Revised 4/28/2023

ULTRASOUND EXAM IMAGE DOCUMENTATION
Based on the ACR Standards

For all exams

- Image anatomy in an organized fashion and correctly label for clarity. Do NOT do all (L) plane images of all structures at once followed by all (T) plane imaging. Do (L) and (T) imaging of each structure or localized region of interest sequentially to prove that you rotated on the anatomy of interest to image it in its entirety.
- When obtaining measurements, provide one image without measurements and identical image with measurements.
- If using color Doppler imaging in any way, obtain the same image without and with color Doppler. A color Doppler image does NOT count as an image for documentation of gray scale anatomy.
- Document any lesions or other focal abnormalities using (L) and (T) planes through the lesion, measure lesions in 3 dimensions unless otherwise specified. For lesions less than 5 mm in non OB cases, still image in (L) and (T) planes but measure only 2 greatest dimensions. Evaluate for internal flow and/or vascularity with color Doppler. Add spectral Doppler if indicated.

For color Doppler exams

- If color Doppler signal is identified in a lesion or anywhere else it is not expected, obtain a spectral tracing to verify that it is vascular flow and not an artifact
- For color Doppler imaging of vasculature, optimize scale so that direction of flow can be determined (minimize aliasing).

For spectral Doppler exams

- Spectral Doppler imaging should be done from color Doppler images. If you need to obtain a spectral Doppler tracing with the color Doppler off, document why. (EXCEPTION: See Hemodialysis graft/fistula section).
- Cursor must be in center of vessel and parallel to the vessel walls
- All spectral Doppler imaging is angle corrected unless otherwise specified.
- Keep Doppler angles at 60 degrees or less (EXCEPTION: for carotid exams keep between 45-60 degrees, preferably at 60 degrees) and parallel to long axis of vessel. If angle is outside of this range, identify it in notes and specify why.
- Spectral tracing must extend the full width of the screen.
- PSV peak systolic velocity should be of the most accurate waveforms in tracings. If the patient has an arrhythmia use the most typical waveform, not the occasional high peak. Report in cm/s.
- EDV end diastolic velocity is obtained only in monophasic waveforms. It is measured at the end of diastole, at the base of the systolic peak. Do not measure proximal to the peak or in mid diastole. Report in cm/s.
- RI resistive index = PSV-EDV/PSV. Does not require angle correction.
- AT acceleration time is measured from end diastole to the first systolic peak. Should be measured any time the rise to the first systolic peak is not straight up

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Complete abdomen exam

- Individual organ documentation as described in the individual organ exam sections unless otherwise specified
- Liver
- Intrahepatic IVC
- Gallbladder
- Pancreas
- Spleen
- Kidneys
- Aorta

RUQ limited abdomen exam (Caromont)

- Our department protocol is a hepatobiliary exam
- Individual organ documentation as described in the individual organ exam sections unless otherwise specified
- Liver
- Gallbladder
- Pancreas
- Note: The right kidney is imaged only as a landmark for the liver. Do not do a full exam of the right kidney unless renal pathology is incidentally identified.

ABDOMINAL EXAMS

Liver gray scale exam – 3-5 MHz curved array

- LPO position usually best for most anatomy (especially CHD)
- Left lobe: Obtain at least 3 longitudinal (L) images to include lateral, mid, medial and 3 transverse (T) images to include superior, mid, inferior left lobe
- Right lobe: Obtain at least 3 longitudinal (L) images to include lateral, mid, medial and 3 transverse (T) images to include superior, mid, inferior right lobe.
- Document these landmarks as well as possible. More than one landmark may be present on a given image. (These landmarks confirm that you saw all areas of the liver and the hepatic vascular anatomy.)
  - Right hepatic dome, right diaphragm, right pleural space adjacent to liver (L)
  - Morison's pouch with right kidney adjacent to liver (L > T)
  - Right, middle and left hepatic veins (T > L)
  - Intrahepatic IVC (L and/or T)
  - Segment 1 (formerly caudate lobe, adjacent to IVC) (T)
  - Right portal vein, (T > L), left portal vein (T > L), main portal vein
  - TIPS, if present
  - If concern for cirrhosis, evaluate liver surface with a high frequency probe
  - For hepatoma screening exams (all cirrhotic patients) obtain 4 cine loops: (L) right lobe, (T) right lobe, (L) left lobe, and (T) left lobe
  - Splenic vein posterior to pancreas (T)
- Biliary system
  - Right portal vein image and left portal vein image document assessment of the intrahepatic bile ducts

  - Image common hepatic duct and common bile duct from portal hilum to pancreas
- Measure
  - Liver length (L) from anterior window at midclavicular line
  - Common hepatic duct at the hilum – where the duct crosses hepatic artery (T or L), inner wall to inner wall
  - Optional additional measurement of distal CBD, if it looks dilated
- You may use color Doppler to help identify anatomy that is in doubt (e.g. differentiating intrahepatic hepatic artery from dilated bile duct); however, color and/or spectral Doppler images are NOT part of required documentation in a gray scale liver exam.

