Abdomen Complete Ultrasound Protocol

Preferred Probe(s): 3.5 to 5 MHz curvilinear
Exam Preset: Abdomen
Patient Positioning: Supine, Decubitus
Patient Preparation: 4-6 hour fast
Common Indications: Abdominal pain, elevated Liver Function Tests, enlarged liver, r/o mets

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Scanning Routine:

Gallbladder and Biliary System:

- Longitudinal gallbladder with wall measurement (supine and decub)
- Transverse gallbladder (supine and decub)
  - For thickened GB wall (>3mm), include color Doppler image of GB
  - Assess for Murphy's sign
- Common duct with inner-to-inner wall measurements at the porta hepatis and widest portion
- Document intra- or extrahepatic ductal dilatation with grayscale and color Doppler

Pancreas:

- Transverse pancreas showing head, body, and tail (2 to 3 images)
- Document dilated pancreatic duct (>2mm) in both grayscale and color Doppler
- If pancreas is not visualized, take representative image of the pancreas area

Liver / IVC:

- Longitudinal grayscale liver images:
  - Left lobe – include lateral, medial (with LHV), and caudate with IVC
  - Right lobe – include GB/main lobar fissure, liver with kidney, and lateral to kidney
- Transverse grayscale liver images:
  - Left lobe – include LHV, LPV, and caudate
  - Right lobe – include dome, hepatic veins, porta hepatis, and GB / kidney
- IVC – document patency with color Doppler
- MPV – spectral Doppler with PSV (use correct angle)
- Examine the right pleural space for pleural effusion

Right and Left Kidneys:

- Longitudinal kidney with length measurement
- Longitudinal lateral and medial aspects
- Transverse kidney with AP and Trans measurements
- Transverse superior and inferior poles
- Longitudinal and transverse kidney with color Doppler

Aorta:

- Longitudinal Prox Aorta with AP measurement
- Longitudinal Dist Aorta with AP measurement
- If aneurysm is visualized, record the AP and Transverse measurements (outer-to-outer wall) at the widest portion.

Spleen:

- Longitudinal spleen with length measurement
- Transverse spleen
- Examine the left pleural space for pleural effusion

Ankle Brachial Index (w/Exercise) Ultrasound Protocol

Preferred Probe(s): 8.1 MH continuous wave probe
Exam Preset: Lower Arterial
Patient Positioning: Supine with legs extended
Patient Preparation: None
Common Indications: Claudication, leg pain

Scanning Routine:

Pulses

- Obtain the pulses at the posterior tibial and dorsalis pedis arteries bilaterally
- Assign a numerical value to the pulses
  - 0 – absent pulse
  - 1 – weak pulse
  - 2 – bounding pulse

Doppler

- Record waveforms from the posterior tibial and dorsalis pedis arteries bilaterally

Segmental Pressures

- Place blood pressure cuffs on arms (10-inch cuff) and ankles (10-inch cuff) bilaterally
  - Use appropriate cuff size – the inflatable part of the cuff should cover at least 80% of the circumference of the upper arm or ankle. Some people may require a larger blood pressure cuff.
- For brachial pressure, obtain the arterial signal at the wrist.
  - If brachial pressures differ by more than 10 mmHg, retake pressures.
  - Use the higher of the two brachial artery pressures to calculate the ABI.
- For ankle pressures, obtain the arterial signal at the posterior tibial and dorsalis pedis arteries.
  - Obtain toe pressures if indicated.

Exercise

- Have the patient walk on the treadmill at 2mph and 10% incline for 5 minutes as tolerated. Ask patient to report any symptoms and note time.
- Immediately after exercise, obtain ankle and brachial segmental pressures every minute for 5 minutes.
  - For brachial pressures, use the arm with the higher pressure
  - For ankle pressures, use either the posterior tibial or peroneal (whichever is higher)
- Record any symptoms the patient experienced while the patient was on the treadmill (severity, location, and time of onset).

Aorta (with Doppler) Ultrasound Protocol

Preferred Probe(s): 3.5 TO 5 MHz curvilinear
Exam Preset: Aorta
Patient Positioning: Supine
Patient Preparation: 4-6 hour fast
Common Indications: Abdominal bruit, AAA screening, f/u AAA, pulsatile abdominal mass

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Scanning Routine:

Longitudinal Grayscale

- Longitudinal prox, mid, and distal Aorta (with AP measurements)
- Longitudinal Rt CIA at bifurcation and at widest portion (with AP measurement)
- Longitudinal Lt CIA at bifurcation and at widest portion (with AP measurement)

Transverse Grayscale

- Transverse prox, mid, and distal Aorta (with AP and Trans measurements)
- Transverse Rt CIA at bifurcation and at widest portion (with AP and Trans measurements)
- Transverse Lt CIA at bifurcation and at widest portion (with AP and Trans measurements)
    - Note: AP and Trans measurements should be within 1-2mm of each other and must be taken from outer-to-outer wall. Use the Longitudinal AP measurement for the worksheet.

