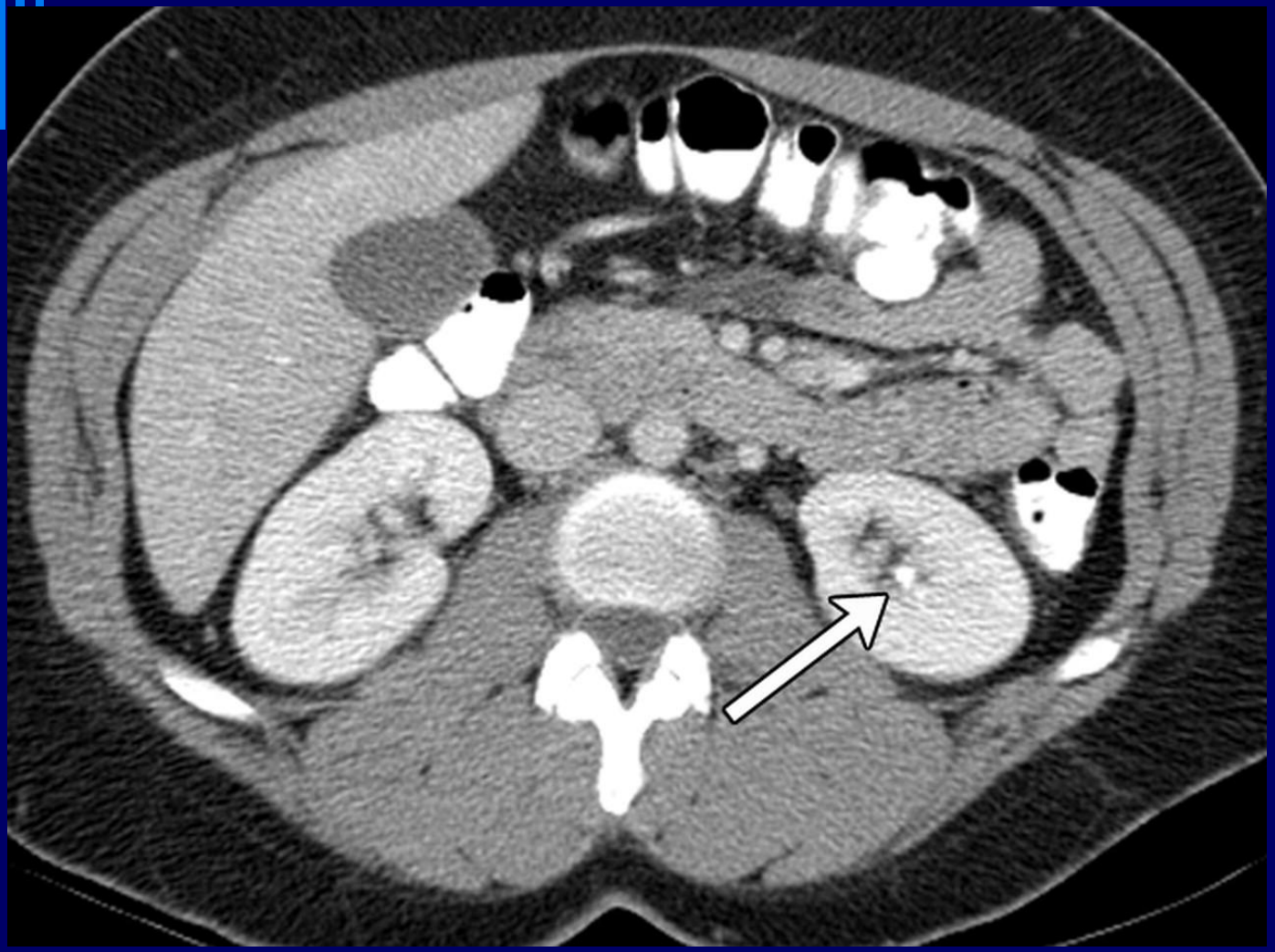
- ULS Freq's much higher than audible sound, so uls attenuated much faster than audible sound.

ULTRASOUND PEARLS

- The more things you try and see, the less you may see of what you really want to see. (old law of diminishing returns.)


pico
DRE - Call: 1.800.462.8195 - Visit: www.dremed.com

Figure 3a: CT scans in a 36-year-old woman with abdominal pain



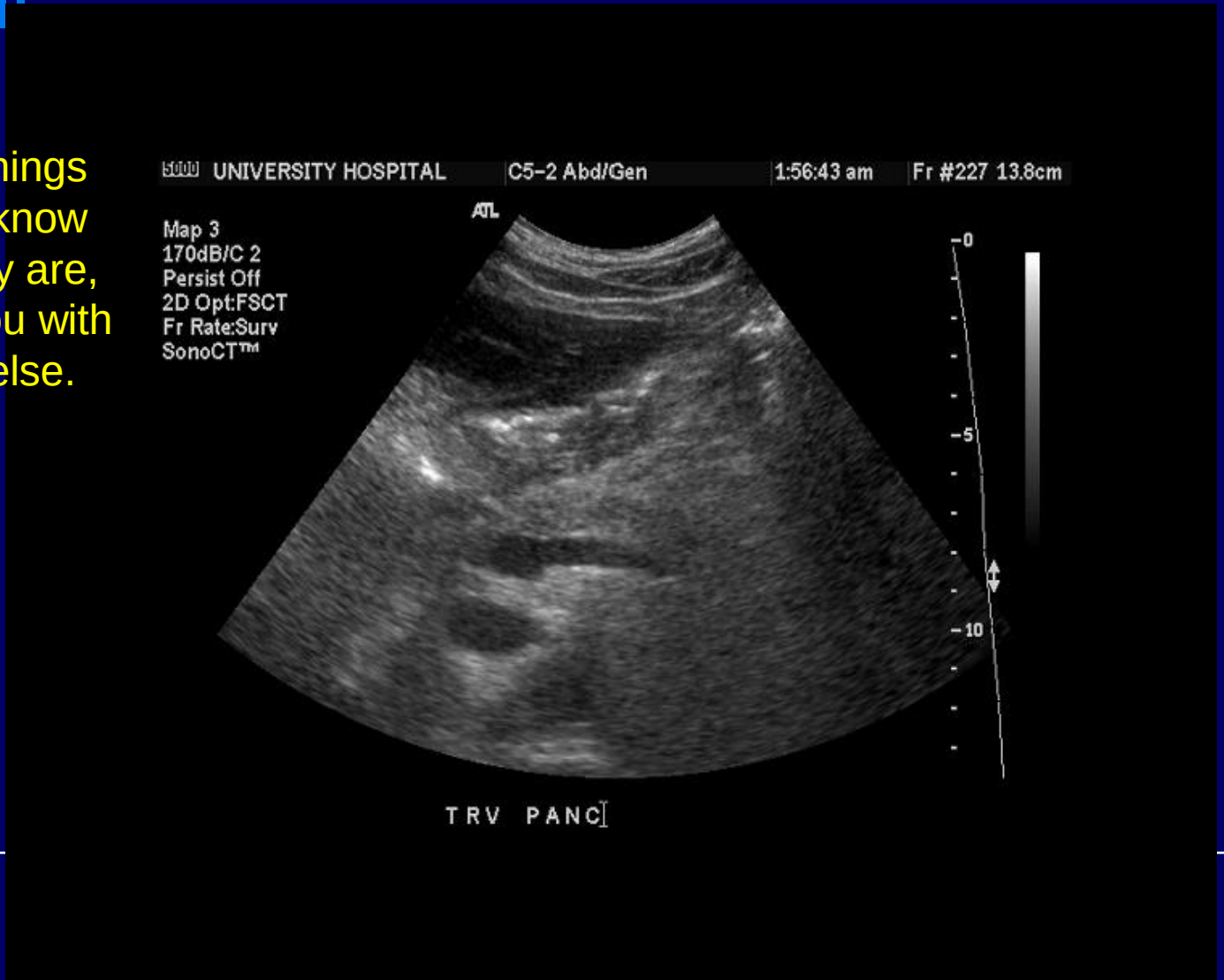
Jaffe, T. A. et al. Radiology 2007;242:175-181

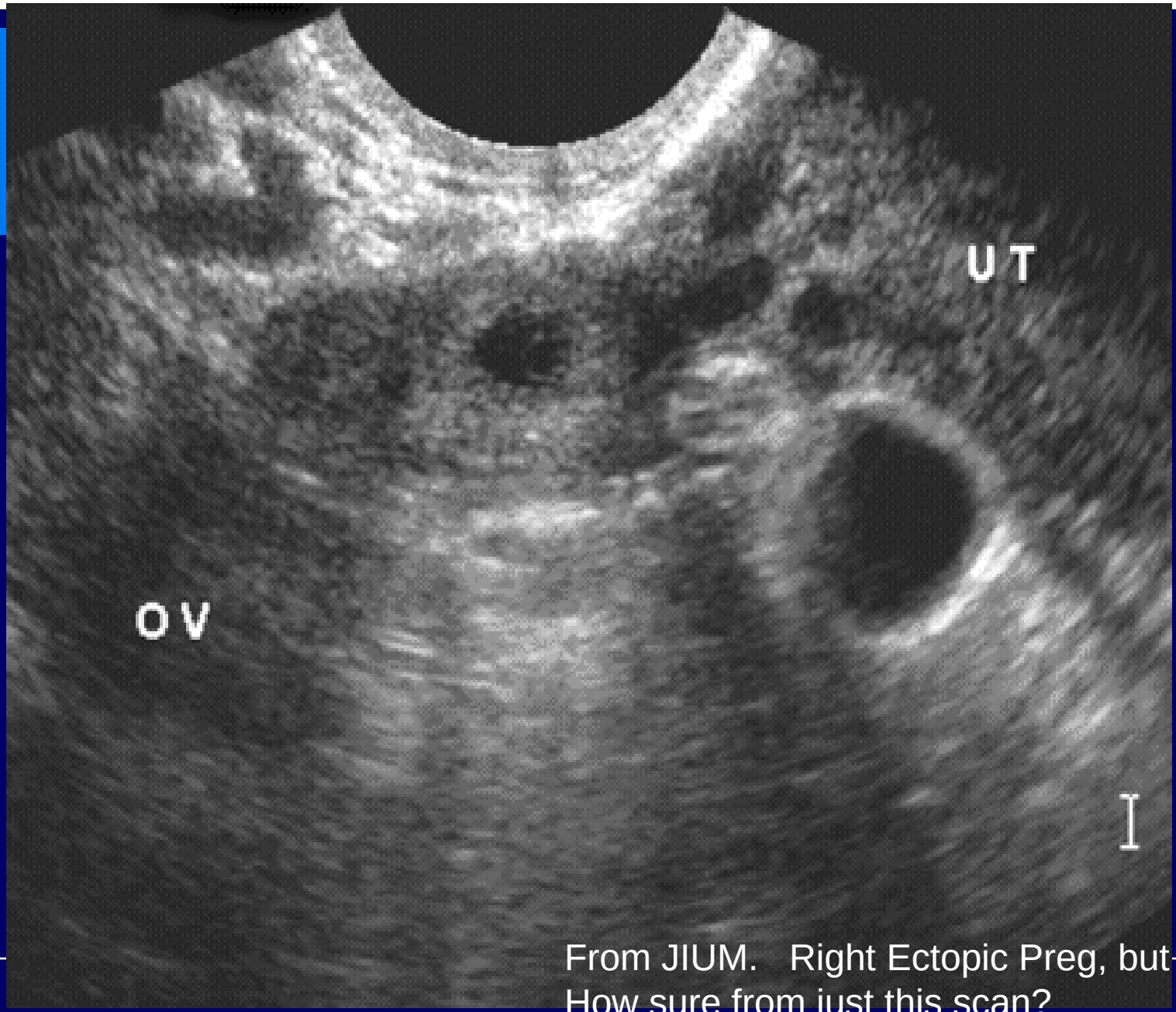
- That was a kidney stone.
- Is uls any good for kidney stones?