Liver Doppler exam – 3-5 MHz curved array

- Use multiple windows – lateral for right lobe, anterior for left lobe; usually not possible to see all vessels with proper angles using only one window.
- All vessels must be labelled
- Obtain (1) gray scale image, (2) color Doppler image, and (3) spectral Doppler image of:
  - Hepatic veins Right hepatic vein (T > L) (angle correction optional)
    - Right, middle and left
  - IVC (L) (angle correction optional)
  - Portal veins (T > L) with PSV measurement
    - Main, right, left
  - Main hepatic artery with PSV measurement
  - Splenic vein posterior to pancreas (angle correction optional)
- Obtain a spectral Doppler image proximal to, at, and distal to any stenosis or other vascular lesion seen
- TIPS exam – do a full liver Doppler exam. Also document:
  - MPV proximal to shunt with PSV measurement
  - MPV distal to shunt with PSV measurement
  - TIPS proximal, mid and distal with PSV measurements
  - Draining HV and IVC

Liver transplant exam – 3 MHz

- Note if whole liver transplant or partial/segmental liver transplant
- Gray scale exam same as for regular liver exam. If it is a partial/segmental liver transplant, do gray scale exam as you would for one lobe of the liver.
- Evaluate subphrenic and subhepatic spaces for fluid collections
- For recent transplant, evaluate abdominal wall incision site for fluid collections
- Transplant Doppler exam guidelines
  - Angle correction for ALL vessels (including IVC and HVs)
  - Optimize settings for each vessel (e.g. baseline, scale, prf, gain). Color Doppler images should not have aliasing unless the vessel is abnormal.
  - If no flow is suspected in a vessel, (1) verify that setting are optimized and (2) confirm no flow on power Doppler
  - All vascular anastomoses should be evaluated
  - Obtain spectral Doppler images proximal to, at, and distal to any stenosis

- Main hepatic artery – Evaluate proximal to anastomosis, at anastomosis, and distal to anastomosis. Obtain PSV, RI, and AT
- Right and left hepatic artery – Obtain PSV and RI. Obtain AT if abnormal waveform.
- Main portal vein – Evaluate proximal to anastomosis, at anastomosis, and distal to anastomosis. Obtain PSV.
- Right and left portal vein – Obtain PSV.
- IVC, right hepatic vein, middle hepatic vein, and IVC – No measurements.
- IVC – Evaluate proximal to anastomosis, at anastomosis, and distal to anastomosis. No measurements.

Gallbladder exam – 3-5 MHz curved array
- Obtain 2-3 (L) images and 2-3 (T) images with patient supine
- Repeat (L) and (T) images in left lateral decubitus or upright position
- Document if any tenderness to compression of gallbladder by transducer versus general RUQ tenderness to transducer pressure (does not localize to gallbladder)
- Measure wall thickness (T)
- Cystic duct, if visualized (optional but helpful)
- Evaluate biliary system with measurements as for a liver exam
  - Show right portal vein and left portal vein (for intrahepatic ducts)
  - Common hepatic duct at the hilum – where the duct crosses hepatic artery (T or L), inner wall to inner wall
  - Common bile duct if seen

Pancreas exam – 3-5 MHz curved array
- Note: (T) images should be in a slightly oblique plane to show as much of the long axis of the pancreas in the image as possible
- Document these landmarks. Comment what is not seen.
  - Uncinate process – (T) triangular part of pancreatic head posterior to SMV
  - Head – (T) and (L). Portal vein/SMV will be a round vessel at the medial edge of the head on (T).
  - Show CBD in head if visible
  - Body – one (T) through splenic vein and one (T) more cranially through splenic artery (the artery winds in and out of view)
  - Tail (T) – if included in body view, label as body and tail
- Evaluate pancreatic duct wherever seen, measure diameter
- Evaluate peripancreatic regions for fluid, adenopathy

Spleen exam – 3-5 MHz curved array
- At least one (L) and one (T) to show landmarks, if visible:
  - Hilum (vessels)
  - Left diaphragm, pleural space
  - Left kidney
- Measure in two planes, usually best on views through hilum

Kidneys gray scale exam – 3-5 MHz curved array
- At least 3 (L) and 3 (T) images through each kidney

  - Use decubitus, prone, upright imaging as needed to see the entire kidney
  - Preferable to scan (L) images medial to lateral, label locations as med, mid and lat
  - Preferable to scan (T) images superior to inferior label locations as sup, mid, inf
- Measure renal length on (L) image through hilum
- Try to obtain at least one image with some adjacent liver/spleen if possible
- Color Doppler may be helpful in showing twinkling artifact in calculi
- Assess perirenal regions
- Document ureteral dilatation if seen. Try to see distal ureter near bladder if hydronephrosis is present (to look for stone in ureter).
- For hydronephrosis identified in pregnant patients:
  - Measure AP diameter of renal pelvis.
  - Spectral Doppler image with RI of segmental/interlobar arteries in upper pole and lower pole.
- For hydronephrosis identified in female patients who are also undergoing transvaginal exam:
  - Try to visualize distal ureter to look for an obstructing calculus.