Longitudinal Color and spectral Doppler

- Longitudinal prox, mid, and distal Aorta (with PSV)
- Longitudinal Rt CIA (with PSV)
- Longitudinal Lt CIA (with PSV)

Additional Images:

- If a stenosis is suspected, take additional spectral Doppler images with PSV measurement proximal to, at, and distal to stenosis.
- If an aneurysm is present (>3cm), take AP and Trans measurements at widest portion (outer-to-outer wall). Determine the shape and location of aneurysm and the distance from the renal arteries and aortic bifurcation. Document patency with color Doppler.

Lower Extremity Arterial (w/ Exercise) Ultrasound Protocol

Preferred Probe(s):	8.1 MHz continuous wave probe
Exam Preset:	Lower Arterial
Patient Positioning:	Supine with legs extended
Patient Preparation:	None
Common Indications:	Claudication, leg pain

Scanning Routine:

Pulses

- Obtain the pulses at the posterior tibial and dorsalis pedis arteries bilaterally
- Assign a numerical value to the pulses
    - 0 – absent pulse
    - 1 – weak pulse
    - 2 – bounding pulse

Doppler

- Record Doppler waveforms from the common femoral, mid femoral, popliteal , posterior tibial, and dorsalis pedis arteries bilaterally.

Pulse Volume Recording

- Place blood pressure cuffs and record PVRS from the upper thigh (12-inch cuff), lower thigh (12-inch cuff), calf (10-inch cuff), and ankle (10-inch cuff).
    - Use appropriate cuff size – the inflatable part of the cuff should cover at least 80% of the circumference of the upper arm or leg. Some people may require a larger or smaller blood pressure cuff.

Segmental Pressures

- Record segmental pressures from the upper arm (10-inch cuff), upper thigh, lower thigh, calf, and ankle bilaterally.
- For brachial pressure, obtain the arterial signal at the wrist.
    - If brachial pressures differ by more than 10 mmHg, retake pressures.
    - Use the higher of the two brachial artery pressures to calculate the ABI.
- For ankle pressures, obtain the arterial signal at the posterior tibial and dorsalis pedis arteries.
    - Obtain toe pressures if indicated.

Exercise

- Have the patient walk on the treadmill at 2mph and 10% incline for 5 minutes as tolerated. Ask patient to report any symptoms and note time.
- Immediately after exercise, obtain ankle and brachial segmental pressures every minute for 5 minutes.
    - For brachial pressures, use the arm with the higher pressure
    - For ankle pressures, use either the posterior tibial or peroneal (whichever is higher)
- Record any symptoms the patient experienced while the patient was on the treadmill (severity, location, and time of onset).

Breast Ultrasound Protocol

Preferred probe(s):	8 to 15 MHz linear
Exam Preset:	Breast
Patient positioning:	Supine or slightly rolled onto side with ipsilateral hand above head
Patient preparation:	None
Common indications:	Palpable lump, abnormal mammogram

Scanning Routine:

- Begin with the patient supine or slightly rolled onto her side (to spread out the breast) with her ipsilateral hand raised above her head. Scan the breast thoroughly in two orthogonal planes (using either a grid pattern or radial pattern) to ensure that the whole breast has been examined. Examine the retro areolar region and axillary tail.
- Correlate ultrasound findings with any palpable lesions or mammogram abnormalities. If any pathology is found, document vascularity and measurements (AP, length, width) in two planes. Document the position in the breast (o'clock and distance from nipple).
- If no abnormality is visualized, take a representative image of the suspected area.
- Discuss findings with radiologist before releasing patient.

Carotid Artery Ultrasound Protocol

Preferred Probe(s): 7 to 10 MHz linear
Exam Preset: Carotid
Patient Positioning: Supine
Patient Preparation: None
Common Indications: Bruit, stenosis, TIA, CVA, syncope, lack of coordination

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Scanning Routine:

Grayscale – Longitudinal and Transverse

- CCA Prox, Mid, and Distal
- Carotid bulb
- ECA
- ICA

Color Doppler – Longitudinal

- CCA Prox, Mid, and Distal
- Carotid bulb
- ECA
- ICA
- Vertebral

Color Spectral Doppler – Longitudinal

- CCA Prox, Mid, and Distal – Enter the Mid CCA PSV and EDV into the package
- ICA Prox, Mid, and Distal – Enter the highest PSV and EDV into the package
- ECA – Enter the highest PSV into the package
- Vertebral

Note: All PSV measurements on spectral tracings must be obtained using an angle < 60°. If following up on a stenosis, use the same angle that was used previously. Remember to angle with the jet and not the vessel wall.

Additional Images:

- If a stenosis is detected, obtain velocities proximal to, at, and distal to stenosis.
- If vertebral waveforms indicate vertebral steal, take additional images of the subclavian artery looking for a stenosis.