- Kid stone?

TR ML Panc – anat, c no c

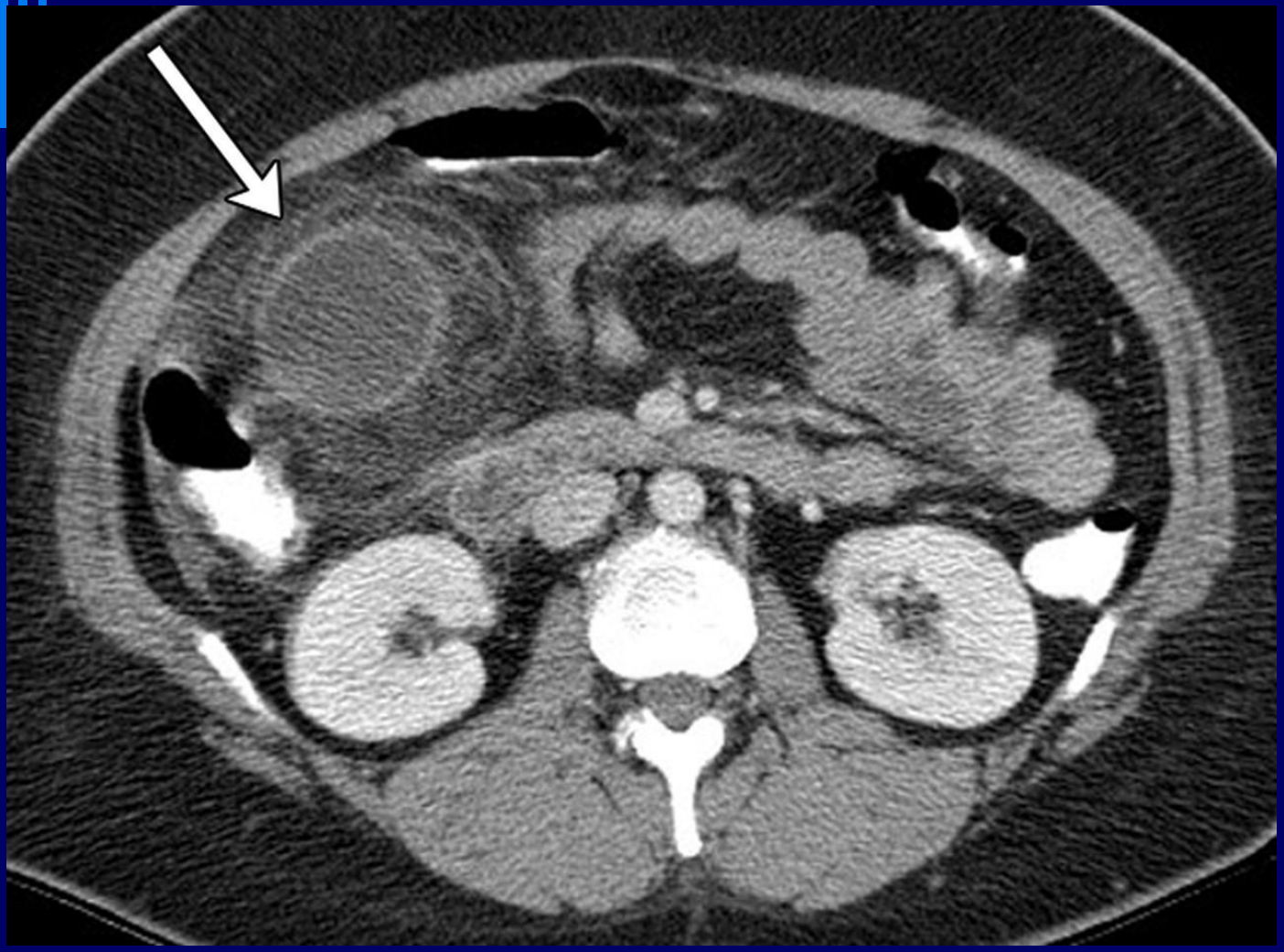
Look for things
That You know
What They are,
To help you with
Anything else.





From JIUM. Right Ectopic Preg, but How sure from just this scan?

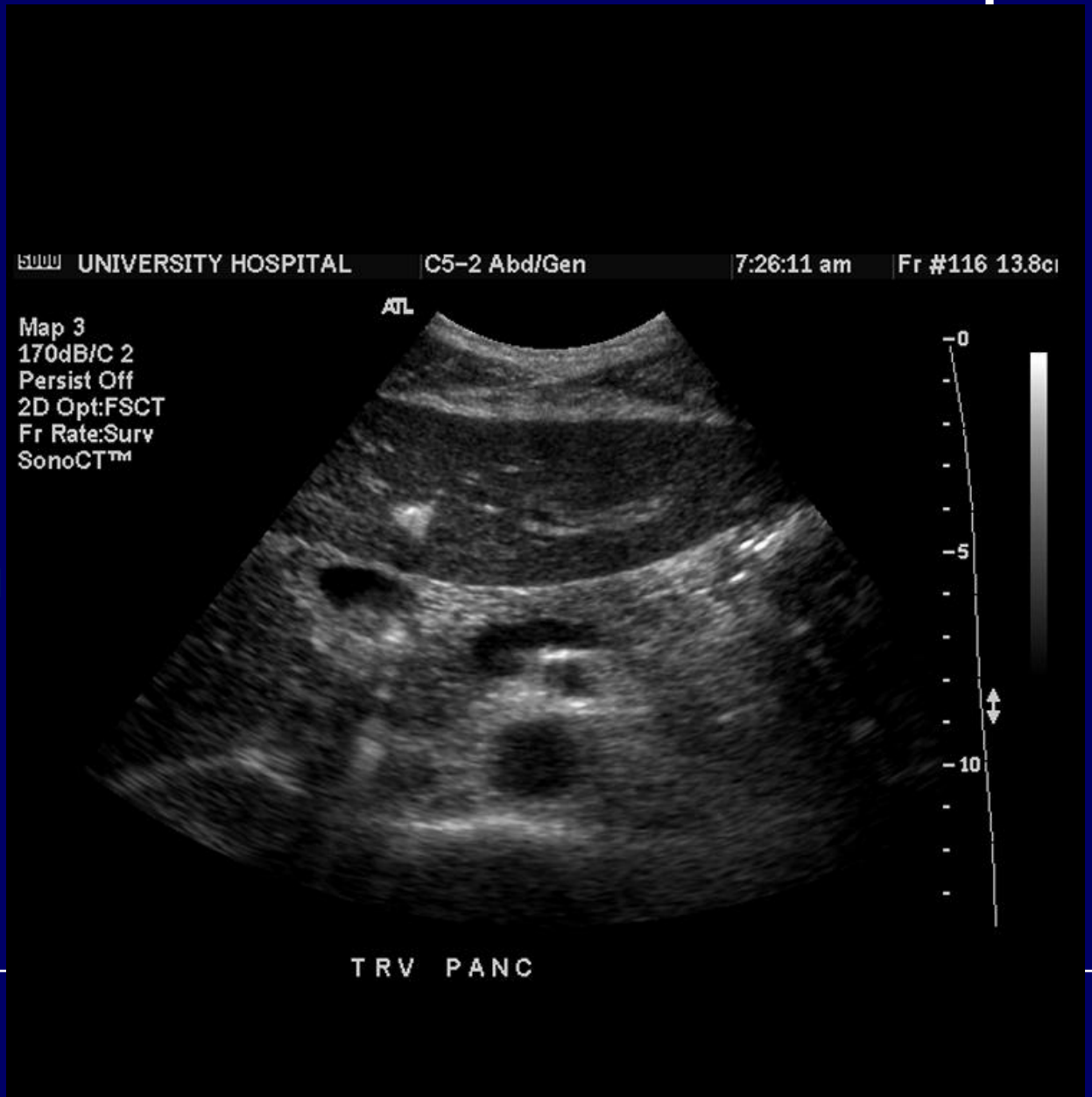
Figure 2a: CT scans in a 43-year-old woman with acute abdominal pain



Jaffe, T. A. et al. Radiology 2007;242:175-181

TR ML - uls anat- ? R of panc

GB or
What?
Duodenum.
NOT SHOWN



Reflection Intensities at interfaces of tissue and ---

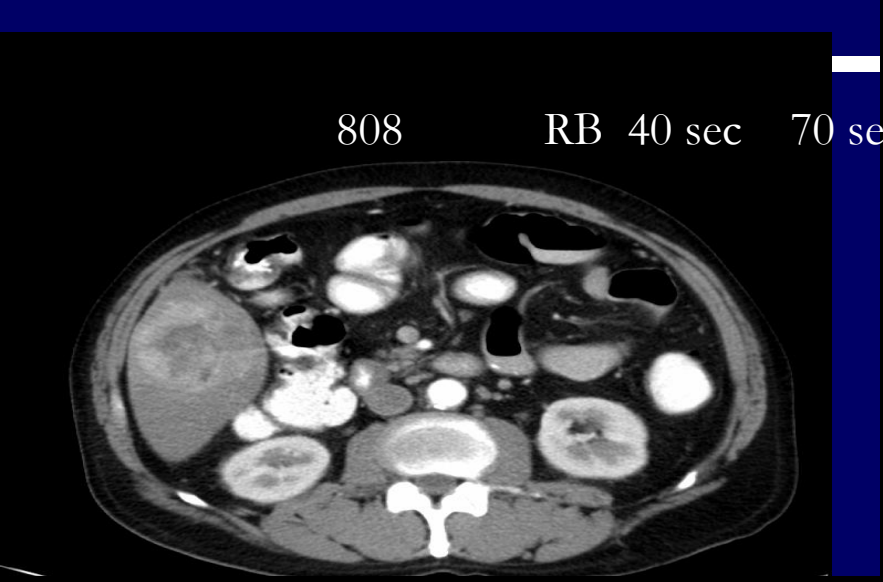
NOT SHOWN

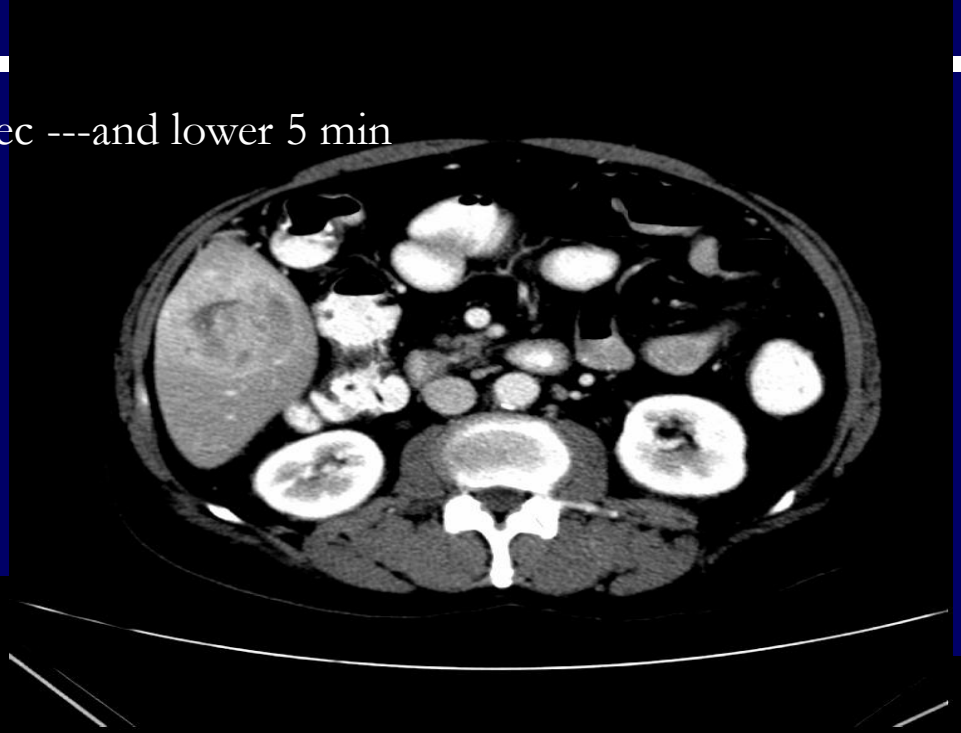
- Tissue to Air ----99% reflected
- Tissue to Bone ---40% reflected
- Soft tissue to fat/muscle --<1% reflected.
-
- Sound to new tissue, wavelength changes, b/c velocity changed.

