



**MEDD 412 Clinical Skills
2016-2017**

**Abdominal Ultrasound
Student Guide**

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ACKNOWLEDGEMENTS

We are indebted to:
Members of the Ultrasound Working Group

ORGANIZATION

The GI 2 and Abdominal Ultrasound sessions are closely tied, but scheduling and organization may vary across sites.

1. GI 2 Clinical Skills - refer to the MEDD 412 GI Clinical Skill Student Guide for learning objectives and activities
2. Abdominal Ultrasound - a tutor will demonstrate ultrasound of the abdominal organs (e.g. liver, spleen, kidneys, etc). Students will have the opportunity to perform limited bedside abdominal ultrasound. Refer to the TECHNIQUE section below.

PREPARATION

Required Readings / Review

- MEDD 412 Ultrasound Student Guide

Required Viewing

- *Introduction to Ultrasound.* UC San Diego. Dr. V Shah (37 minutes)
 - MEDICOL -> Year 1 -> MEDD412 -> Clinical Experiences -> Clinical Skills Common Course Videos

Suggested Resources (including other texts, websites, course material, etc.)

The following online references will enhance your understanding of bedside abdominal ultrasound. You are not required to review them prior to the session, but you will find your image recognition to be much faster if you do.

- Gastrointestinal Ultrasound. UC Irvine. Dr. J. Christian Fox
<https://itunes.apple.com/us/podcast/abdominal-aorta-vena-cava/id429668500?i=92619366&mt=2>

OBJECTIVES

On completion of this session, students should be able to:

- Describe the basic physics of ultrasound
- Understand portable ultrasound machine use and scanning procedures
- Describe the indications for, and limitations of, portable ultrasound examination
- Describe the indications for, and limitations of, ultrasound examination of the abdomen
- Recognize anatomic structures of the abdomen (e.g. liver, kidney) using ultrasound

EQUIPMENT

- Students must wear professional dress and wear UBC student ID.
- Portable ultrasound machines are provided.

ASSESSMENT & EVALUATION

Student Assessment

Students will be formally assessed during Clinical Skills using Workplace Based Assessment (WBA) Forms in conjunction with the Clinical Skills Milestones (located in students' Clinical Experiences Green Book) to inform the WBAs.

Each Clinical Skills session or block of sessions have associated milestones which we ask students to review with their tutor at the start of the session/block. At the end of each session or block, students will be required to review with their tutors whether they are progressing at their expected level (see Milestone description and education level). Students will then be responsible for asking their tutor to sign off on completed milestones in their Green Books.

The associated milestone(s) for this session/block is below:

Clinical Skills Session(s): **Abdominal Ultrasound (part of GI Session 2)**
Milestone title: **“Bedside Ultrasound Skills” & “GI History & Abdominal Exam”**
Page: **Page 59, 60 of Green Book**
Competency Level: **“By End of 1st Year (MEDD 412)”**

An example of how to use your Milestones is included below:

| Clinical Skill | At First Encounter various times during 1st/2nd year | By End of 1st Year (MEDD 412) | By Middle of 2nd Year (MEDD 421) | At the end of preclinical studies (TICE) |
|---|--|---|--|--|
| Bedside Ultrasound Skills | Students have read the basics of ultrasound physics and “knobology.” | Students have described the indications and limitations of portable ultrasound to their tutors. | Students have been observed using a portable ultrasound machine for scanning procedures. | Students have described how to integrate bedside ultrasound findings (from cardiac or volume assessment ultrasound) into their overall clinical assessment of a patient. |
| Tutor Initial & Date | | LH Feb 14/17 | | |
| Tutor Initial & Date | | | | |
| Tutor Initial & Date | | | | |
| Tutor Initial & Date | | | | |
| Notes: | | | | |
| <div style="border: 1px solid red; padding: 5px; display: inline-block;"> In the second term of 1st year, their tutor will sign off this milestone if the student achieves the indicated level of competency for the end of first year (MEDD 412). </div> | | | | |

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C/S Milestones

**We recognize that the milestones are somewhat unclear so please note we are actively working on improving this process in future.*

Please refer to the Year 1 Assessment Package on Medicol to access student assessment information for Clinical Skills:

- Year 1 > MEDD 412 > Exam & Assessment Resources

At the end of term, student competency will be further assessed through written Multiple Choice Exams and a Summative OSCE (Objective Structured Clinical Examination) on Saturday, April 8, 2017. Material from the Abdominal Ultrasound session will be examinable on the Year 1 OSCE and Year 1 MCQ Exams held at the end of MEDD 412.

As part of your professional commitment, you may be required to complete an online assessment of your tutor and a course evaluation on one45.