Print report page

Neonatal Brain Ultrasound Protocol

Preferred Probe(s): 5-8 MHz vector, high frequency linear
Exam Preset: Neo Brain
Patient Positioning: Supine (place cloth under baby's head)
Patient Preparation: None
Common Indications: Macrocephaly, microcephaly, premature birth, craniosynostosis

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Scanning Routine:

Sagittal views (vector probe):

- Take serial sagittal grayscale images from far lateral to medial for both right and left hemispheres. Include the following images:
    - Midline with corpus callosum, 3rd and 4th ventricles, and cerebellum (1-2 images)
    - Right and Left parasagittal with the caudothalamic groove
    - Right and Left lateral ventricles
        - Measure the trigone of the lateral ventricles
    - Right and Left far lateral showing the periventricular white matter (include Sylvian fissure)
- If there is intracranial hemorrhage, add a single-color Doppler exam of the superior sagittal sinus (document presence/absence of SSS thrombosis)

Coronal views (vector probe):

- Take serial coronal grayscale images from anterior to posterior. Label the right and left hemispheres. Include the following images:
    - Anterior view with the orbits
    - Caudate region
    - Lateral ventricles (include series of images from caudate to trigone of lateral ventricles)
        - Measure the frontal horn of the lateral ventricles at the caudate nucleus (Normal: < 4mm)
    - Occipital region
- If there is intracranial hemorrhage, add a single-color Doppler exam of the superior sagittal sinus (document presence/absence of SSS thrombosis)

Note: Depth of images should be the same throughout study except for the magnified views. Additional images can be taken of areas of interest.

Magnified views (with high frequency linear probe):

- Take 4-6 magnified coronal images of the lateral ventricles from the anterior horns to the back of the ventricles. All magnified images should have the same depth.

Preferred Probe(s): 3.5 to 5 MHz curvilinear
Exam Preset: OB
Patient Positioning: Supine
Patient Preparation: Full bladder
Common Indications: Oligohydramnios, decreased fetal movement

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Scanning Routine:

- Duration of exam should last 30 minutes (for each fetus in multiple gestations) unless all criteria are observed in less amount of time.
    - Fetal breathing – 30 seconds of sustained fetal breathing
    - Gross body movement – at least 3 episodes of movement involving the trunk or limbs
    - Fetal tone – at least 1 episode of limb flexion to extension and return to flexion. Opening and closing of hand counts as evidence of fetal tone.
    - Amniotic fluid evaluation – calculate AFI and document fluid pocket with at least 1cm depth in two different planes

- Include estimated fetal weight (EFW) if one has not been performed within the last 2 weeks
    - BPD, HC, AC, FL

- Document fetal heart rate – preferably with M-Mode

First Trimester OB (< 14 weeks) Ultrasound Protocol

Preferred Probe(s):	3.5 to 5 MHz curvilinear and/or endovaginal probe
Exam Preset:	OB or Endovaginal
Patient Positioning:	Supine (transabdominal) Lithotomy (endovaginal)
Patient Preparation:	Full bladder (transabdominal) Empty bladder (transvaginal)
Common Indications:	Dating, viability, vaginal bleeding, pelvic pain

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Scanning Routine:

This exam may be performed transabdominally or transvaginal.

Maternal anatomy

- Longitudinal cervix
- Uterine corpus in longitudinal and transverse views. Document uterine position and any pathology noted (e.g. fibroids).
- Adnexa – Ovaries with measurements (long, trans, AP). Document blood flow to ovaries with color Doppler and spectral Doppler.

Pregnancy specific findings

- Number of gestational sacs and their location and size
- Placental location if discernible (especially in multiple gestations)
- Pregnancy viability – document fetal heart rate, preferably using M-Mode
- Presence or absence of yolk sac, as well as size and quality (translucent v. opaque)
- Crown-rump length for gestational age (avoid measurements when the fetus appears extended or hyper-flexed)
- Between 9 and 14 weeks, look for fetal anatomy and document major anatomical structures (e.g. cranium, heart, kidneys, extremities, feet, hands)
- Document any fetal structural defects noted

Print Report Page

Second Trimester OB Complete Ultrasound Protocol

Preferred Probe(s): 3.5 to 5MHz curvilinear
Exam Preset: OB
Patient Positioning: Supine
Patient Preparation: Full bladder
Common Indications: Anatomic survey

Scanning Routine:

Maternal anatomy

- Longitudinal cervix with measurement
  - All patients should have cervical evaluation transabdominally. If indicated, transvaginal exam should be performed (e.g. evaluate for funneling, proximity to placenta).
- Survey uterus / adnexa and document pathology (e.g. fibroids)

Pregnancy related findings

- Fetal number and viability (obtain fetal heart rate preferably using M-Mode)
- Fetal presentation
- Amniotic fluid index
- Placenta location and cord insertion site
  - Document edge of placenta in relation to the internal cervical os and take longitudinal and transverse images of the placenta. If there appears to be placenta previa and the bladder is full, add transvaginal ultrasound post-void to confirm placenta previa.
- Placental parenchyma evaluation (e.g. abnormal thickness, echogenicity, lesions)
- Fetal biometry for gestation age and fetal growth evaluation
  - BPD, HC, AC, FL, and humerus measurements
  - In multiple gestations, discordance (>20%) should be noted