RB 808

Notice thru transmission, more of a fluid trait,
But this not a fluid lesion..

808 RB 40 sec 70 sec ---and lower 5 min





+ for HCC , hx hepc and etoh abuse-- uls done was only for bx

Needle Uls guided bx – hepatoma.

Sag GB fld, wall prom, stone not AC by HIDA

Gallstones
And some ascites

TR RT – small R Pleural Eff

Sag R Kid- normal

Sag R Kid - med ren dz

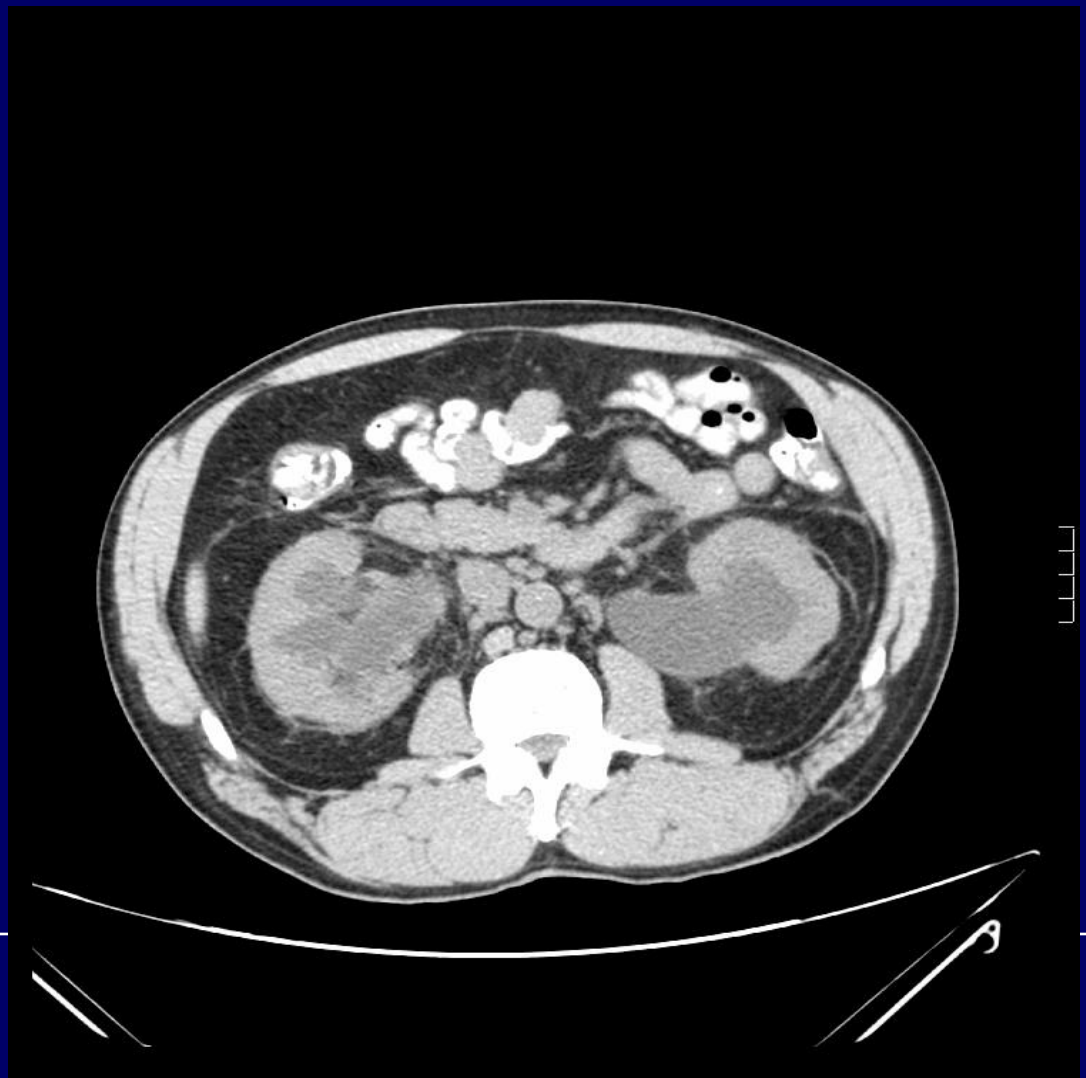
R Kid hydro


UNIVERSITY HOSPITAL
C5-2 Abd/Gen
2:03:38 am
Fr #204 13.8cm
Map 3
170dB/C 2
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT™
ATL
0
5
10
SAG RT KIDN

L Kid Hydro


5000
UNIVERSITY HOSPITAL
C5-2 Abd/Gen
2:14:22 am
Fr #186 13.8cm
Map 3
170dB/C 2
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT™
ATL
0
5
10
SAG LT KIDN

CT oral contrast only- kid hydro Bilat.



Sag pel – uterus IUP

Endovag
Early IUP, about 6 weeks, same pt as prior slide.

Uls TA (probe on skin) 6wk iup

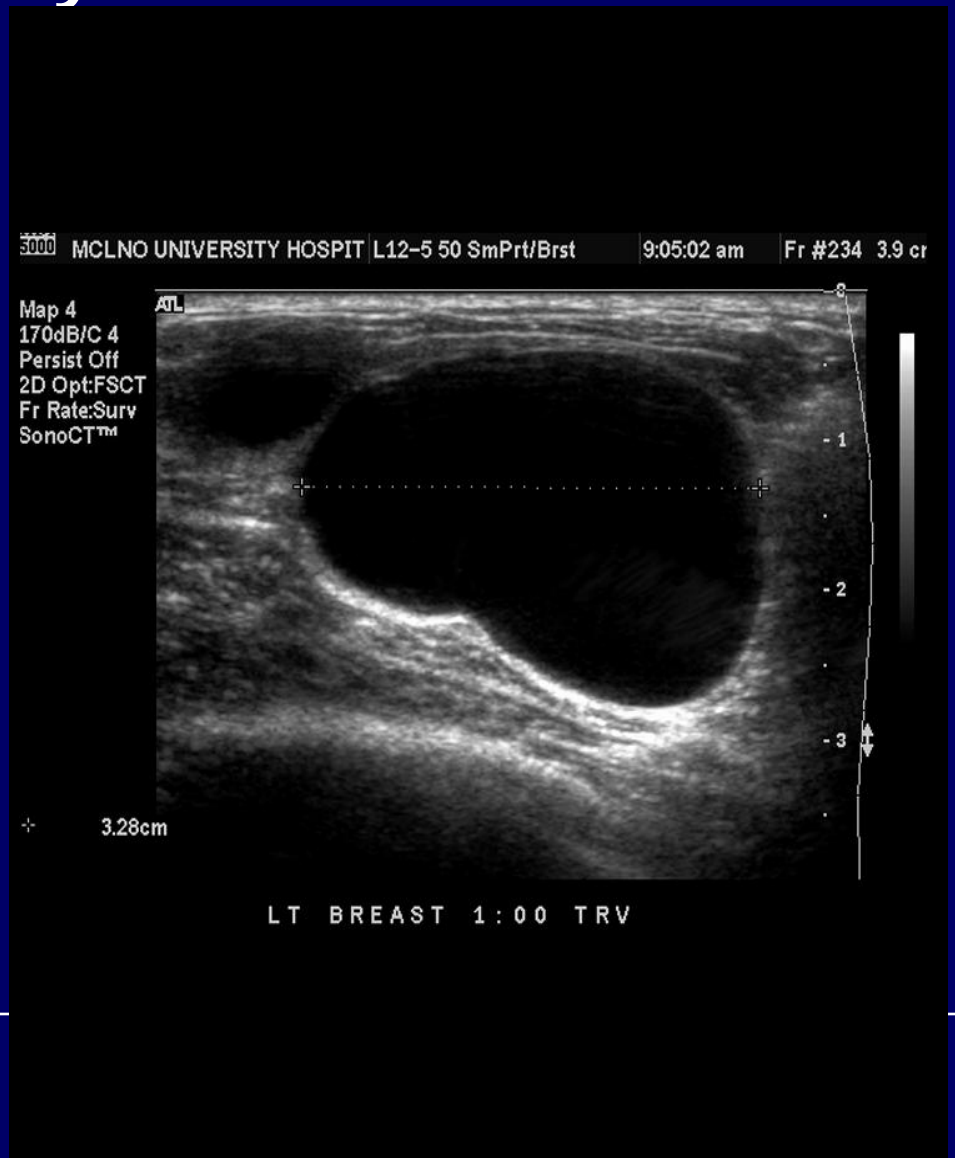
NOT SHOWN

NOT SHOWN

5.5 – 6 wk Preg, endo Vag uls. Gest sac And yolk Sac. No Fetal seen Or expected To be seen Yet.