TECHNIQUE

Indications/Limitations

| Area | Key Anatomic Structures/Relationships | Clinical Indications <i>*Common bedside application</i> | Limitations |
|---------------|---|---|--|
| RUQ | <ul style="list-style-type: none"> • Liver • Right kidney • Hepatorenal interface • Diaphragm • Gall bladder | <ul style="list-style-type: none"> • <i>Trauma (free fluid)</i> • Hepatic pathology (mass) • Gall bladder/biliary tract pathology (<i>stones, cholecystitis, obstruction, mass</i>) • Renal pathology (mass, obstruction, stones) | <ul style="list-style-type: none"> • Small amounts of free fluid are easily missed • Adhesions (prior surgery) can redirect free fluid away from the upper quadrants • Degree of solid organ injury can be difficult to appreciate (CT better) • Difficult/impossible to image retroperitoneal organs (e.g. ureters) |
| LUQ | <ul style="list-style-type: none"> • Spleen • Splenorenal interface • Left kidney • Diaphragm | <ul style="list-style-type: none"> • <i>Trauma (free fluid)</i> • Splenic pathology (mass, splenomegaly) • Renal pathology (mass, obstruction, stones) | |
| Pelvis | <ul style="list-style-type: none"> • Bladder • Uterus • Adnexae | <ul style="list-style-type: none"> • <i>Trauma (free fluid)</i> • Bladder pathology (mass, stones) • <i>Early pregnancy</i> • Adnexal pathology (mass, abscess, torsion, ectopic pregnancy) | <ul style="list-style-type: none"> • Usually need a full bladder to generate good images • Visualizing an adnexal mass is uncommon in ectopic pregnancy (<50%) • Physiologic pelvic free fluid common in young women |

Preparation/Positioning

- The patient should be positioned supine on the stretcher and appropriately draped. The costal margin to the pelvic brim should be exposed for scanning (Figure 1)



Figure 1 – Appropriate draping with abdomen exposed from costal margin to pelvic brim

- Ensure the stretcher is adjusted to an ergonomic height
- Use a mid-frequency (3.5 MHz) curved linear array probe for the abdominal scan (Figure 2)



Figure 2 – 3.5 MHz probe

- Depth should be set to max initially to ensure no important structures are missed (Figure 3)
- Gain should initially be set mid-range. Adjust as the scan proceeds (Figure 4)

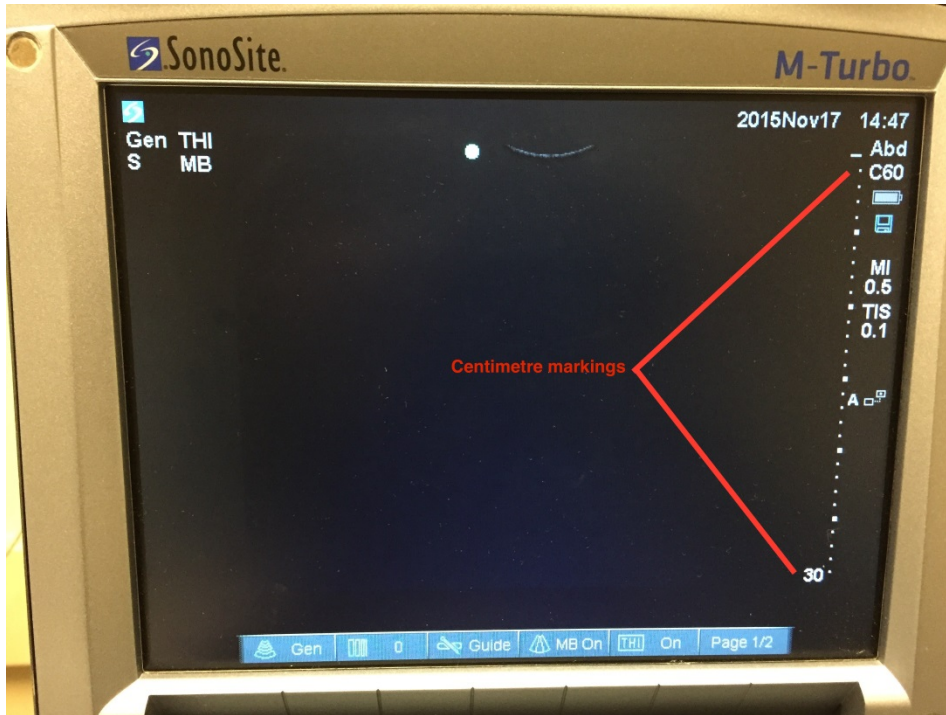


Figure 3 – Centimetre markings are located to screen right. The more cm markings, the more depth.

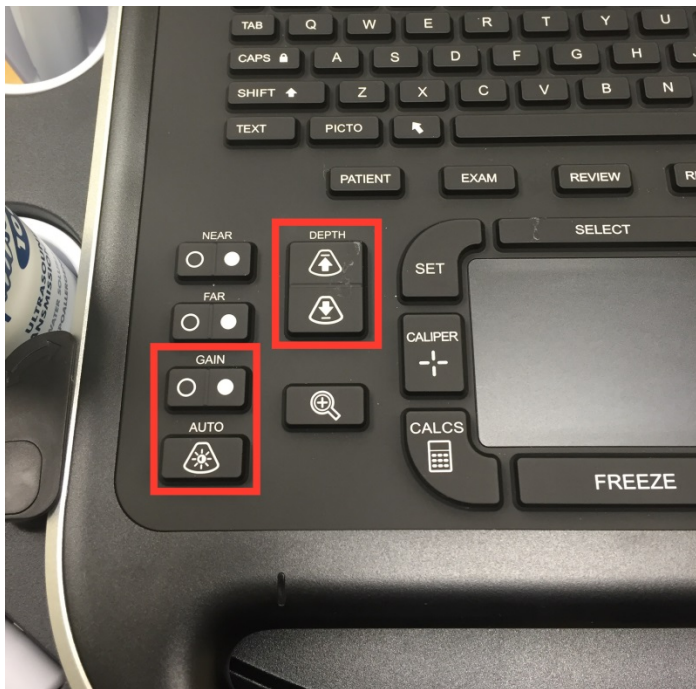


Figure 4 – Gain toggle and Autogain button (lower left box), and depth buttons (upper right).

