Objectives:

- Discuss clinical indications and questions answered by RUQUS
- Review of pertinent RUQ anatomy
- Share techniques & scanning tips
- Literature to support use of RUQUS

Scope of the problem:

- Abdominal pain accounts for 5-10% of ED visits in US
- 1/3 of our abdominal pain patients in ED have GB etiologies for their pain
- 20M Americans have gallstones; ½ M undergo cholecystectomy each year

SEE MORE PATIENTS!
DISPO THEM FASTER!
SPEND LESS MONEY!

BUT DON'T COMPROMISE QUALITY OF CARE.
One solution:

- http://personalbestpersonaltraining.com/5‐nutrition‐aha‐moments/
- https://yazrooney.wordpress.com/2012/11/24/the-aha-moments-that-heal/
- http://www.uk-ireland.bcftechnology.com/blog/2013/september/introduction-to-small-animal-veterinary-probes

Current imaging options for AC:

- **HIDA:**
  - highest diagnostic accuracy in older studies
  - sensitivity 90%, specificity 90%

- **Ultrasound:**
  - sensitivity 88-90%, specificity 80-88%
  - NPV 95-98%

- **CT:**
  - helpful for detecting complications
  - sensitivity 71-99%, specificity 43-74%

- **MRI:**
  - similar to u/s test characteristics
  - MRCP helpful if cholelithiasis suspected

“But isn’t that why we have radiologists?”

- ED performed RUQ ultrasound shown to be as sensitive and specific for radiology performed RUQ ultrasound for acute cholecystitis!

- ED physicians often not formally trained in RUQ u/s and test characteristics still acceptable

- Advantage: increased efficiency, decreased time to diagnosis and disposition

Purpose of RUQUS:

**Evaluate for:**

- Cholelithiasis
- Acute cholecystitis
- Obvious liver/biliary pathology

**Indications:**

- RUQ pain
- Flank/shoulder/epigastric pain
- Ascites
- Hepatomegaly
- Jaundice
- Pancreatitis
- Sepsis
Anatomy

- Gallbladder is located at the inferior surface of the liver; consists of the fundus, the body, and the neck.
- The neck of the gallbladder drains into the cystic duct which joins the hepatic duct to form the common bile duct (CBD).
- The portal triad consists of the hepatic artery, common bile duct (CBD), and the portal vein.
- The CBD and the hepatic artery lie anterior to the portal vein.

Techniques 101: Probe selection

- Use 2.5-5 MHz low frequency abdominal probe.
Techniques 101: SUBcostal approach

- The probe is placed below the rib cage, lateral to epigastrium
- Good for avoiding Rib shadows
- Reliable Sono Murphy’s
- Probe marker to head/R Shoulder
- Hold probe at shallow angle

Techniques 101: INTERcostal approach

- Probe placed in the right anterior axillary line over the lower rib spaces, marker facing to right shoulder/head
- Slow sweep across the ribs
- Use the liver as an acoustic window
- Anchor your hand for stability
- Aka “X minus 7”

Techniques 101: Positioning in Left Lateral Decubitus

- Can place probe subcostal or intercostal
- GB should move anteriorly
- Use the liver as acoustic window
- Slow sweep along costal margin

Techniques 101:

- Always scan the entire gallbladder in two planes:
  - Longitudinal
  - Transverse
- Slowly fan through entire gallbladder in these two planes
What should you see: GB long

Normal Gallbladder in long axis

What should you see: GB short
The highly elusive Common Bile Duct...

- CBD lies anterior to portal vein and next to hepatic artery
- Color Doppler can help identify vascular structures
- Normal <7mm.
- CBD dilates with increasing age and after cholecystectomy!
- PEARL: measure CBD from inner wall to inner wall

‘Exclamation point’ sign

Find the Gallbladder in the longest axis, follow the main lobar fissure from the neck of the gallbladder to the porta hepatis.

CBD forms the point of the exclamation mark, anterior to the portal vein.