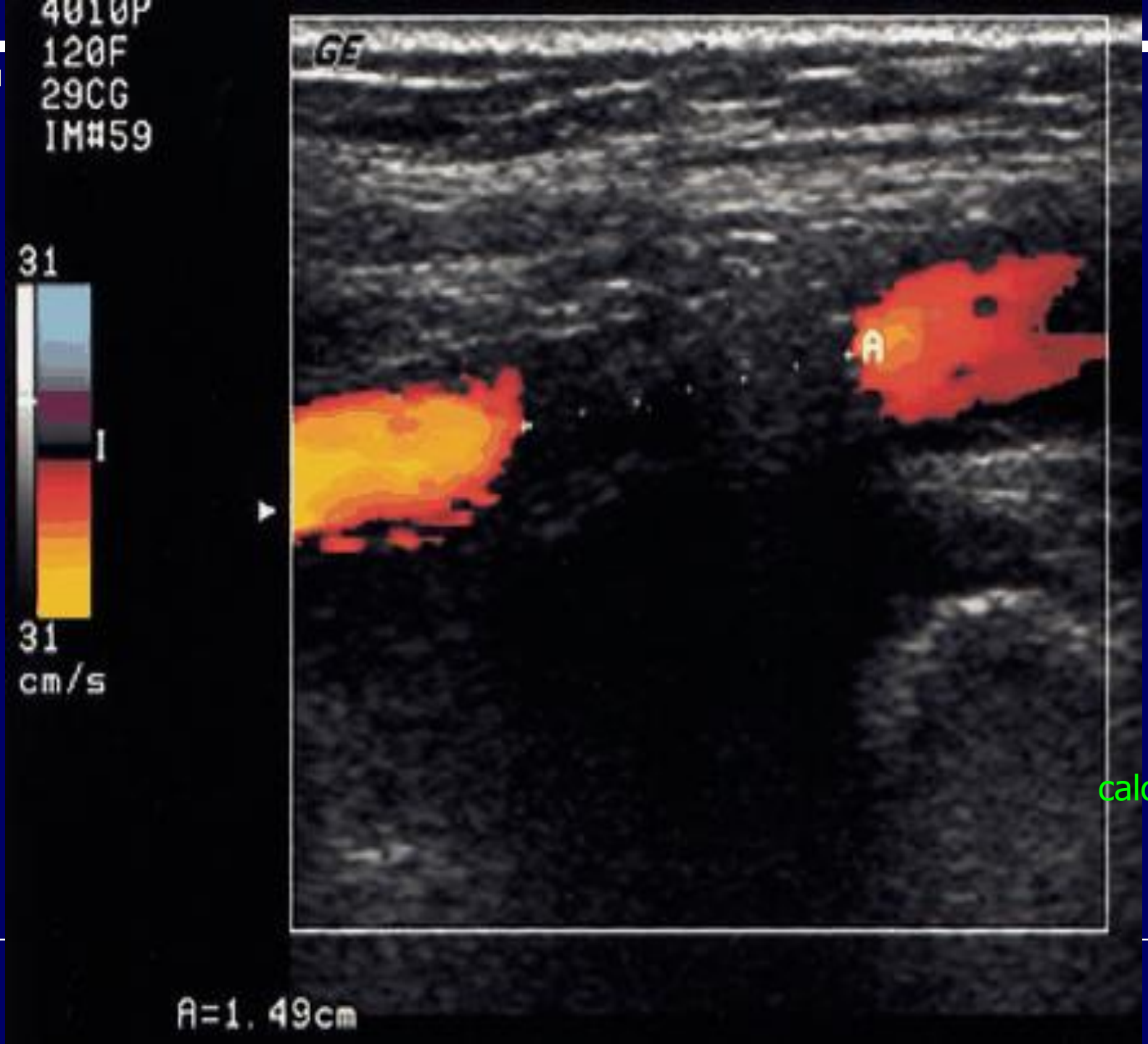
Normal breast at uls

Breast cyst at uls



Breast Cancer at uls

Breast uls is
Debated. Good
For some things
Like palp masses
, but
Does it find too
Many things??,
Particularly if pt. is
asymptomatic
And just being
Screened???
Maybe.



calcification
-can't
-See
-Behind it

ULTRASOUND PEARLS

IS ULTRASOUND USER DEPENDANT?

- yes, …….but what isn't.

- Good info, good techs, good docs, lead to good scans.

ULTRASOUND PEARLS

- Boast about weaknesses
- (don’t try and DO IT ALL yourself.)
- “If I must boast, I will boast of the things that show my weakness. …… “ For when I am weak, then I am strong.”

- (1 Cor 11:30, 12:10b)

ULTRASOUND PEARLS

- People,
  People who need people,
  Are the luckiest people in the world
  We're children, needing other children
  And yet letting a grownup pride
  Hide all the need inside
  Acting more like children than children…

- ---Barbara Streisand

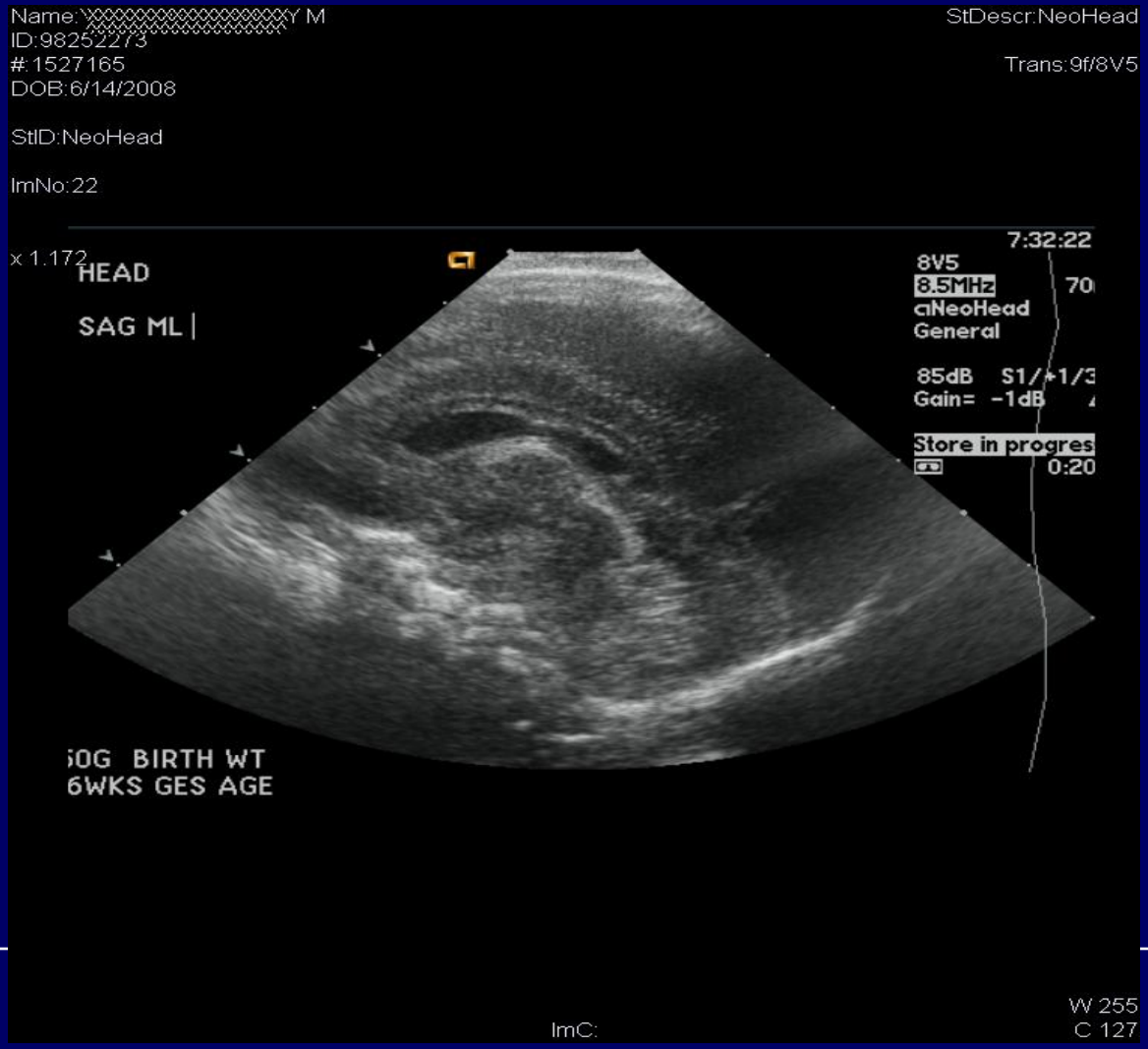
Foley cath in bladder, and uterus with gest sac in it.