- Apply gel directly to the probe when scanning the flanks (RUQ/LUQ); apply directly to the patient for the gallbladder and pelvis scans (Figure 5)



Figure 5 – Gel is applied to the probe when scanning on the sides/flanks. When scanning the anterior surface of the abdomen (i.e. gallbladder, pelvis), gel is applied directly to the patient.

RIGHT UPPER QUADRANT

- For the RUQ, make a four-finger platform for the probe with your right hand and use your thumb to stabilize the probe (Figure 6)



Figure 6 – Proper probe grip for RUQ scan

- Position the probe in the longitudinal plane at the point where a line drawn laterally from the xiphoid intersects the posterior axillary line (Figure 7)

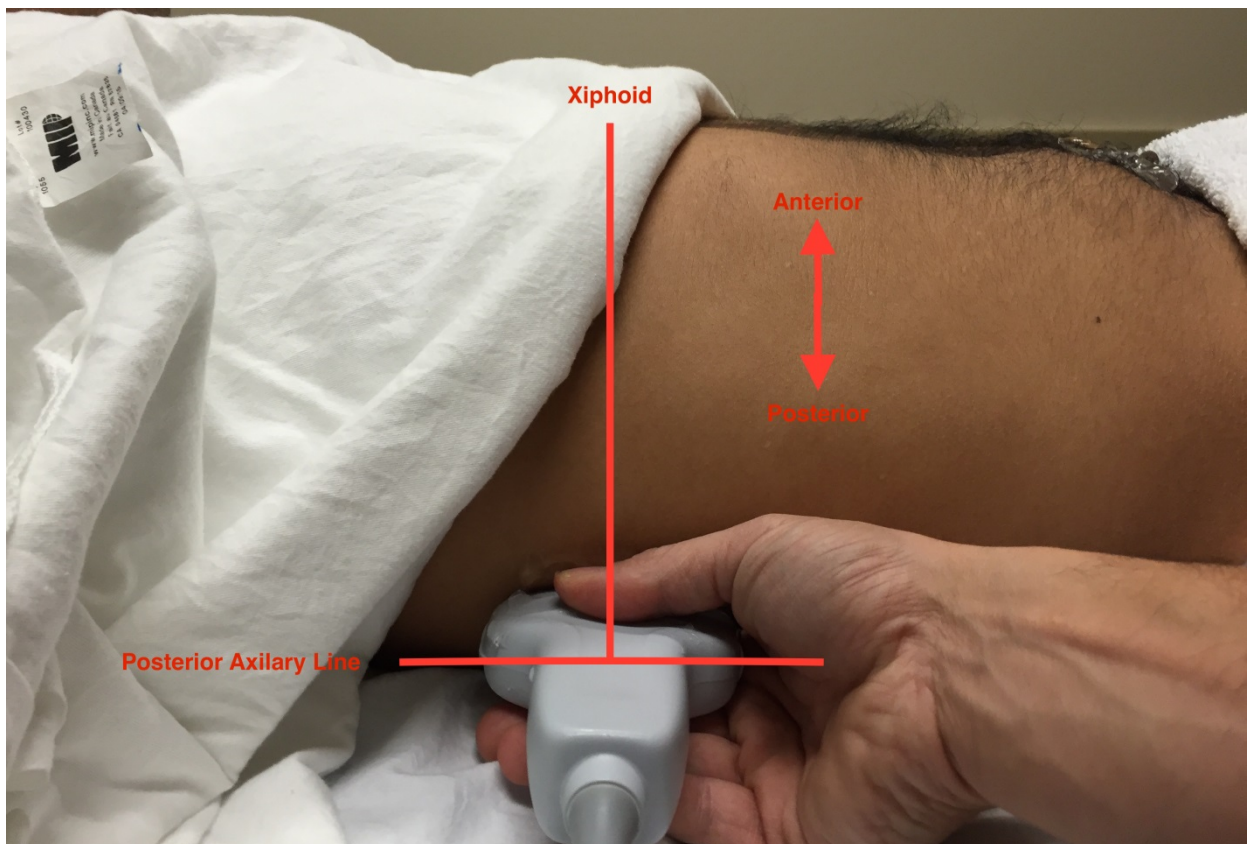


Figure 7 – Starting point for RUQ scan.

- Slide the probe in the anterior/posterior directions to find the best view of the kidney (double density – darker cortex, brighter collecting system) (Figure 8)



Figure 8 – Normal kidney from longitudinal view of RUQ

- Slide the probe cephalad/caudad directions to better visualize the entire kidney, hepatorenal space (Morison’s pouch), liver, and diaphragm (Figures 9 & 10)



Figure 9 – Movement of the probe in the longitudinal plane to visualize the RUQ structures