Fetal Anatomy

- Intracranial anatomy – cranium, choroid plexus, lateral ventricle, cerebellum, cisterna magna, nuchal fold, midline falx, cavum septi pelucidi, thalami
- Face – orbits, mouth, nasal bone, lip, chin, forehead
- Spine – cross-sectional and longitudinal or coronal views of the cervical, thoracic lumbar, and sacral levels
- Heart – 4 chamber heart view, cardiac size, position of heart in the thorax, outflow tracts
- Diaphragm – document relationship to the heart and stomach in coronal view
- Evaluate lungs for lesions and pleural effusions

Paracentesis Ultrasound Protocol

Preferred probe(s): 3.5 to 5 MHz curvilinear
Exam Preset: Abdomen
Patient positioning: Supine
Patient preparation: PT/INR lab work if patient is anticoagulated (to be ordered by provider)
Common indications: Ascites

Scanning Routine:

1. Gather the following supplies before exam(verify items with radiologist):
    - Thoracentesis kit
    - 1% Lidocaine
    - 15G metal Caldwell needle
    - Sterile gloves for radiologist
    - 3L suction canister
    - Towels, gel, and marking pen
    - Consent form
2. Check for any lab results (e.g. PT/INR) and make sure that they are within normal limits.
3. Bring the patient into the exam room and explain the procedure and to do the initial scan to assess for ascites. Document RLQ and LLQ and measure the deepest pocket of fluid.
4. After making sure that there is enough ascites to draw off, set up the supplies.
5. Obtain consent and then sign as a witness.
6. Discuss findings with radiologist.
7. Assist the radiologist by operating the US machine and transducer.
8. After the initial draw, take over for the radiologist in drawing off fluid
9. When done, remove the catheter and apply pressure to the site with gauze. Apply band aids or derma bond to the puncture site.
10. Clean the work area, disposing of needles into the Sharps container and ascites into the toilet.
11. If the procedure is diagnostic, take fluid sample to lab with appropriate paperwork (e.g. lab order, cytology form, etc.)

Pelvis Ultrasound Protocol

Preferred Probe(s):	3.5 to 5 MHz curvilinear and/or endovaginal probe
Exam Preset:	Pelvic or Endovaginal
Patient Positioning:	Supine (transabdominal) Lithotomy (endovaginal)
Patient Preparation:	Full bladder (transabdominal) Empty bladder (endovaginal)
Common Indications:	Pelvic pain, abnormal vaginal bleeding, IUD location

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This exam may be performed transabdominally and/or endovaginally. If only transabdominal exam is done, the patient should have a fully distended bladder. **For male sonographers: Do not perform the transvaginal exam without a *hospital-employed* female chaperone in the room.**

Scanning Routine:

Uterus - Longitudinal Grayscale

- Long cervix
- Long mid uterus with longitudinal and AP measurement
- Long right and left lateral aspects of uterus
- Long endometrium with AP measurement in thickest portion

Uterus - Transverse Grayscale

- Trans cervix
- Trans body with trans measurement
- Fundus of uterus

Uterus - Color Doppler

- Longitudinal mid uterus
- Trans mid uterus

Note: Document fibroids with grayscale and color Doppler and measure them. Document any fluid in the cul-de-sac. For post hysterectomy, document midline area in long and trans.

Ovaries

- Grayscale long and trans with measurements (AP, long, trans) of each ovary
- Color and spectral Doppler images of each ovary

Note: Document and measure any ovarian cysts/ masses with grayscale and color Doppler. If ovary is not identified, take images of long and trans adnexa.

Pyloric Stenosis Ultrasound Protocol

Preferred probe(s): 9 to 12 MHz linear
Exam Preset: Abdomen
Patient positioning: Supine
Patient Preparation: Bring bottle
Common Indications: Projectile vomiting, weight loss, failure to thrive

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Scanning Routine:

Tip: Using a high-frequency transducer, perform the exam soon after a feeding if possible. It may help to roll the infant slightly onto his right side so that the fluid fills the antrum of the stomach and acts as an acoustic window. Begin by scanning transversely to locate the pylorus, which is found medial and posterior to the gallbladder.

- Assess for the passage of fluids through the pyloric canal. An open canal with normal passage of gastric content excludes hypertrophic pyloric stenosis (HPS).

- Document the thickness of the pyloric muscular layer in transverse (outer-to-outer wall)
  - 3mm = abnormal
  - 2-3mm = indeterminate
  - <2mm = normal

- Document the length of the pyloric canal in longitudinal
  - >12mm = abnormal

Note: The muscle thickness of the pylorus is a more reliable finding than the length of the canal.