Same as prev TRV 13 wk iup

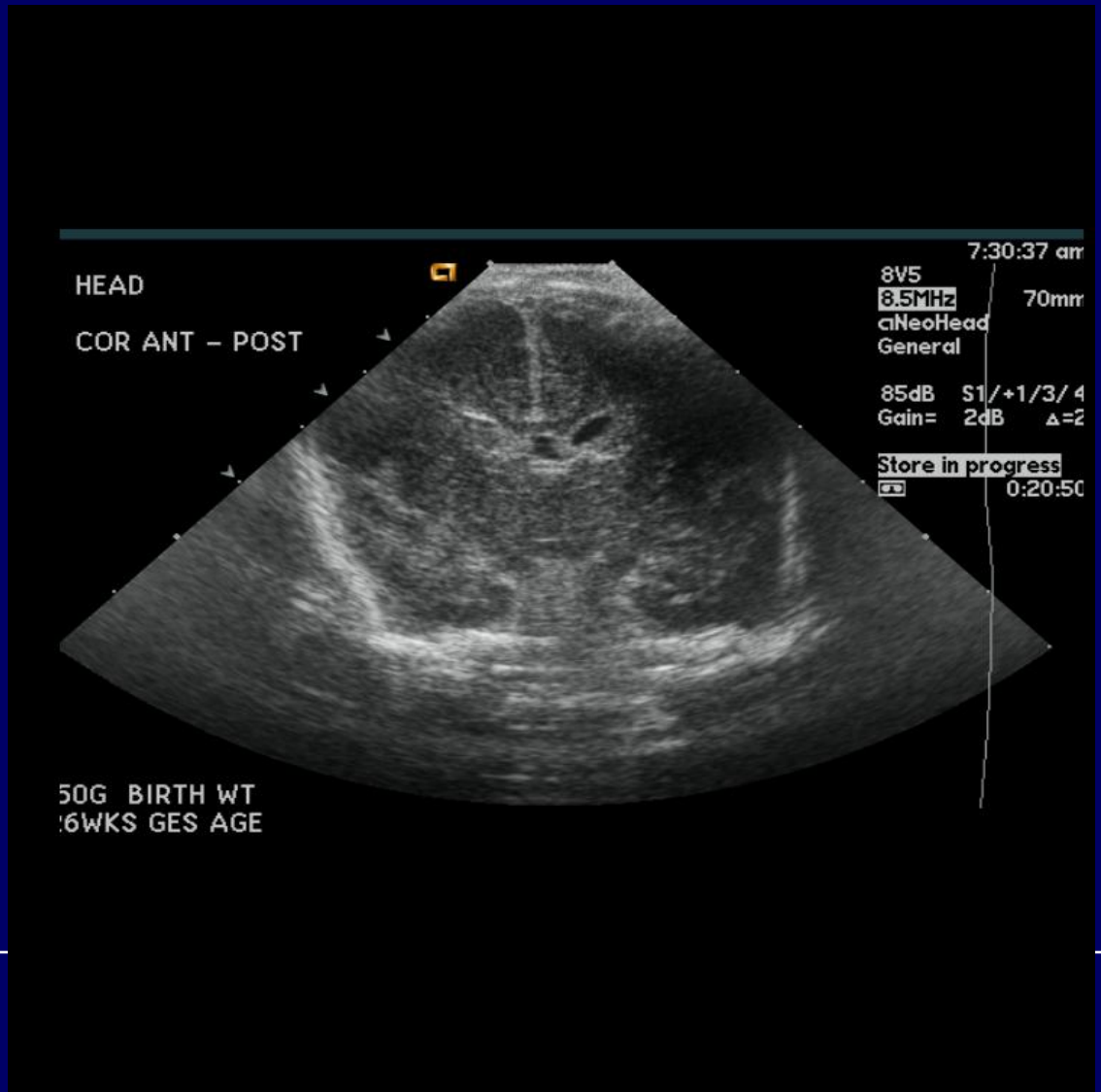
ULS pearls

- **THANK YOU**
- **THE END. Maybe.**

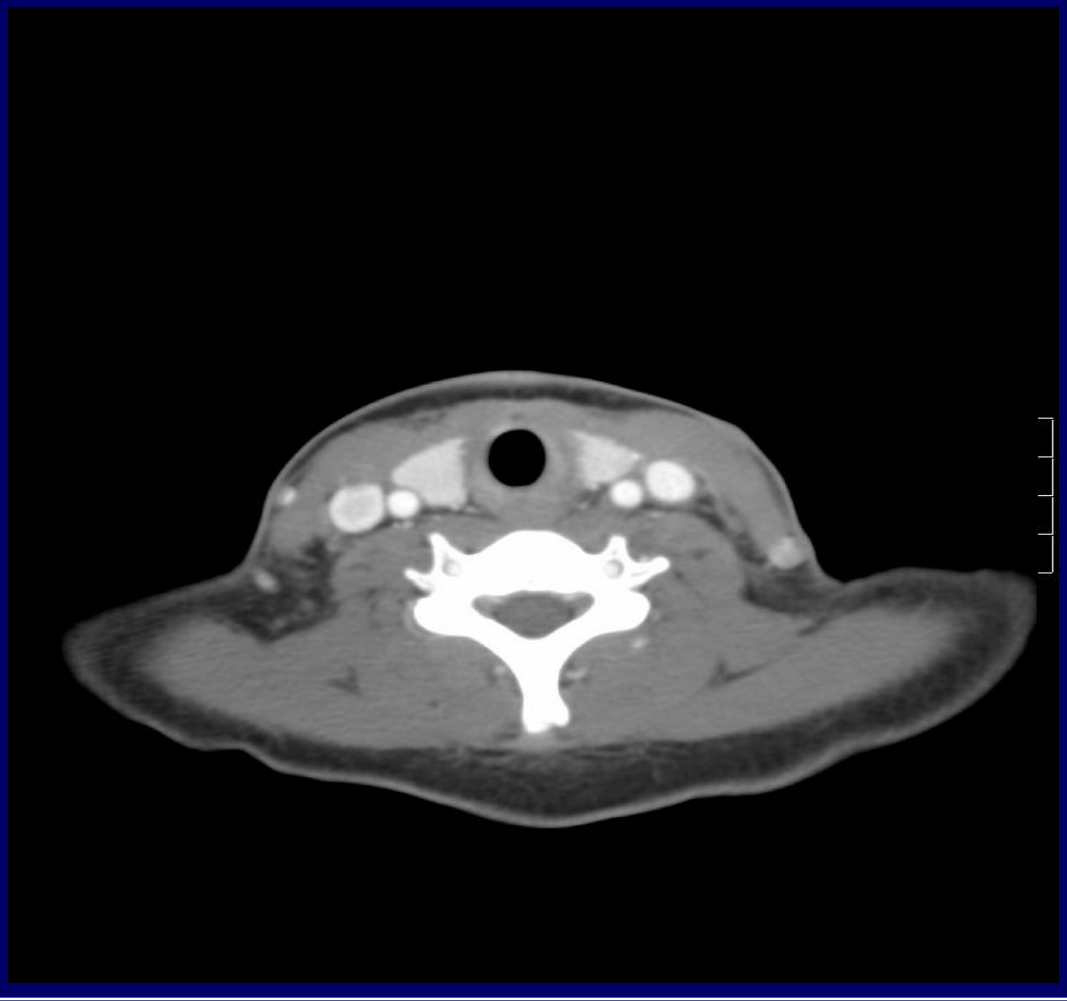
ULS 26 wk gest newborn- sag



ULS 26 wk gest newborn COR

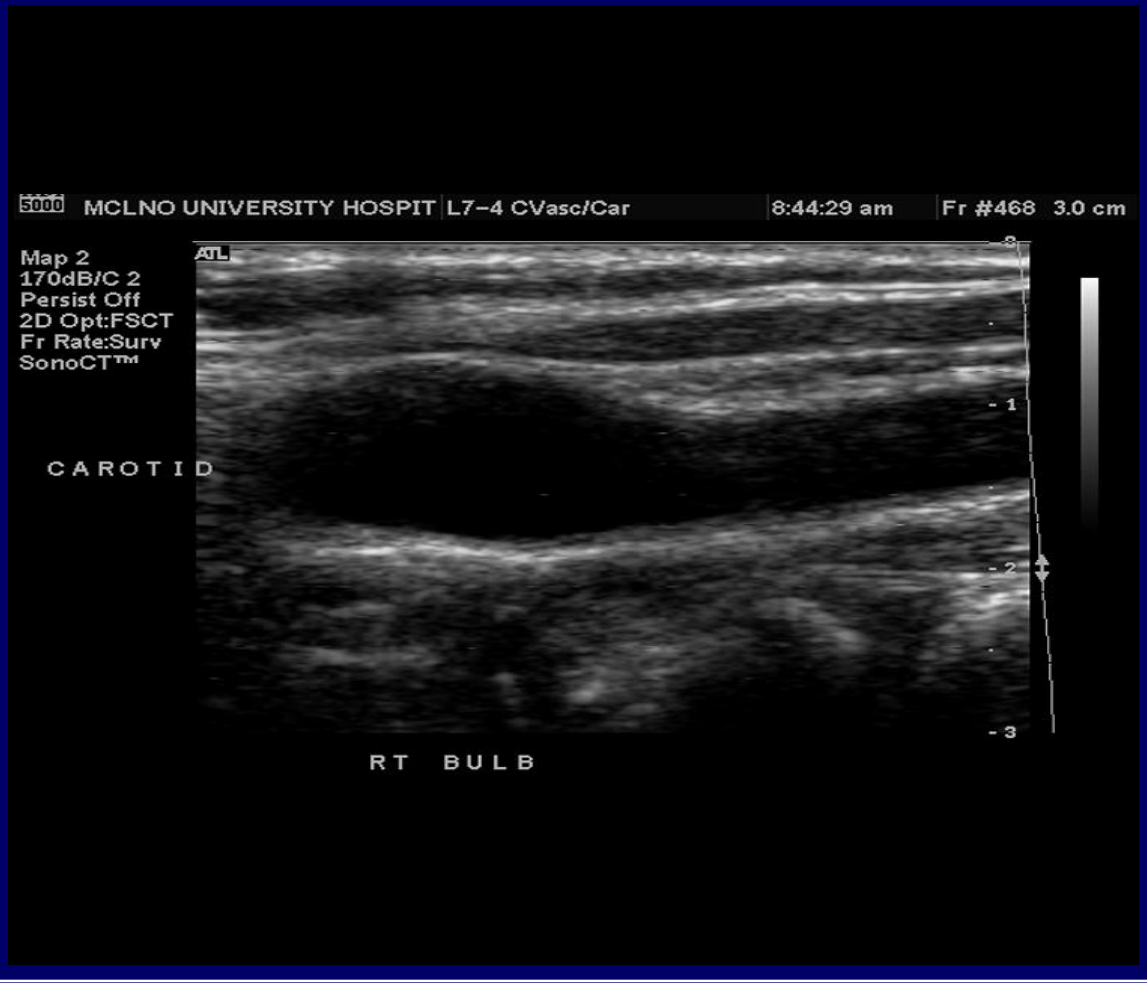


CT neck + IV contrast

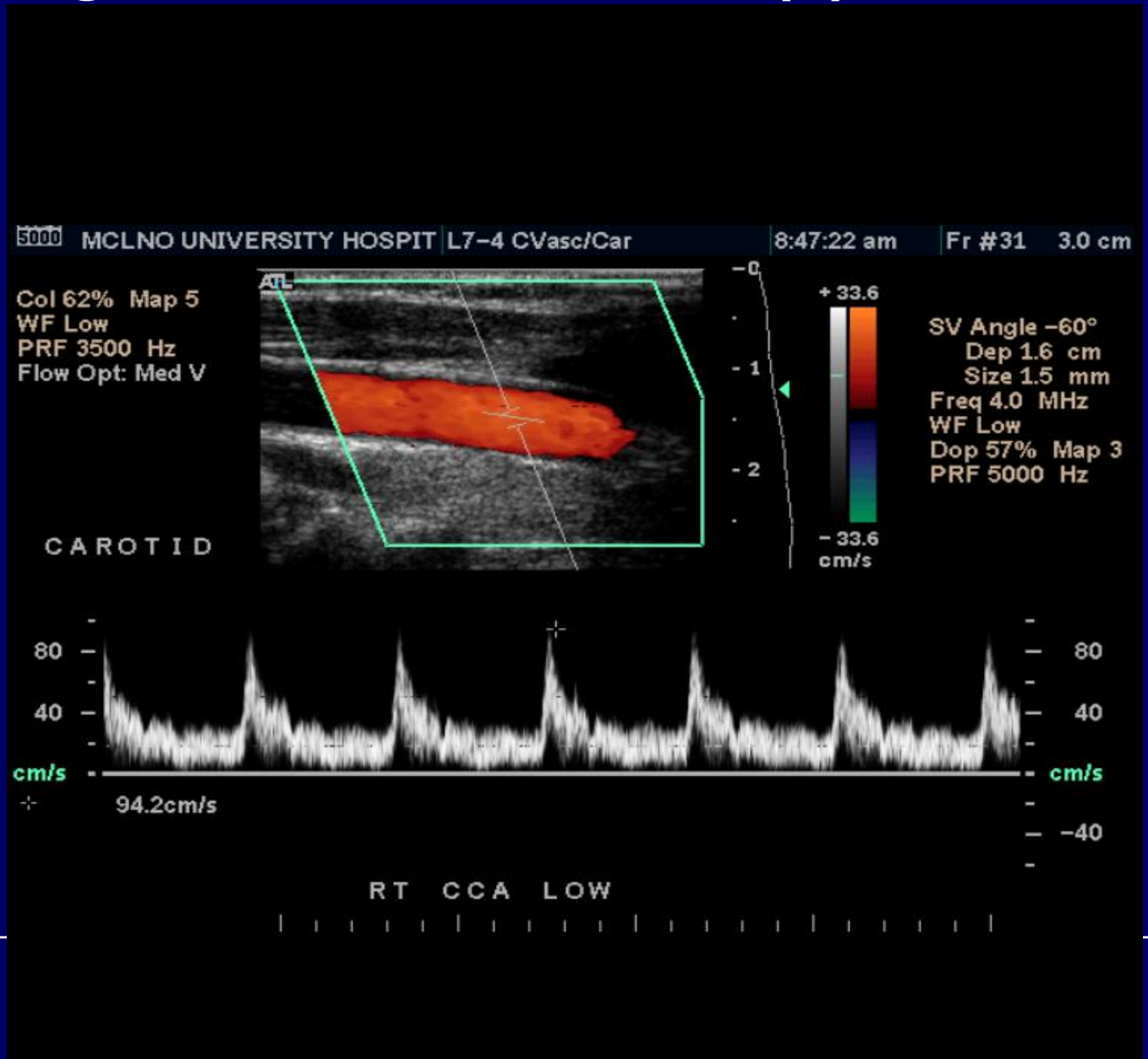


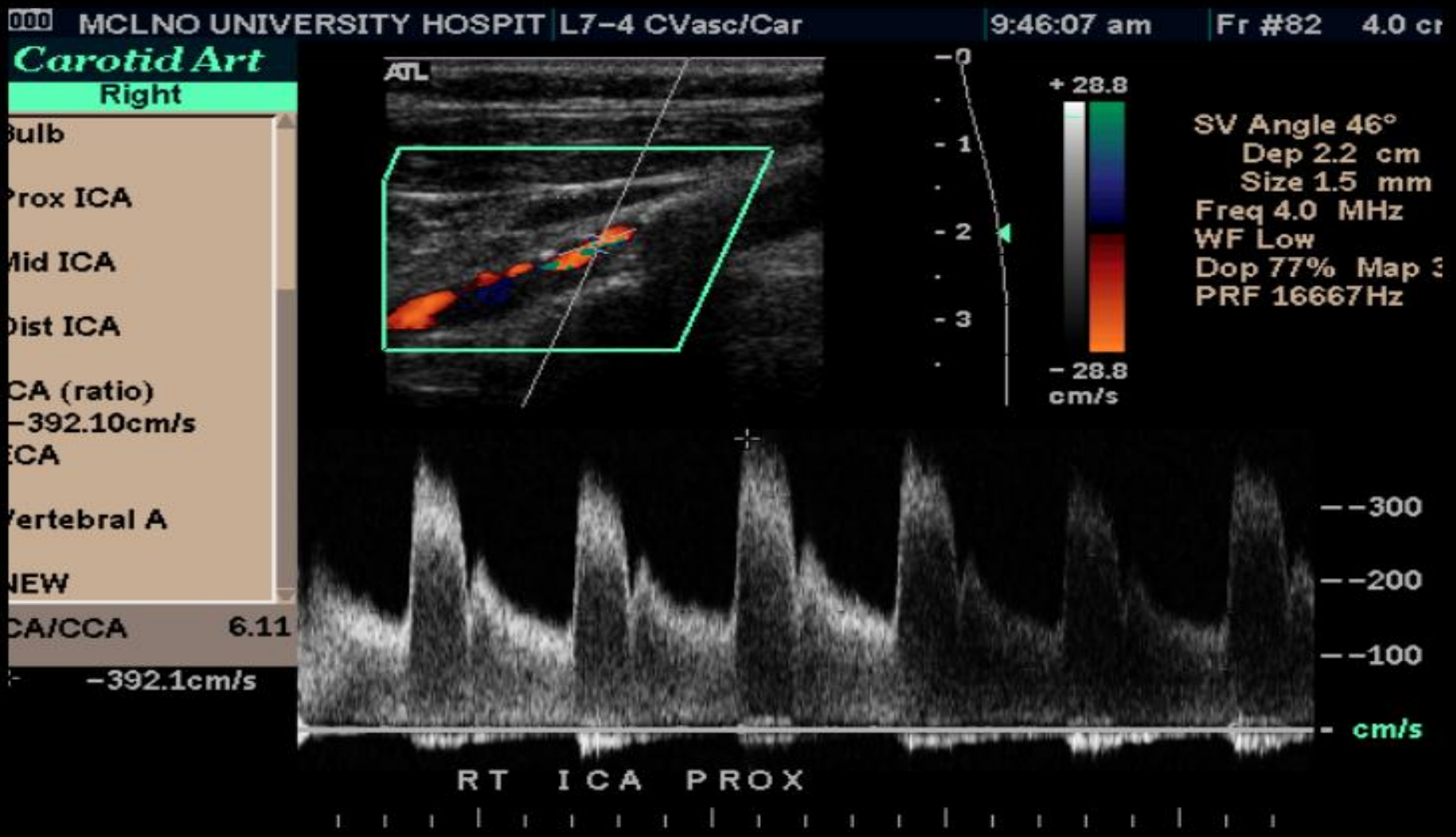
Tr R Thy - nodule