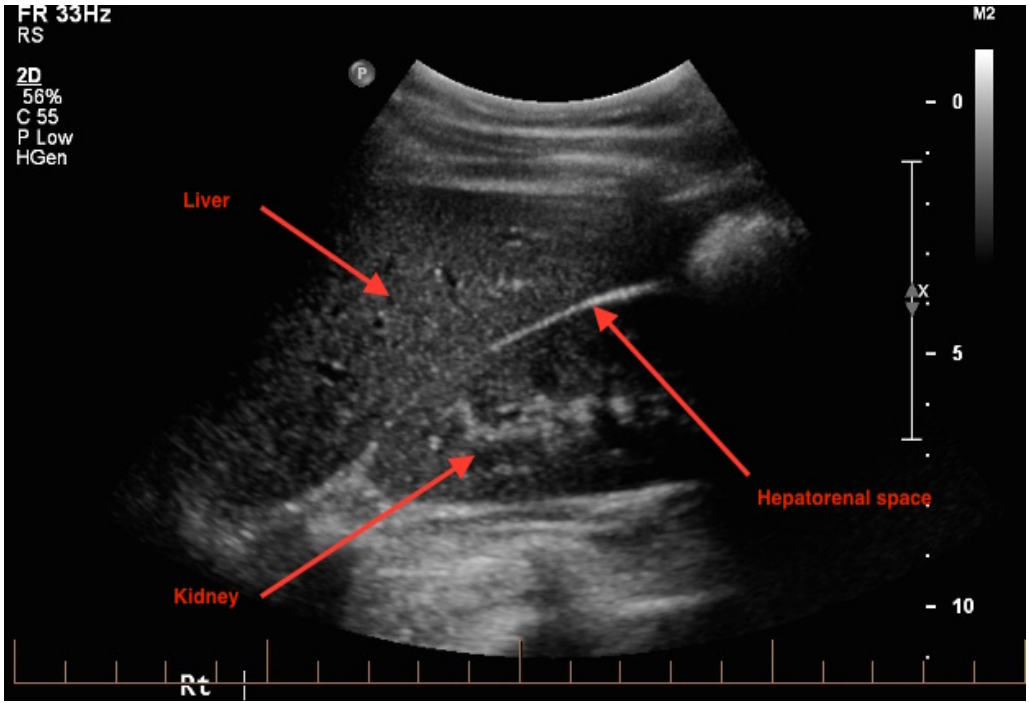


Figure 10 – Normal RUQ

- To perform a FAST (Focused Assessment with Sonography for Trauma) scan, the probe is positioned with the best view of the hepatorenal space, the image is optimized (adjust gain/depth), and a sweep of the area is conducted – angle the probe back and forth keeping the same point of contact with the patient (Figure 11)

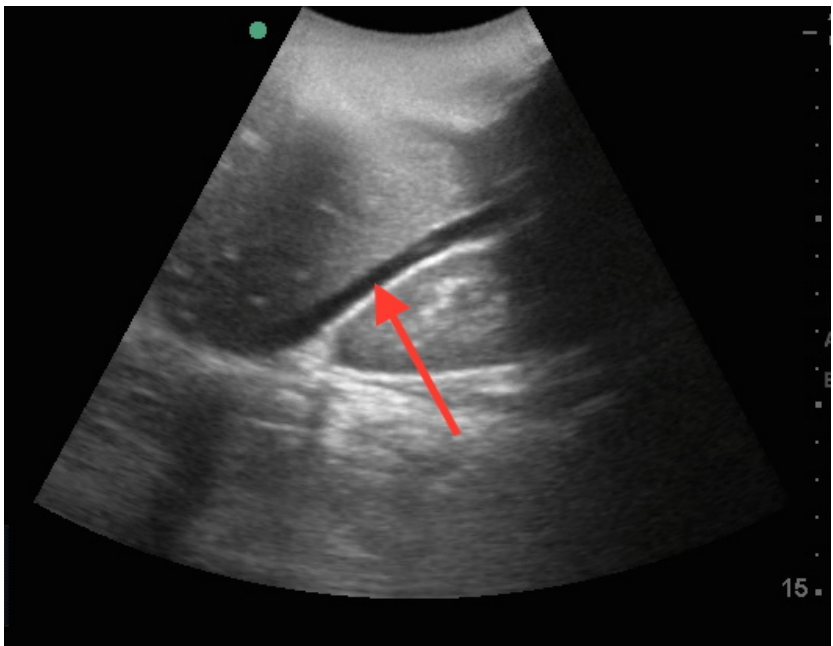


Figure 11 - Positive RUQ FAST scan with free fluid in the hepatorenal space

- Many patients may be able to assist your scan by holding their breath either at end-inspiration or end-expiration. The structures you're scanning move with respiration, and are often better imaged at one end or the other of the respiratory cycle.
- Gallbladder:
 - If not yet identified in your scan of the RUQ, position the probe in the longitudinal plane at the intersection of the mid-clavicular line and the costal margin (Figure 12)
 - You will need to change your grip on the probe (Figure 13)



Figure 12 – Starting point for the gallbladder scan



Figure 13 – Proper probe grip for the gallbladder scan

- Slide the probe medial-lateral along the costal margin to identify the gallbladder (black, fluid-filled, cystic structure) (Figure 14)