Renal Ultrasound Protocol

Preferred Probe(s):	3.5 to 5 MHz curvilinear
Exam Preset:	Renal
Patient Positioning:	Supine, RPO/LPO, and/or decub
Patient Preparation:	Full bladder
Common Indications:	Flank pain, hematuria, renal failure, recurrent UTIs

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Scanning Routine:

Grayscale Longitudinal Kidney (Right and Left)

- Mid kidney with pole-to-pole measurement
- Lateral aspect of kidney
- Medial aspect of kidney
- Document cortical thickness at the poles
- Right kidney/liver and left kidney/spleen (for relative echogenicity)

Grayscale Transverse Kidney (Right and Left)

- Mid kidney with AP and Trans measurements
- Upper kidney
- Lower kidney
- If there is hydronephrosis, AP measurement of renal pelvis

Color Doppler

- Longitudinal mid kidney
- Transverse mid kidney

Additional Images

- Document masses in grey scale and color Doppler and take measurements in three dimensions.
- If a solid mass is visualized, document the patency of the renal vein with color Doppler.
- If hydronephrosis is seen, re-image affected kidney (longitudinal and transverse) after patient voids.

Bladder with pre-void and post-void volumes

- Document bilateral ureteral jets in color Doppler

Pediatric Renal Exams

Right Lower Quadrant Ultrasound Protocol

Preferred Probe(s): 7 to 15 MHz linear
Exam Preset: Abdomen
Patient Positioning: Supine
Patient Preparation: None
Common Indications: RLQ pain

Scanning Routine:

Tip: Begin by scanning transversely at the hepatic flexure and follow the bowel down to the level of the cecum while attempting to displace bowel gas with deep graded pressure. If unable to visualize appendix with patient supine, roll patient into LPO position to move the cecum off of the appendix. For female patients with RLQ pain and a negative appendix scan, rule out ovarian pathology as a source of pain.

If appendix is not visualized:

- Take representative images in longitudinal and transverse at the level of the cecum and any area of focal tenderness. Use graded pressure to attempt to displace bowel gas.
- Note: Non-visualization of appendix does not exclude appendicitis

If appendix is visualized:

- Take pictures of the appendix in transverse with and without compression
- Image appendix with color Doppler
- Take AP measurements of sagittal appendix from outer-to-outer wall (> 6mm = abnormal)

Assess RLQ for fluid, mass, or echogenic changes in the fat suggesting inflammation

For female patients:

- Grayscale long and trans with measurements (AP, long, trans) of right ovary
- Color and spectral Doppler images of right ovary

Findings positive for appendicitis:

- Non-compressible appendix with AP diameter > 6mm
- Non-peristaling, blind-ending tube connected to the cecum
- Point tenderness

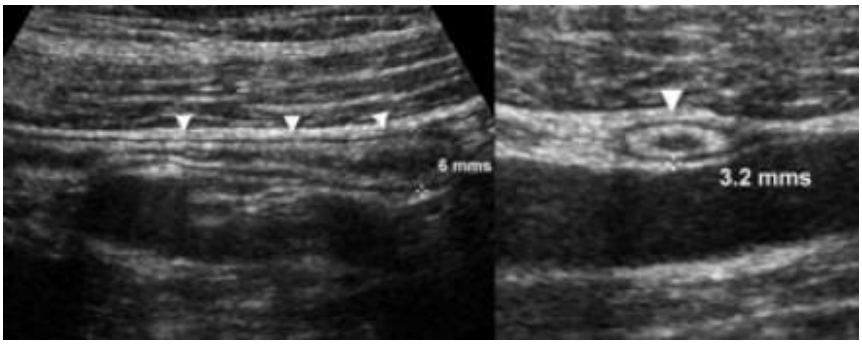

Figure 1 Normal appendix (measures 6mm and demonstrates compressibility)

http://www.radiologyassistant.nl/en/p420f0a063222e/appendicitis-mimics.html

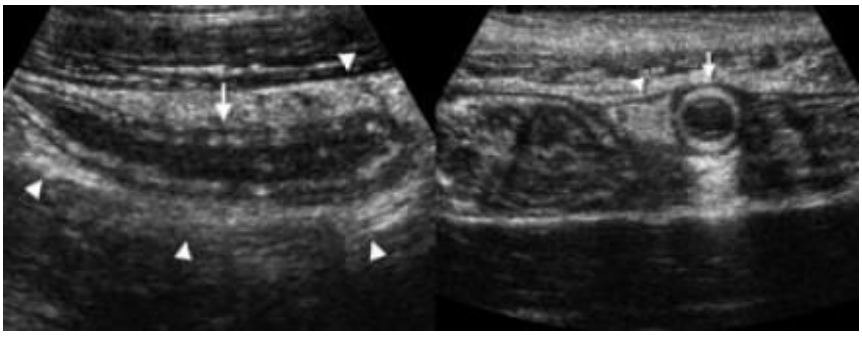

Figure 2 Abnormal appendix (measures >6mm and is not compressible)