Sag R CCA- Bulb



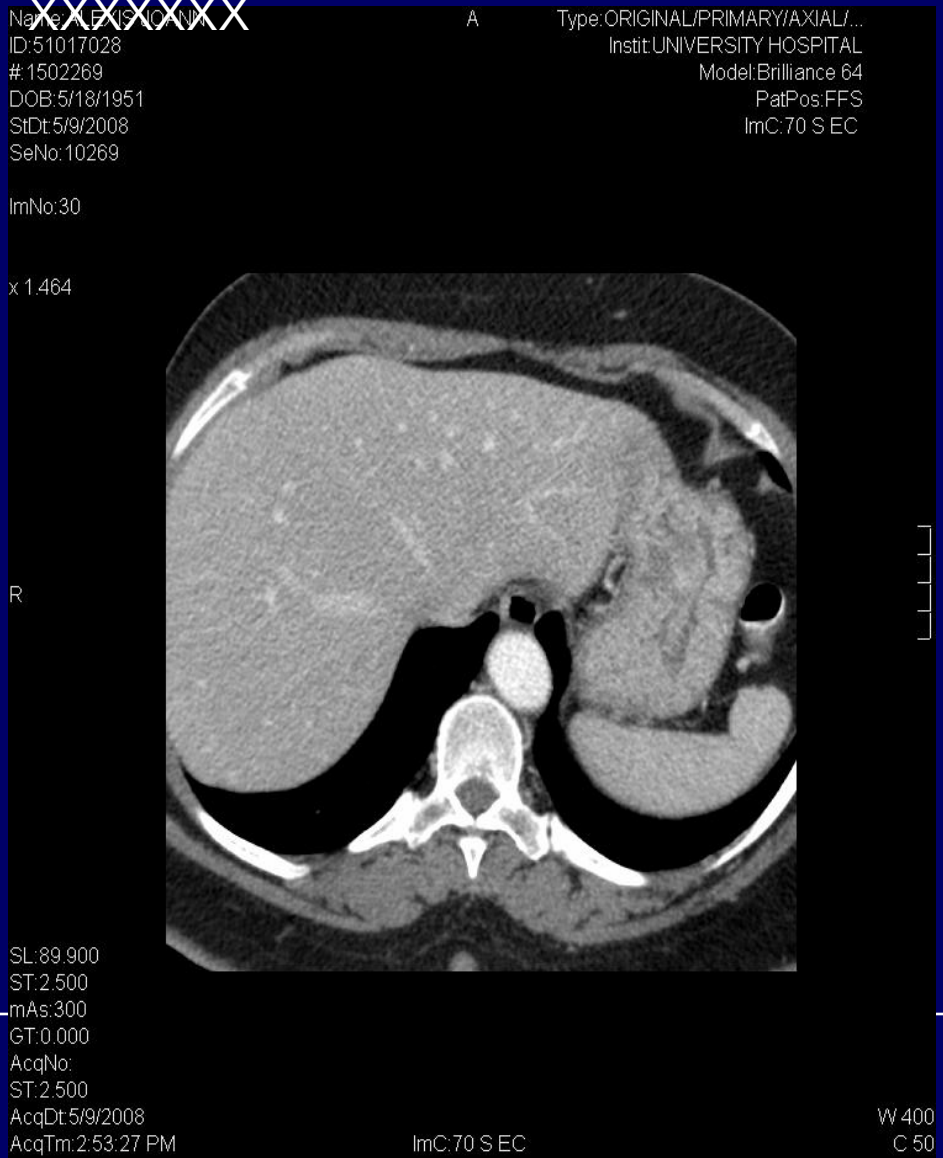
Sag R CCA- color dopp




MCLNO UNIVERSITY HOSPIT
L7-4 CVasc/Car
9:46:07 am
Fr #82
4.0 cr
Carotid Art
Right
Bulb
Prox ICA
Mid ICA
Dist ICA
CA (ratio)
-392.10cm/s
ICA
Vertebral A
NEW
CA/CCA 6.11
-392.1cm/s
ATL
+ 28.8
- 28.8
cm/s
SV Angle 46°
Dep 2.2 cm
Size 1.5 mm
Freq 4.0 MHz
WF Low
Dop 77% Map 3
PRF 16667Hz
300
200
100
cm/s
RT ICA PROX