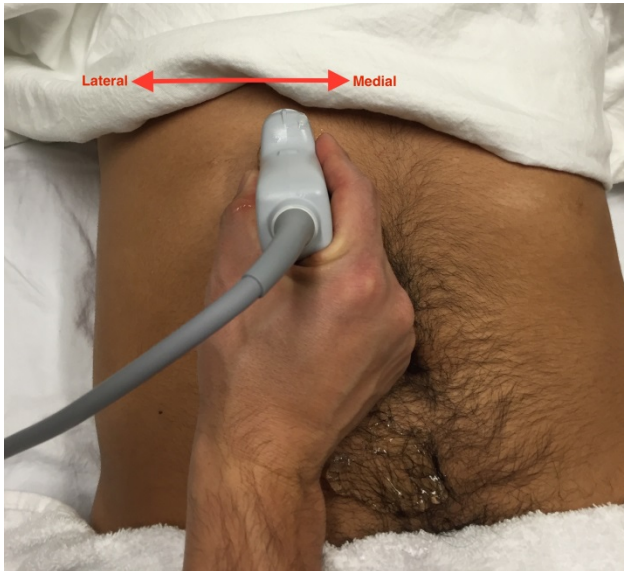


Figure 14 – Direction of probe movement along the costal margin

- Once identified, the image is optimized (adjust gain/depth), and the gallbladder is swept in longitudinal and transverse planes (Figures 15 & 16)

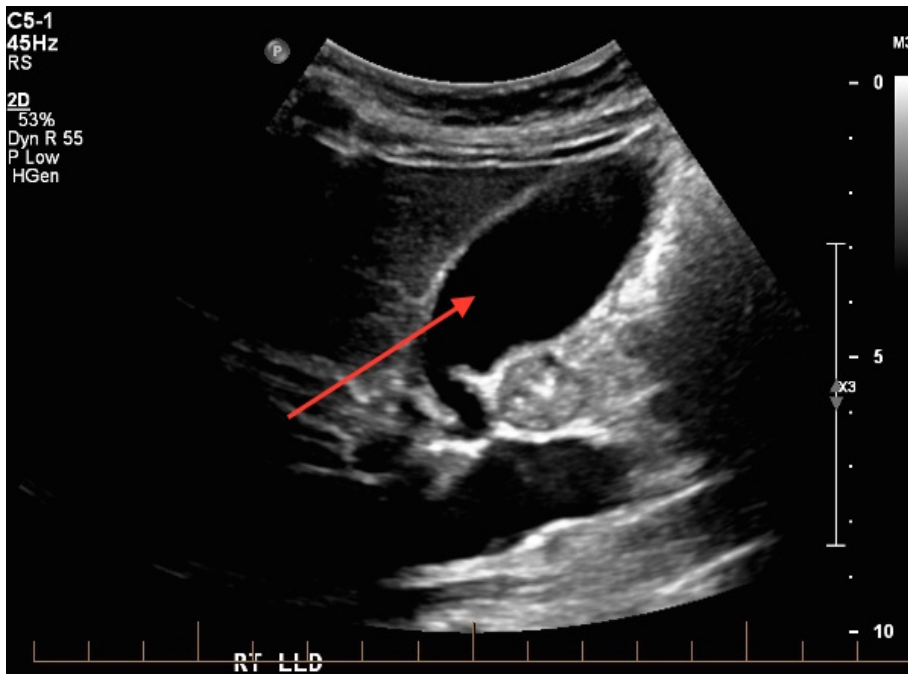


Figure 15 - Normal gallbladder in longitudinal view



Figure 16 - Normal gallbladder in transverse view

- Gall stones are seen as bright (echogenic) structures that cause distal shadowing (Figure 17)

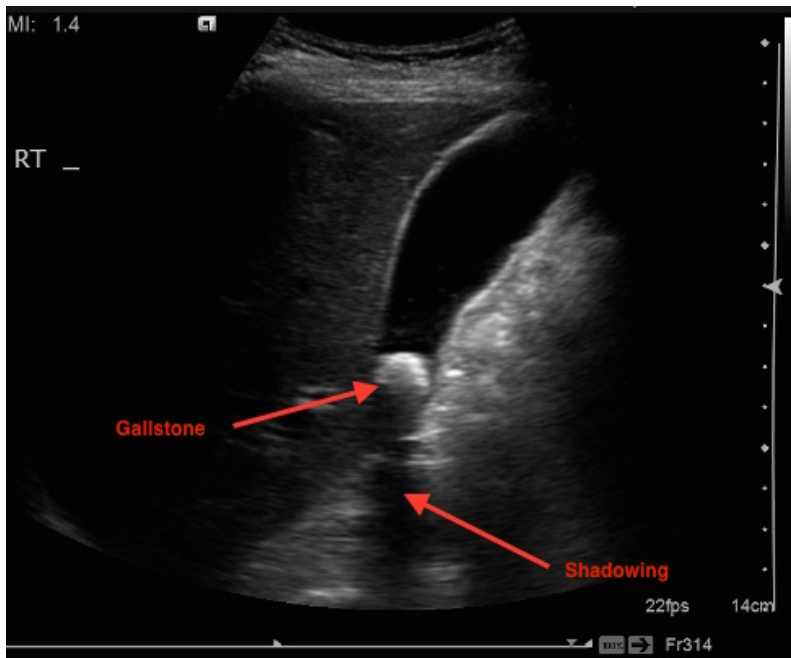


Figure 17 – Gallbladder with gallstone

- The gallbladder can also be inspected/tested for wall edema, pericholecystic fluid, and a Sonographic Murphy’s Sign – the tutor will elaborate at the bedside
- Several ‘tricks’ can be employed to identify an elusive gallbladder (right decubitus positioning, patient respiration, intercostal or lateral views)

LEFT UPPER QUADRANT

- For the LUQ, make a four-finger platform for the probe with your hand and use your thumb to stabilize the probe (Figure 18)