http://www.radiologyassistant.nl/en/p420f0a063222e/appendicitis-mimics.html

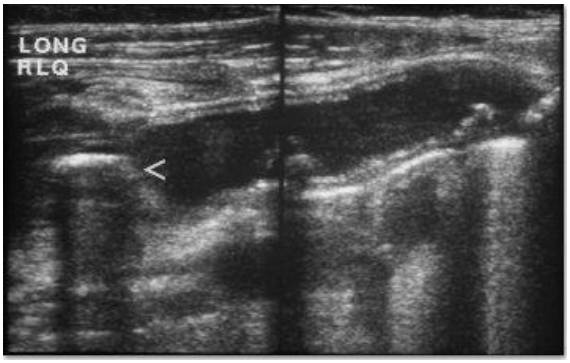

Figure 3 Abnormal appendix with appendicoliths

http://www.madisonradiologists.com/SvcCTAbdominalPain.htm

Right Upper Quadrant Ultrasound Protocol

Preferred Probe(s): 3.5 to 5 MHz curvilinear
Exam Preset: Abdomen
Patient Positioning: Supine, Decubitus
Patient Preparation: 4-6 hour fast
Common Indications: Abdominal pain, elevated Liver Function Tests, enlarged liver, r/o mets

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Scanning Routine:

Gallbladder and Biliary System:

- Longitudinal gallbladder with wall measurement (supine and decub)
- Transverse gallbladder (supine and decub)
    - For thickened GB wall (>3mm), include color Doppler image of GB
    - Assess for Murphy's sign
- Common duct with inner-to-inner wall measurements at the porta hepatis and widest portion
- Document intra- or extrahepatic ductal dilatation with grayscale and color Doppler

Pancreas:

- Transverse pancreas showing head, body, and tail (2 to 3 images)
- Document dilated pancreatic duct (>2mm) in both grayscale and color Doppler
- If pancreas is not visualized, take representative image of the pancreas area

Liver / IVC:

- Longitudinal grayscale liver images:
    - Left lobe – include lateral, medial (with LHV), and caudate with IVC
    - Right lobe – include GB/main lobar fissure, liver with kidney, and lateral to kidney
- Transverse grayscale liver images:
    - Left lobe – include LHV, LPV, and caudate
    - Right lobe – include dome, hepatic veins, porta hepatis, with GB and kidney
- IVC – document patency with color Doppler
- MPV – spectral Doppler with PSV (use correct angle)
- Examine the right pleural space for pleural effusion

Right Kidney:

- Longitudinal kidney with length measurement
- Longitudinal lateral and medial aspects
- Transverse kidney with AP and Trans measurements
- Transverse superior and inferior poles
- Longitudinal and transverse kidney with color Doppler

- Liver/kidney image (for relative echogenicity)

Scrotum (with Doppler) Ultrasound Protocol

Preferred probe(s): 9 to 12 MHz linear
Exam Preset: Scrotum
Patient positioning: Supine with the scrotum supported (e.g. on a towel)
Patient preparation: None
Common indications: Enlargement, palpable mass, undescended testicles, testicular pain

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An attempt should be made to have a male sonographer available to perform the scan. Female sonographers should consider having a hospital-employed chaperone with them in the room.

Scanning Routine:

Longitudinal Grayscale

- Mid testicle with AP and length measurement
- Lateral aspect of testicle
- Medial aspect of testicle
- Epididymal head in relationship to testicle
- Epididymal body and tail

Transverse Grayscale

- Mid testicle with width measurement
- Superior aspect of testicle
- Inferior aspect of testicle
- Epididymal head
- Dual image showing both Rt and Lt testicles

Color Doppler

- Dual image showing both Rt and Lt testicles with color Doppler
- Color images of epididymis in relation to testicle

Spectral Doppler

- 1-2 Arterial and venous spectral tracings in each testicle

Inguinal Canal

- Longitudinal inguinal canal (bilateral) with and without Valsalva to assess for hernia

For varicocele:

- Longitudinal AP measurements of the largest vein with and without Valsalva (grey scale)
- Color Doppler images of varicocele with and without Valsalva

SONOGRAPHER SHOULDER ULTRASOUND SYNOPSIS

Patient is to sit on chair with hand of affected shoulder on thigh palm up (neutral position).

View full long head of the bicep tendon from insertion to pectoralis tendon. Acquire LONG AND SHORT AXIS VIEWS OF THE BICEPS TENDON.

While externally rotating the arm (bring forearm laterally with elbow tight by the side and palm up) view subscapularis tendon from insertion to muscle. Acquire LONG AND SHORT AXIS VIEWS OF THE SUBCAPULARIS TENDON.

View AC joint with arm in neutral position. Then have the patient slowly move the arm to touch the contralateral shoulder. If no pathology, then acquire ONE LONG VIEW OF THE AC JOINT. If abnormal, ACQUIRE CINE LOOP.

Posterior shoulder with arm in neutral position, view infraspinatus muscle and tendon, spin glenoid notch, glenoid and labrum with internal and external rotation of arm. If no pathology then acquire LONG AXIS VIEWS OF THE POSTERIOR JOINT, ONE VIEW OF SPINOGLENOID NOTCH, LONG AND SHORT AXIS VIEWS OF INFRASPINATUS MUSCLE/TENDON. If abnormal, ACQUIRE CINE LOOP.