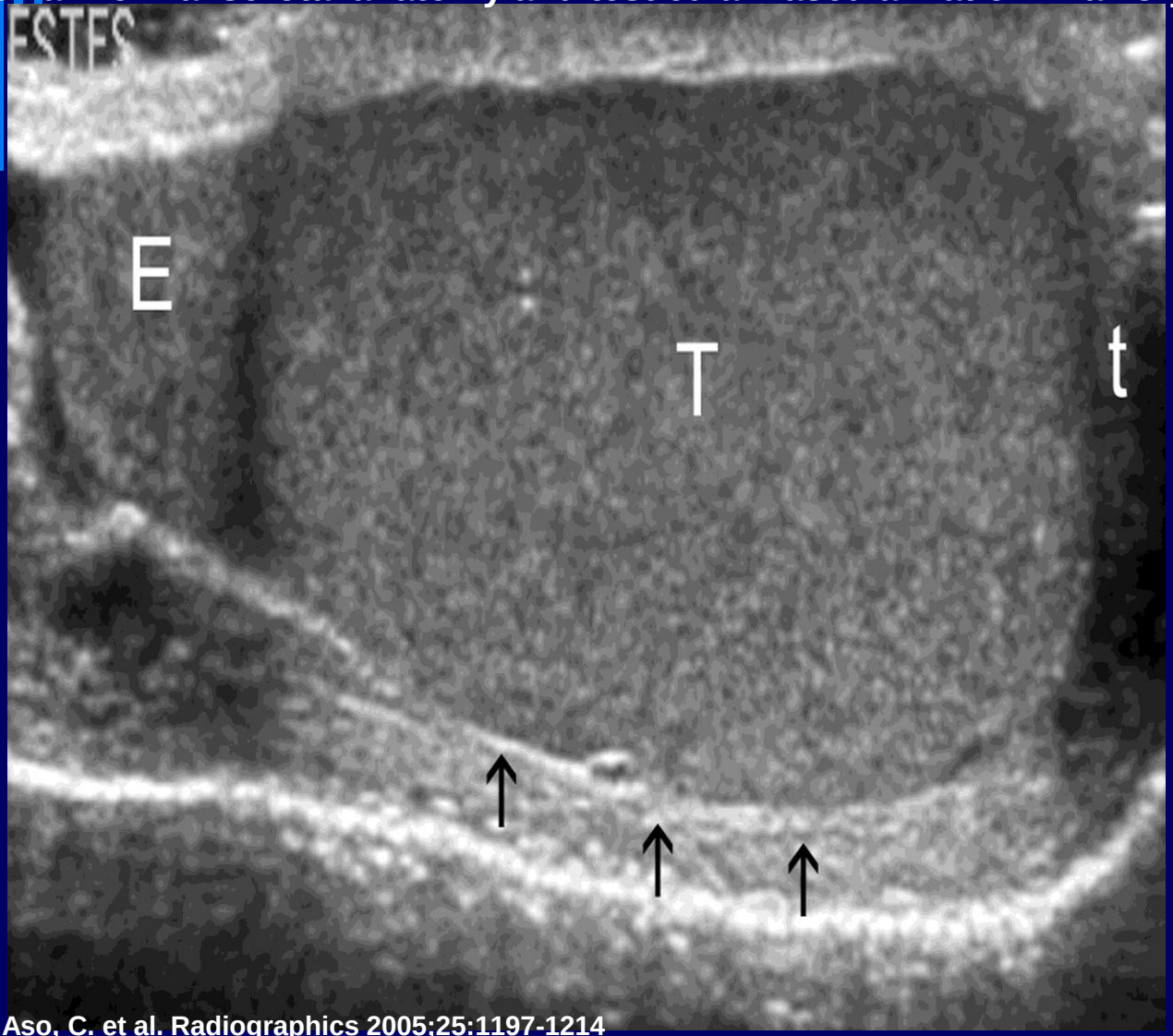
TR ML- Rt – IVC – HV's liver

CT Abd + IV Contrast



TR ML Panc Stom Liv

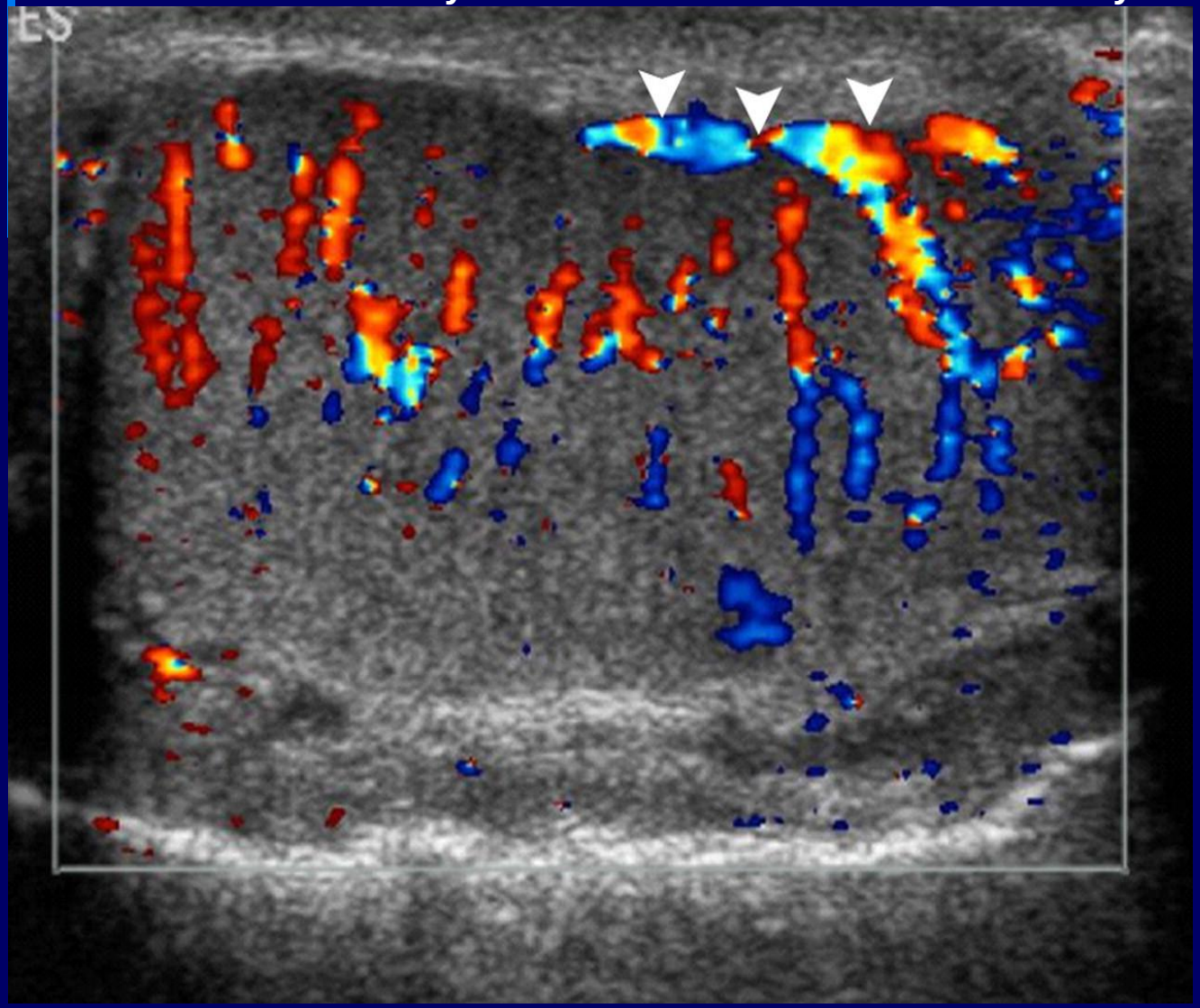
Figure 1a. Normal scrotal anatomy and testicular vascularization in a 13-year-old boy



Aso, C. et al. Radiographics 2005;25:1197-1214

RadioGraphics

Figure 1c. Normal scrotal anatomy and testicular vascularization in a 13-year-old boy



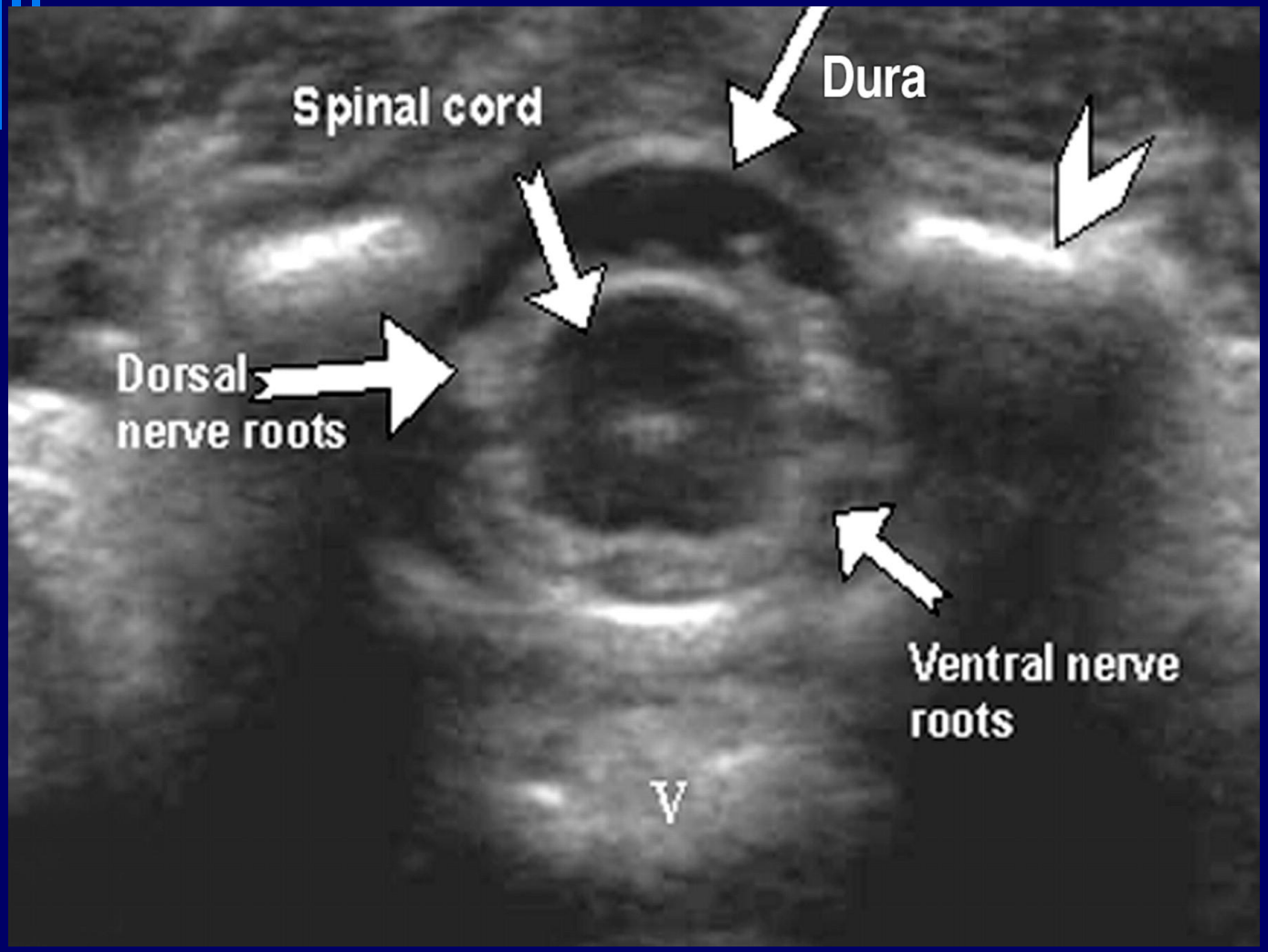
Aso, C. et al. Radiographics 2005;25:1197-1214

RadioGraphics

ele


UNIVERSITY HOSPITAL
L12-5 50 SmPrt/Testi
7:42:42 pm
Fr #218 4.8 cm
Map 3
170dB/C 6
Persist Off
2D Opt:FSCT
Fr Rate:Surv
SonoCT™
ATL
-0
-1
-2
-3
-4
4.36cm
3.07cm
SAG LT MID

11-week-old boy with normal lumbar spine sonogram and history of unilateral renal agenesis



Lowe, L. H. et al. Am. J. Roentgenol. 2007;188:733-738

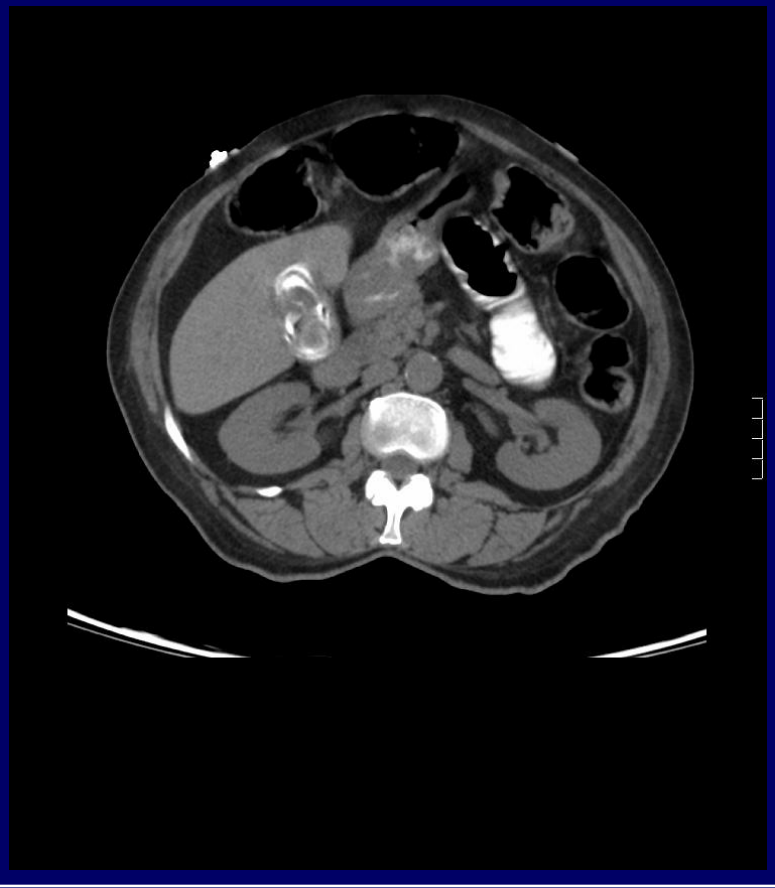
ULTRASOUND PEARLS

- People who need people ????

