Abdominal Ultrasound
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Bloodroot
Abdominal Ultrasound

- Vasculature
- Hepatobiliary
- Spleen
- Kidney
- Bladder
- Bowel
Where to put the probe?
Vasculature

We are going to talk about …
Celiac Trunk
Superior Mesenteric Artery
Portal Veins
Hepatic Veins
Celiac Trunk and SMA
Transverse Celiac
Transverse SMA-Bull’s Eye
Biliary Scanning - Longitudinal

- For the gallbladder start with the probe marker pointing to the head, in the mid-clavicular line. Move the probe toward the midline until you find a gallbladder looking structure.
- Rotate the probe so you get a long-axis view.
Transverse Approach from Superior to Inferior

- Hepatic veins
- Portal vein
- Then locate the most anterior cystic structure... the gallbladder.
Some questions…

• Who are you going to scan?
• What are you going to do with the information? What if you get “no” information?
• When are you going to do it? Before you order labs? After everything comes back?
• Does everybody need a “formal exam?”
• What are you going to say to the patient?
My Answers

• I haul the machine in if the triage note makes me think gallbladder.

• I do it right away since I may order lots or little based on what I see in conjunction with the H & P.

• I’ll order a formal exam on everybody who needs to see a surgeon, or if I’m not sure.

• I tell patients this is a focused exam, and they may need more “stuff done” later.
Biliary Colic Workup

Figure 7-1. Biliary colic algorithm. This flow diagram outlines some of the decision points to consider for patient disposition based on clinical parameters and ultrasound findings. (Courtesy of James Mateer, MD.)
Thickened Gallbladder Wall

- Measure the anterior wall.
- Normal less than 2mm.
- Need to be fasting.
- Thick wall seen in jaundice, hepatitis, ascites, etc.
Thick Gallbladder Wall

0.78cm
Pericholecystic Fluid and other findings

Posterior Shadow

• Stones send back all the sound waves to the transducer, thus they make a shadow...posterior shadowing.

• Stones also move if they are not stuck.
A Layer of a Whole Bunch of Small Stones

- There is a multiple tiny stones producing this posterior shadowing.
SONOGRAPHIC MURPHY

- See liver, or bowel, or whatever.
- Press on it.
- Does it hurt?
- See gallbladder.
- Press on gallbladder.
- See it move.
- Does that hurt?
Sonographic Murphy’s Sign,

- A positive sonographic Murphy’s sign, defined as the presence of maximal tenderness elicited by direct pressure of the transducer over a sonographically localized gallbladder, is present in most patients with acute cholecystitis.

- The positive predictive value of sonographic Murphy’s sign combined with the presence of gallstones is reported to be 77% to 92%.
Negative Sonographic Murphys
Wall Echo Sign

Happens when the gallbladder is full of stones, or when it has one big one.
Wall Echo Sign-Multiple Stones

• Note the hypoechoic (black) stripe between the wall and stones. This represents bile.

• Important to know about since it can be confused with gas filled bowel.
CBD anterior to Portal Vein
Portal Vein

• Visualize the portal vein in a long axis view.
• Anterior to the PV, (towards the skin) you should see the bile duct.
• Portal vein has brighter (more echogenic) walls compared to hepatic veins.
Find that CBD

Follow the gallbladder neck to the portal triad. The main lobar fissure should take you there (present in about 70% of people).
Main Lobar Fissure
Porta Hepatis=Portal Triad

- Rotating the probe on the portal vein should bring the common bile duct, hepatic artery and portal vein into view.
- The probe marker should be pointing to the patient’s right.
Mickey Mouse

- If the CBD is dilated than the rodent has a swollen right ear.
- If you forget which ear is which, you can doppler the big one.
Dilated Common Bile Duct
CBD- Measure the Internal Diameter.

• Mean diameter is 4 mm, more than 7 mm is dilated.
• CBD diameter increases with age, up to 10 mm in the elderly.
• In general it should be 1/10th the patient’s age.
Acute Cholecystitis

- The solid arrows are pointing to the thickened gallbladder wall.
- What are the open arrows pointing to?
Polyps

- Non-mobile
- No posterior shadowing
Gallbladder Sludge

- Mobile
- Non-shadowing
- Dependent
Phrygian Cap

Transverse congenital septum in the fundus

**Phrygian**
adj
/ˈfriːdʒiən/
Gk geog name of, relating to, or characteristic of the ancient country of Phrygia.
*In Rome the Phrygian cap was worn by emancipated slaves as a symbol of their freedom.*
Pitfalls in Gallbladder Imaging

• Misidentification of the gallbladder. A loop of bowel or the IVC can look like a gallbladder. Gut does peristalsis, IVC has flow on doppler. If possible you should show that the gallbladder communicates with main portal triad via the major lobar fissure.

• Bowel gas, try left lateral decubitus position.

• Contracted gallbladder in non-fasting patient.