View distal supraspinatus tendon anteriorly/superiorly with arm in same position. Perform impingement test by abducting the arm. If no pathology acquire ONE VIEW OF THE DISTAL SUPRASPINATUS TENDON WITH THE ARM IN NEUTRAL POSITION AND ONE WITH THE ARM ABDUCTED (USE SPLIT SCREEN, SIDE BY SIDE).

Acquire ONE TRANSVERSE PANORAMIC VIEW OF THE MUSCLES OF THE ROTATOR CUFF FOR MUSCLE VOLUME EVALUATION. MUST ACQUIRE ONE IMAGE FROM CONTRALATERAL SIDE FOR COMPARISON.

Have patient position the arm in marked internal rotation and adduction. This may be achieved by putting their arm behind their back and reaching for the contralateral shoulder or reaching back to grasp the back of their chair or reaching as if to place their hand in their back pants pocket. This will draw the maximal portion of the supra and infraspinatus tendons from beneath the acromion so that they may be examined. Acquire LONG AND SHORT AXIS VIEWS OF SUPRASPINATUS AND INFRASPINATUS TENDONS IN THIS POSITION.

REMEMBER : The contralateral shoulder can easily be examined for comparison if pathology is questionable. Feel free to include comparable images from the asymptomatic contralateral shoulder and make sure that they are **clearly marked** as such.

Thoracentesis Ultrasound Protocol

Preferred probe(s):	3.5 to 5 MHz curvilinear
Exam Preset:	Abdomen
Patient positioning:	Sitting with legs over side of bed and leaning onto tray table w/ pillow
Patient preparation:	PT/INR lab work if patient is anticoagulated (to be ordered by provider)
Common indications:	Pleural effusion

Scanning Routine:

12. Gather the following supplies before exam (verify items with radiologist):
    - Thoracentesis kit
    - 1% Lidocaine
    - 15G metal Caldwell needle
    - Sterile gloves for radiologist
    - Towels, gel, and marking pen
    - Consent form
13. Check for any lab results (e.g. PT/INR) and make sure that they are within normal limits.
14. Determine whether the procedure is therapeutic and/or diagnostic. If diagnostic, be prepared to take a sample to lab right after radiologist starts drawing fluid.
15. Bring the patient into the exam room and explain the procedure and to do the initial scan to assess for pleural effusion. Document the deepest pocket of fluid.
16. After making sure that there is enough pleural fluid to draw off, set up the supplies.
17. Obtain consent and then sign as a witness.
18. Discuss findings with radiologist.
19. Assist the radiologist by operating the US machine and transducer.
20. When done, remove the catheter and apply pressure to the site with gauze. Apply band aids or derma bond to the puncture site.
21. Clean the work area, disposing of needles into the Sharps container and fluid into the toilet.
22. If the procedure is diagnostic, take fluid sample to lab with appropriate paperwork (e.g. lab order, cytology form, etc.)

****Patient must be cleared with a chest x-ray before leaving the department****

Thyroid Ultrasound Protocol

Preferred probe(s): 9 to 12 MHz linear
Exam Preset: Thyroid
Patient positioning: Supine, with neck as extended as tolerated
Patient preparation: None
Common indications: Thyroid nodule, thyroid enlargement, f/u thyroid cancer

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Scanning Routine:

Longitudinal Grayscale Thyroid (Rt and Lt)

- Mid thyroid with length measurement
- Medial aspect of thyroid
- Lateral aspect of thyroid
- Note: If unable to fit pole-to-pole thyroid on one image, try a curvilinear probe or take additional images showing the superior and inferior thyroid poles

Transverse Grayscale Thyroid (Rt and Lt)

- Mid thyroid with AP and Trans measurements
- Superior thyroid
- Inferior thyroid
- Isthmus with AP measurement
- Dual image showing both lobes with and without color Doppler

Color Doppler

- Longitudinal mid thyroid
- Transverse mid thyroid

Additional Images

- Document pathology in both grey-scale and color Doppler. Measure nodules in three dimensions and draw them onto the worksheet with measurements**.**
- Survey the neck for any abnormal lymph nodes. Document and measure any abnormal lymph nodes and draw them onto the worksheet.

Note: Use the above protocol for necks without a thyroid and label “thyroid fossa” in place of “thyroid”

TIPS Ultrasound Protocol

Imaging Protocol: This exam will include the entire liver, a four-quadrant evaluation for ascites, and color and spectral Doppler evaluation of the TIPS, the portal veins, and the hepatic vein that the TIPS communicates with.