Normal variants of the Gallbladder

- Pharyngian cap: The fundus is folded onto the body
- Septate GB: thin septa inside gallbladder

Normal Gallbladder in short axis
Again, CBD anterior to portal vein and hepatic artery. CBD does not show flow, helps to identify the CBD.

Great news… perhaps finding the CBD doesn’t really matter?!

What am I looking for exactly?
Look for Acute cholecystitis by asking:

1) Are there gallstones present?
   AND
2) Is there pericholecystic fluid present?
3) Is there GB wall thickening?
4) Is there a sonographic murphy’s sign?
5) +/- Is the CBD dilated?

1) Are there any stones?

When looking for stones, keep in mind...

**Stones**: hyperechoic, cast a shadow. Stones are often mobile; scan patients in different positions. ALWAYS convince yourself there is no stone in GB neck.

**Wall-echo-complex (WES)**:
When GB is filled multiple stones or one giant stone you just see wall, then bright reflex and then shadow.

**Sludge**: biliary sand/microlithiasis: Echoes within depending part of GB without shadowing (resettles in dependent parts > scan patients in different positions)
1) Are there any stones?

Posterior acoustic enhancement

1) Are there any stones?
1) Are there any stones?

WES sign

Gallbladder filled completely with stone
Stones vs polyps or tumors:
- Stones are mobile and can be moved by changing the position of the patient, not adhered to wall.
- Polyps do not shadow.

1) Is there a stone?

Life just got easier…

Brief mention: CBD stones

CBD stones: round echogenic lesion with posterior shadowing. Most stones are impacted in the distal duct at the papilla.
#2) Is there pericholecystic fluid?

PEARL: Measure anterior wall because resolution is better.

3) Is there GB wall thickening?
RUQUS and GB wall thickening:
- NONSPECIFIC finding!
- DDx include:
  - CHF
  - Renal failure
  - Hypoalbuminemia
  - Hepatitis
  - Cirrhosis
  - Pancreatitis
  - Carcinoma

4) Is there a Sono Murphys sign?
- maximal abdominal tenderness from pressure of the ultrasound probe over the visualised gallbladder
- SMS is a sign of local inflammation around the gallbladder along with right upper quadrant pain, tenderness or mass

5) Is the CBD dilated?
- <=6mm is normal
- Add 1 mm as normal dilatation for every decade above 60 years old
- CBD dilated in pts s/p cholecystecomy
- Measure INNER wall to inner wall

FYI: Cholangitis
- Fever, RUQ pain, Jaundice.
- ~85% of cases associated with CBD stones.
- On ultrasound:
  - Dilation of biliary tree
  - Choledocholithiasis and possibly sludge
  - Bile duct wall thickening
  - Hepatic abscess

FYI: Cholangitis
- Fever, RUQ pain, Jaundice.
- ~85% of cases associated with CBD stones.
- On ultrasound:
  - Dilation of biliary tree
  - Choledocholithiasis and possibly sludge
  - Bile duct wall thickening
  - Hepatic abscess
Again, ask yourself:

1) Are there gallstones present?

2) Is there pericholecystic fluid present?

3) Is there GB wall thickening?

4) Is there a sonographic murphy’s sign?

5) +/- Is the CBD dilated?

Take home points:

- Always scan through the GB in both longitudinal and transverse planes.
- Scan through GB neck to ensure no obstructing stone.
- Use color Doppler to help distinguish nonvascular from vascular structures.
- Be aware of normal variants (folds).
- Measure the anterior wall of the gallbladder.
- Normal GB wall <4mm
- Normal CBD <7mm
- Position for success: left lateral decubitus
- Can’t see the GB? Ask pt to take a deep breath in
- Stones are mobile and shadow; polyps do not.
- Ultrasound findings must ALWAYS be interpreted in the context of the clinical presentation.

Thank you!

Questions?

Kathleen.OBrien@kp.org, katieoinaz@gmail.com

Further reading


A prospective evaluation of emergency department bedside ultrasonography for the detection of acute cholecystitis. Shal et al.