Figure 18 - Proper probe grip for the LUQ scan

- The scan of the LUQ is a mirror image of the scan of the RUQ (Figure 19)
- Ensure you visualize the entire kidney, splenorenal space, spleen and diaphragm (Figure 20)

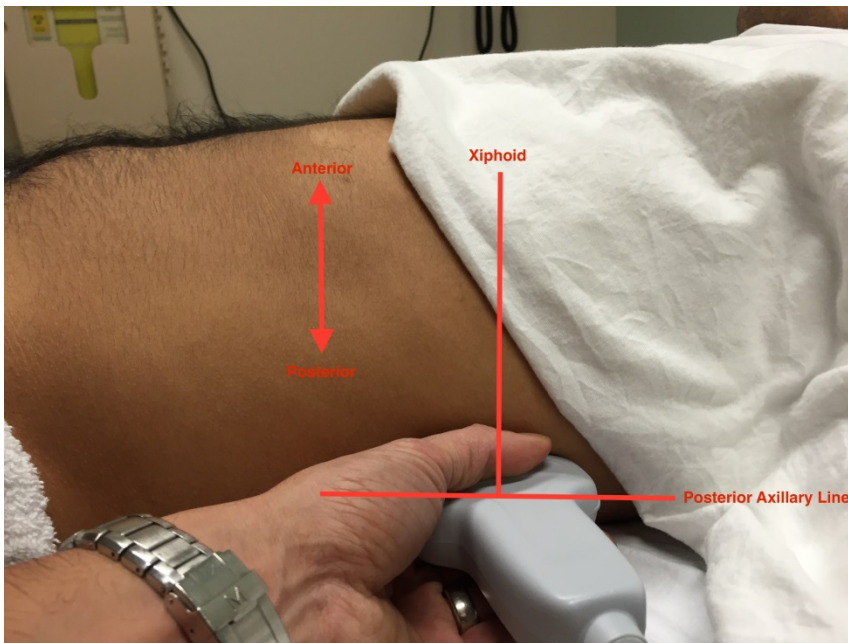


Figure 19 – Starting point for LUQ scan

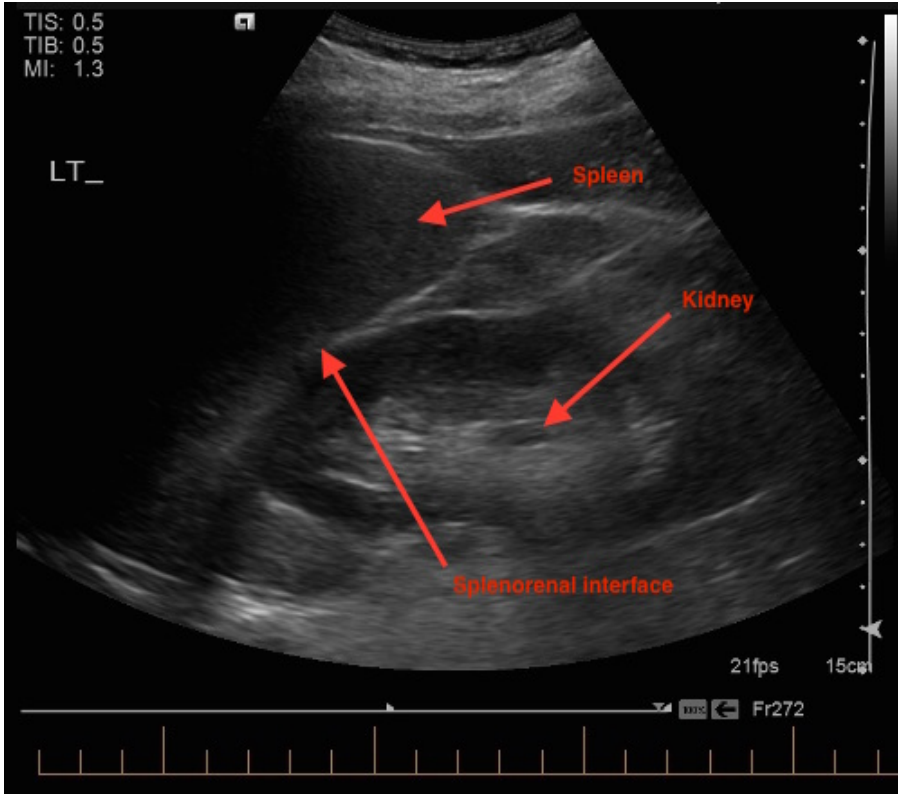


Figure 20 – Normal LUQ

- To perform a FAST scan of the LUQ, the probe is positioned with the best view of the splenorenal interface, the image is optimized (adjust gain/depth), and a sweep of the area is conducted similar to the RUQ. The diaphragm should be swept as well in the LUQ scan, as free fluid can accumulate superior to the spleen. (Figure 21)



Figure 21 - Positive LUQ FAST scan with free fluid in the splenorenal space

- The structures of the LUQ are often more difficult to image, as the window (the spleen) is smaller than the window in the RUQ (the liver)

PELVIS

- For pelvis scans, hold the probe similar to how you would grasp a large pencil
- Position the probe in the transverse plane in the midline at the pelvic brim (Figure 22)



Figure 22 – Starting point for the transverse pelvis scan. Note the change in probe grip for this scan.