Gray Scale Images

1. Transverse liver with all hepatic veins: take more than one image if necessary to be sure all three hepatic veins are imaged.
2. Transverse image of the liver with the portal vein
3. Longitudinal liver with images to include:

   - Left lobe of liver with prox. aorta
   - Left lobe of liver with left portal vein
   - Liver with IVC labeled
   - Right lobe of liver with right portal vein
   - Right lobe of liver / right kidney interface

4. Four quadrant assessment for ascites (RUQ, RLQ, LUQ, LLQ)

Color and Spectral Doppler Images (Determine which portal and hepatic vein the TIPS communicate with)

1. Color and angle-corrected spectral Doppler with PSV measured of the portal vein proximal to its communication with the TIPS
2. TIPS at its communication with the portal vein with color and angle-corrected spectral Doppler and PSV measured
3. Proximal TIPS with color and angle-corrected spectral Doppler and PSV measured
4. Mid TIPS with color and angle-corrected spectral Doppler and PSV measured
5. Distal TIPS with color and angle-corrected spectral Doppler and PSV measured
6. TIPS at its communication with the hepatic vein with color and angle-corrected spectral Doppler and PSV measured
7. Hepatic vein just distal to its communication with the TIPS with color and angle-corrected spectral Doppler
8. All portal veins (main, right, left) should be evaluated for flow direction with color and angle-corrected spectral Doppler with the PSV measured

Lower Extremity Venous Ultrasound Protocol

Preferred Probe(s):	7 to 10 MHz linear
Exam Preset:	PV Venous
Patient Positioning:	Supine with leg externally rotated
Patient Preparation:	None
Common Indications:	Pain, swelling, redness, f/u thrombosis

Scanning Routine:

Transverse grayscale with and without compression

- CFV
- SFJ
- GSV
- Fem V prox, mid, and distal
- Pop V prox and distal

Longitudinal Color and Spectral Doppler

- CFV (with Valsalva)
  - Note: If unilateral, do contralateral side if the side undergoing evaluation is positive
- SFJ (with Valsalva)
- Profunda (with augmentation)
- Fem V proximal, mid, and distal (with augmentation)
- Pop V proximal and distal (with augmentation)

Calf Veins

- Transverse grayscale with and without compression (prox, mid, distal)
- Transverse color Doppler image

Popliteal Fossa

- Survey and take one image of the popliteal space if normal
- Document the presence of a Baker's cyst with grayscale and color Doppler, and measure in 3 dimensions

Additional Images:

- Document the location and extent of any thrombus with grayscale and color Doppler. If thrombus is seen within the proximal GSV, document the distance from the SFJ.

If thrombus is detected, the radiologist may need to contact the ordering provider for patient instructions.

Lower Extremity Venous Mapping Ultrasound Protocol

Preferred Probe(s): 7 to 10 MHz linear
Exam Preset: PV Venous
Patient Positioning: Supine with leg externally rotated and knee slightly bent and upright
Patient Preparation: None
Common Indications: Varicose veins

Scanning Routine:

Deep Venous Study

- Transverse grayscale images with and without transducer compressions of the affected lower extremity of the CFV, SFJ, mid FV, popliteal vein, GSV, and LSV. Demonstrate patency with color and spectral Doppler. Document the presence, location, severity, and age of thrombosis (acute v. chronic).

Superficial Vein Mapping

- Measure diameter and vessel depth of the GSV at the proximal, mid, and distal thigh, and 5cm distal to the knee. Measure diameter and vessel depth of the LSV at the proximal and mid-calf.
    - Inner-to-inner wall vessel measurements must be obtained in the transverse plane
    - Document the presence and location of any major tributaries, varicosities, tortuosity, or aneurysmal segments of the GSV and LSV

Competency

- Reflux is treatable if the vein refluxes for more than 3 seconds (< 0.5 seconds reflux is normal). Patency and competency should be demonstrated with color and spectral Doppler in the following veins with the patient upright and bearing weight on the unaffected leg (or in steep reverse Trendelenburg if the patient is unable to stand). Competency should be tested using the Valsalva maneuver and/or distal augmentation. If vein is competent proximally, then distal augmentation should be used to test for reflux.
    - SFJ (w/ Valsalva)
    - GSV
    - SPJ (Note: This is absent in 25% of the population)
    - LSV

Perforating Veins

- If indicated, examine perforating veins located in the medial calf (begin by scanning transversely along the posterior tibial veins). If flow is observed going from deep to superficial, the perforator is incompetent. Document incompetent perforators and their diameter, depth, and distance from medial malleolus.

Upper Extremity Veins Ultrasound Protocol

Preferred probe(s): 7 to 10 MHz linear
Exam Preset: PV Venous
Patient positioning: Supine
Patient preparation: None
Common indications: Pain, swelling, redness

Scanning Routine:

Transverse Grayscale (w/ and w/out compression)

- Jugular vein (upper and lower)
- Subclavian vein
- Axillary vein
- Brachial veins (prox and distal)
- Basilic vein (upper arm and forearm)
- Cephalic vein (upper arm and forearm)
- Radial and Ulnar veins

Color Doppler and Spectral Doppler

- Lower jugular vein
- Brachiocephalic vein
- Subclavian vein (medial to clavicle)
    - Note: Spectral Doppler must be done bilaterally even if doing unilateral study
- Axillary vein (lateral to clavicle)
- Brachial veins

Additional images

- Image areas of focal tenderness
- Document location and extent of any thrombus with grey scale, color, and spectral Doppler

If thrombus is detected, the radiologist may need to contact the ordering provider for patient instructions.