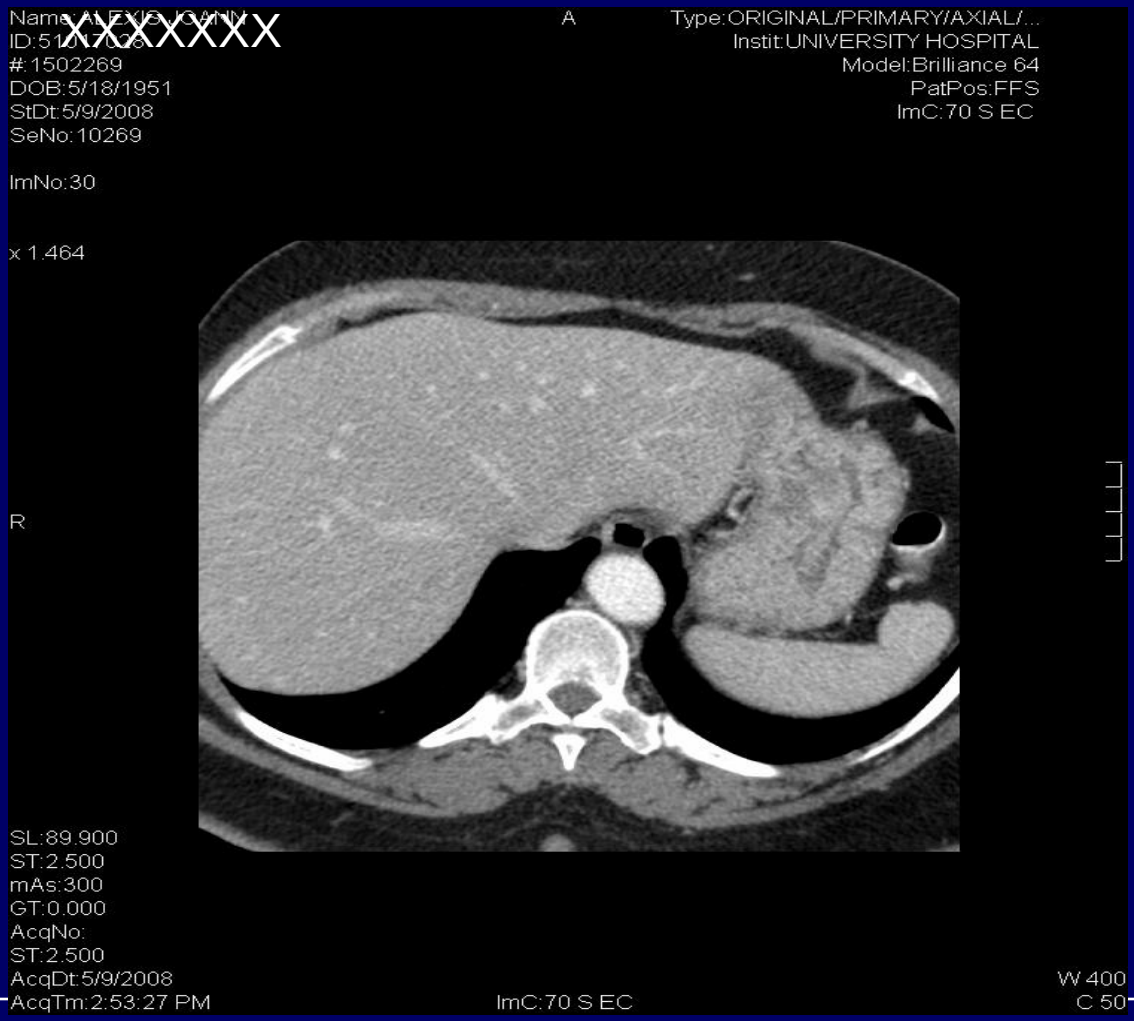
- http://www.youtube.com/watch?v=Bwpppplxq0yo

TR RT same as 20 b

CT Abd, same pt as 20b,& 21

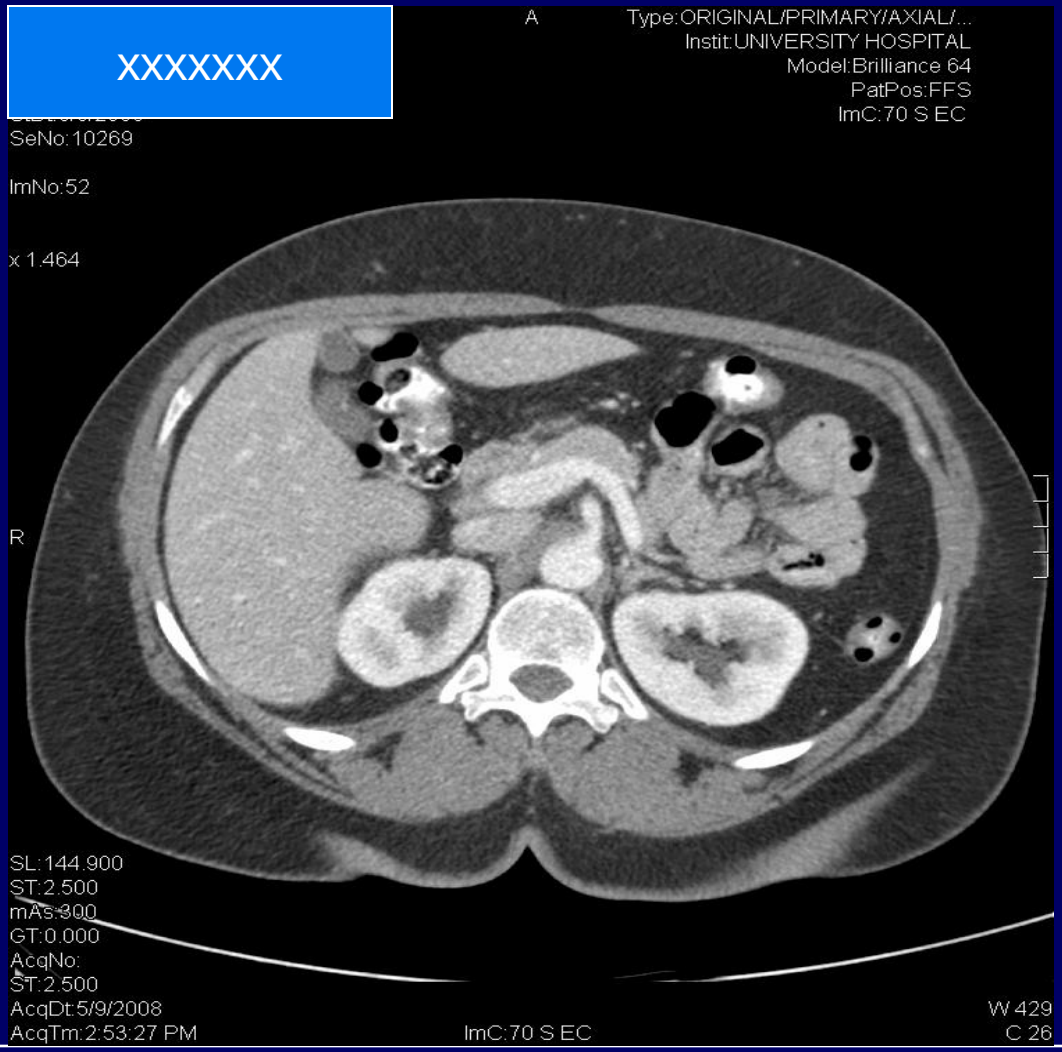


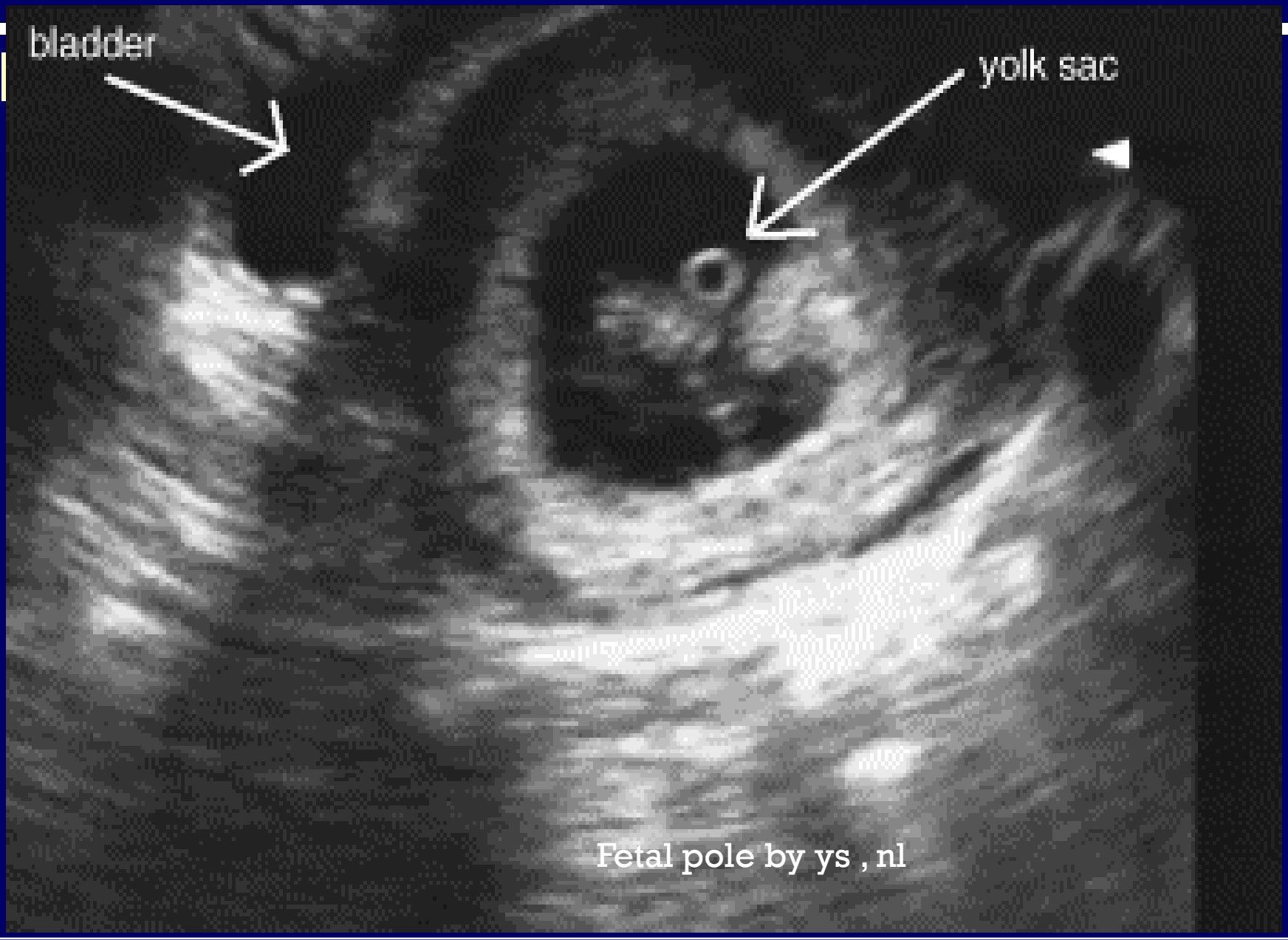
CT Abd + IV Contrast--ANAT



Std CT - TR ML- classic anat

Hep flexure of Colon often next To GB.





Mag EV of an Est 6 - 6.5 wk gest age EV uls