- Optimize the image (adjust gain/depth) and sweep the probe caudally into the pelvis and then return cephalad. Recall that sweeping means angling the probe back and forth keeping the same point of contact with the patient.
- Identify the bladder, and if applicable, the uterus and recto-uterine pouch (Figure 23)

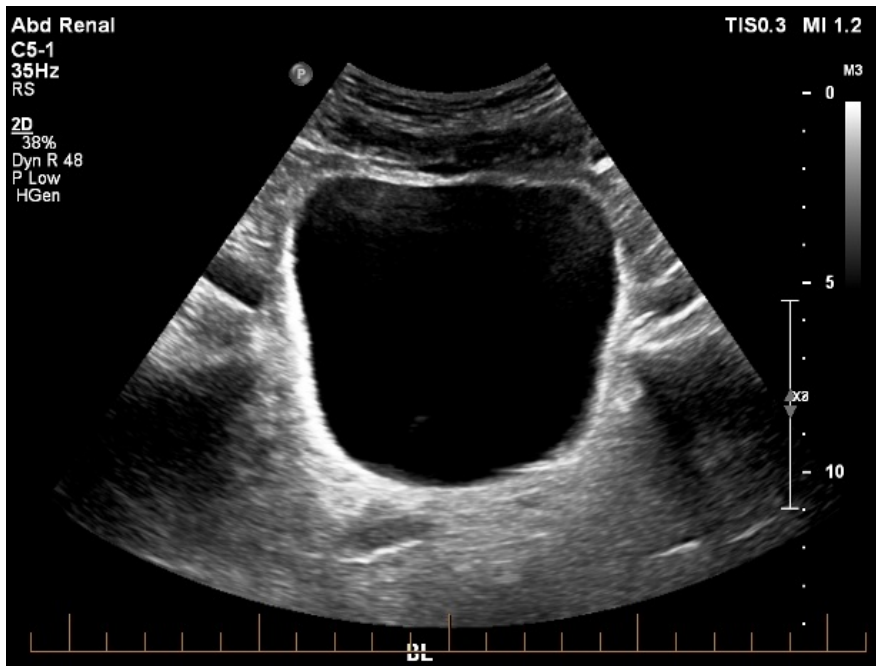


Figure 23 – Normal male pelvis with filled bladder

- In the FAST scan, observe for free fluid outside the margins of the bladder in the pelvis (Figure 24)



Figure 24 - Positive pelvic FAST scan with free fluid

- Early Pregnancy:
 - In addition to scanning the uterus in the transverse plane, it should also be scanned in the longitudinal plane (Figures 25 & 26)