• Lack of power to penetrate adipose.
The Liver

- Interesting findings can be seen in many patients...including
  - portal hypertension
  - cirrhosis
  - fatty liver
  - bile duct obstruction
  - cysts
  - tumors
Vena Cava and Hepatic Veins

- There are three main hepatic veins, right, left and middle.
- They have thin, hypoechoic walls, and converge on the vena cava.
- Remember that the portal vein has hyperechoic walls.
Bunny Sign

- The rabbit’s head is the vena cava, the ears are the middle and left hepatic veins.
- Use m-mode to observe the change in diameter of the vena cava with respiration
Transducer Parallel to the Costal Margin
Portal Hypertension

- Usually seen in the setting of cirrhosis.
- The portal vein is dilated to more than 15 mm.
- Often seen with ascites and splenomegaly.

Note the portal vein’s hyperechoic walls.
Cirrhosis—Early Stage

- Loss of peripheral hepatic vessels
- Increased echogenic wall of the portal vein.
- Hepatomegaly
Cirrhosis Advanced Stage

- Nodular liver contour.
- Contracted liver.
- Usually ascites
Fatty Liver

• Results in increased echogenicity (brighter). Best compared to right kidney cortex.
Bile Duct Obstruction
Liver Cysts-Benign

• To be called a cyst it must have
  – echo free content
  – spherical shape
  – smooth outline
  – distal acoustic enhancement
Liver Tumors

• The liver is a favorite site for metastatic tumors. GI tract, breast, lung, and the esophagus are the usual primaries.

• Note the hypoechoic halo.
Renal Ultrasound

- Hydronephrosis
- Cysts including polycystic kidney disease
- Stones
- Wilm’s tumor
- Measuring Bladder Volume
The Normal Kidney

- The echogenicity (brightness) of the renal cortex should be less than that of the liver or spleen.
- In other words the kidney should be a tad darker than the liver.
Kidney Size

• Size is best evaluated as length, which should be 10 to 12 cm in adults.
• Each kidney should be within 2 cm of each other in length.
Approach

- Use the liver as your window on the right.
- The left can be harder.
- Try prone.
- Breath holding helps.
Hydronephrosis Grades - Mild, Moderate, Severe

I  spraying
II  bear claw
III  severe, loss of renal parenchyma

This is grade 2.
Bear Claw - Hydronephrosis
Simple Cyst Seen while doing a FAST
Polycystic Kidney
Nephrolithiasis

- CT is better, but there is a place for doing a focused ED U.S.
- Someone with known stones to look for obstruction.
- Pregnancy.
- When AAA is in the differential.
Seeing the Stone

- Stones are rarely seen in the ureter, but they are visible in the kidney, bladder and UVJ. Note distal shadowing.
Ureteral Jets

• Color Doppler probe is used to find urine squirting from the ureter into the bladder.

• If the jet is present then there is no obstruction on that side.
Wilm’s tumor

- Younger than 6.
- Have a flank mass and hematuria.
- Mass is solid on U.S.
Urinary Bladder

- Female patient (note the uterus).
- Top image is a longitudinal view.
- Bottom is transverse.
Measure urine volume

Why only one “up down” measurement and two “side to side”?
Bladder volume is estimated by measuring maximal anteroposterior, coronal, and craniocaudal measurements and multiplying by pi/6 (0.52)
Spleen Viewing Position

Best seen from the a posteriolateral approach, with the probe position in between the ribs.
Spleen

• A spleen looks like a crescent moon.
• Usually best seen halfway between full inspiration and expiration.
Splenomegaly

- The “normal” spleen measures less than 12 cm long, 5 cm thick and 7 cm in breadth.
- It can be hard to get the whole spleen on the screen if your probe’s footprint isn’t big enough.
Bowel Obstruction/Ileus

- I mention this because you will run into while looking for a AAA.
- Usually bowel isn’t seen since gas disperses the beam. But in obstruction the bowel has a lot of fluid in it.
Bowel Obstruction
Bowel Obstruction
Appendicitis
Greater than 6 mm in diameter
Press Down

The image on the right is obtained by pressing down on the probe. Note the appendix does not compress.
Appendicitis

Wall is greater than 3 mm thick.
Appendicolith

- Note the posterior shadowing.
- Exam is done with a high frequency probe.
How to use this skill clinically.

• 17 year old girl
• C/O RLQ pain.
• HCG –
• Appendicitis versus tubo-ovarian abscess?
Mesenteric Adenitis

- Often seen in children after a viral illness.
- Often confused with appendicitis on clinical exam.
References

References:
Abdominal Ultrasound CD by Mark Deutchman (great resource)
Emergency Ultrasound by Ma and Mateer
Ultrasound in Emergency and Ambulatory Medicine by Simon and Snoey
Ultrasound Teaching Manual by Hofer
Web Pages

• http://www.gemedicalsystems.com/inen/rad/us/education/msucmehd.html