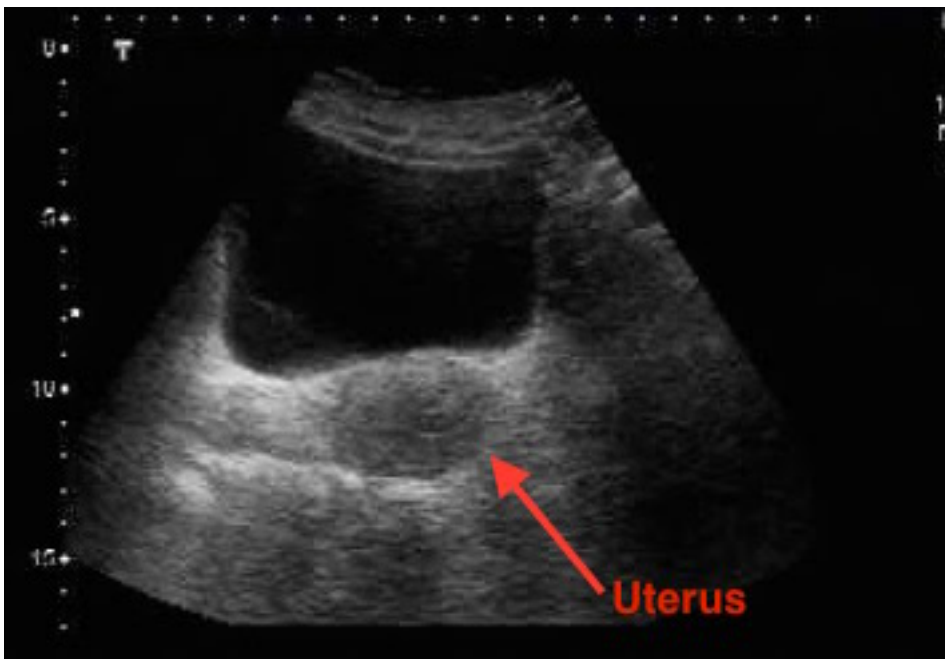


Figure 25 – Transverse view of normal female pelvis

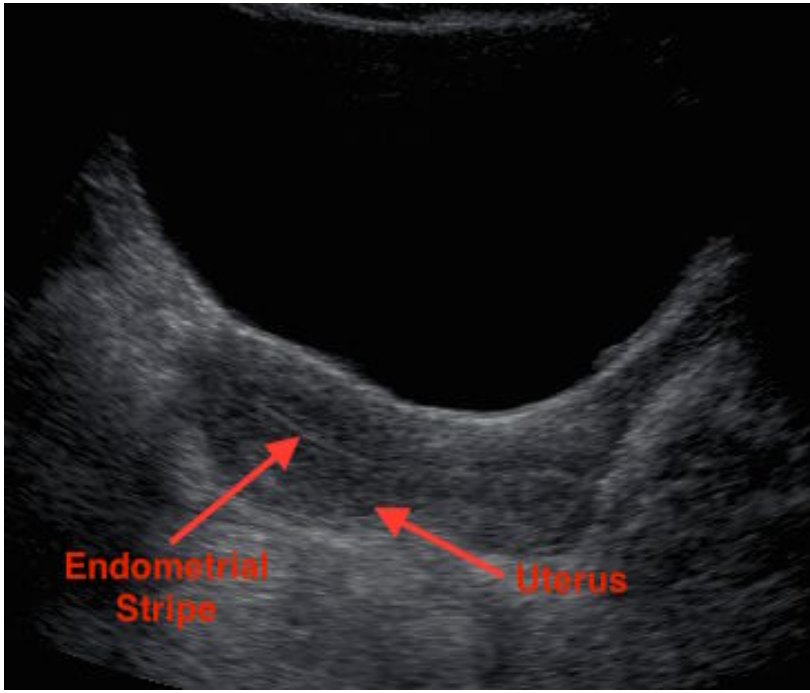


Figure 26 - Longitudinal view of normal female pelvis with endometrial stripe visible in uterus

- Rotate the probe into the longitudinal position, and slide left and right to find the best view of the uterus (Figure 27)
- Once the best view is found, sweep the probe left to right to visualize the uterus



Figure 27 – Scanning the pelvis in the longitudinal plane

- Early signs of pregnancy (gestational sac, yolk sac, fetal pole – see Figure 28) can be visualized along the endometrial stripe – a bright line in the uterus seen in longitudinal (Figure 26)

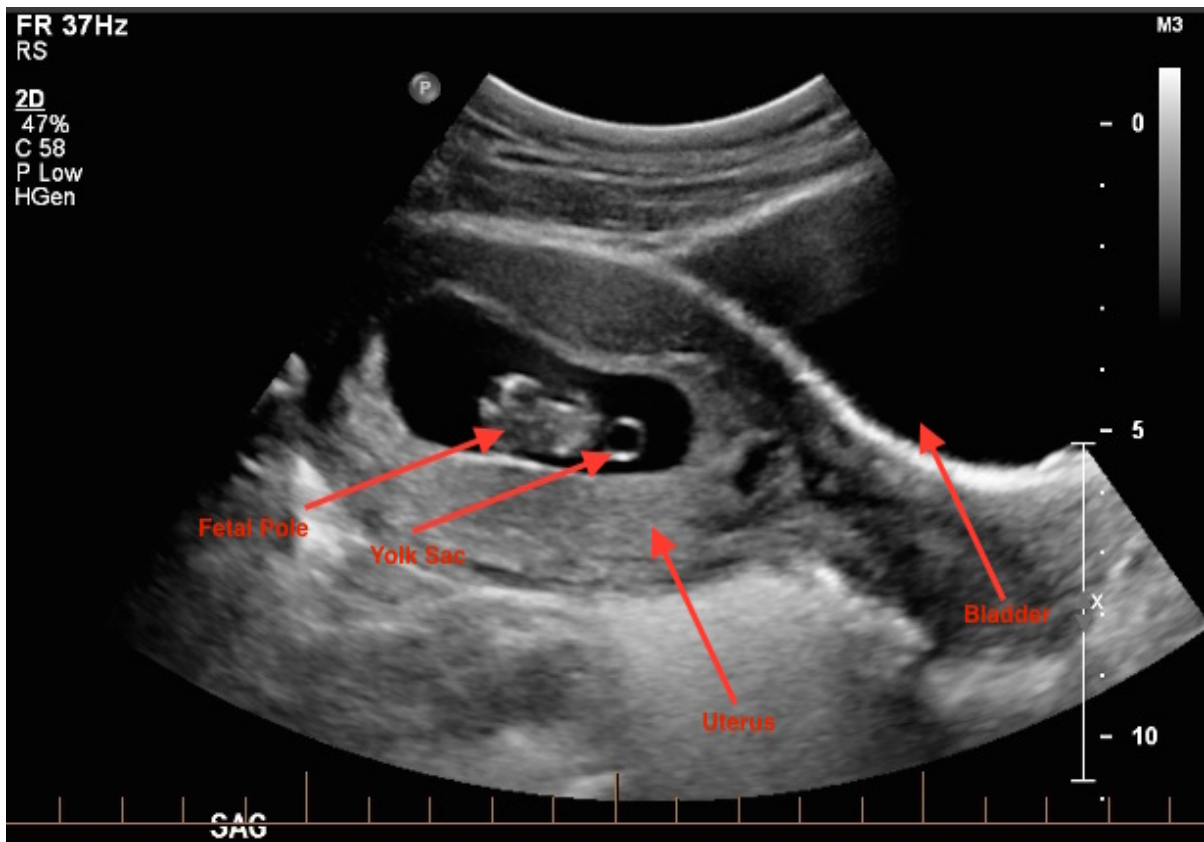


Figure 28 – Early intrauterine pregnancy with visible gestational sac, yolk sac, and fetal pole

- In the setting of early pregnancy, ultrasound findings **must** be correlated with clinical signs/symptoms and serum Beta-HCG levels – your tutor may elaborate
- Trace amounts of *physiologic* free fluid is commonly seen in the female pelvis of childbearing age