Bladder exam – 3-5 MHz curved array
- At least 3 (L) and 3 (T) images
- Measure wall thickness
- For bladder volume, measure in 3 dimensions for volume calculation (L cm x W cm x H cm x 0.52 = volume mL); pre-void and/or post-void as requested
- Measure bladder volume if bladder looks dilated (an average full bladder is approximately 350 mL)
- Document any lesions
- Optional color Doppler images to document bilateral ureteral jets if suspected ureteral obstruction
- In male patients, measure prostate if visible

Kidney Doppler exam – 3-5 MHz curved array
- Full kidneys gray scale exam unless ordered Doppler only.
- Keep Doppler angles as low as possible.
- For all kidney Doppler exams, gray scale (L) and (T) images of aorta at and above renal arteries.
  - Spectral Doppler image of aorta. Measure PSV.
  - Search infrarenal aorta for accessory renal arteries, but obtain images of infrarenal aorta only if an accessory RA is found.
- Color Doppler images of each main renal artery from origin to renal hilum (same for any accessory RAs).
  - Use power Doppler as needed to find all of artery
  - Note if any part of artery is not seen
- Spectral Doppler images of each main renal artery from origin to renal hilum (same for any accessory RAs). Document PSV at:
  - Origin/proximal
  - Mid artery

  - Hilar segment of artery
- Spectral Doppler images of intrarenal segmental/interlobar arteries in upper pole, mid pole, and lower pole.
  - Measure PSV and EDV.
  - If systolic upstroke is not vertical, measure AT.
  - Measure RI.
- Routine renal vein screening in RA arterial exam. For each main renal vein obtain:
  - (L) gray scale image
  - (L) color Doppler image
  - (L) spectral Doppler image.
- Dedicated renal vein exam (e.g. rule out renal vein thrombosis).
  - (L) and (T) gray scale images of each main renal vein
  - (L) color Doppler images of each main renal vein and of intrarenal venous branches
  - (L) spectral Doppler images of each main renal vein and of venous branches in upper pole, mid pole, and lower pole
- For any thrombus seen
  - Document extent of thrombus, evaluate for extension into IVC
  - Color Doppler image of thrombus to evaluate for internal vascularity
  - Spectral Doppler image of any positive color flow signal
- For any stenosis, obtain a spectral Doppler image proximal to, at, and distal to each stenosis.

Kidney transplant exam – 3-5 MHz curved array

- Gray scale exam of transplant kidney same as regular kidney exam with bladder exam
  - If any hydronephrosis, note the level of obstruction
  - Evaluate perinephric space for fluid collections
  - If a stent is in place, identify proximal and distal ends
  - If a ureteral jet is seen in the bladder, document it
- Distal aorta
  - (L) color Doppler image
  - (L) spectral Doppler image with PSV
- External iliac artery
  - (L) color Doppler image
  - (L) spectral Doppler image with PSV
    - Proximal to anastomosis
    - At anastomosis
    - Distal to anastomosis
- External iliac vein
  - (L) color Doppler image
  - (L) spectral Doppler image
    - Proximal to anastomosis
    - At anastomosis
    - Distal to anastomosis
- Main RA

- (L) color Doppler image
- (L) spectral Doppler image with PSV, AT, RI
    - At anastomosis
    - Proximal
    - Mid
    - Distal
- Calculate main renal artery to iliac artery ratio
- Document any stenoses

- Main renal vein
    - (L) color Doppler image from hilum to anastomosis
    - (L) spectral Doppler image with PSV
        - In mid vein
        - At anastomosis
- Intrarenal arteries
    - (L) color Doppler image of entire kidney. Can add power Doppler image if needed.
    - Spectral Doppler image with RI
        - Upper pole
        - Mid pole
        - Lower pole
- Intrarenal veins
    - Included in (L) color Doppler image of entire kidney
    - spectral Doppler image if needed to evaluate any abnormal areas of color flow

Aorta – 3-5 MHz curved array

- As part of abdomen complete
    - 3 (L) survey images through proximal, mid and distal aorta (reference points below). Measurements only if an aneurysm is identified. Measure on supplemental (T) images.

- Dedicated aorta exam – if unable to see aorta with anterior approach, try a lateral approach. Gray scale imaging.
- (L) images along the long axis of the aorta/iliac artery
    - Proximal – below diaphragm near the celiac axis
    - Mid – near the level of renal arteries
    - Distal – include the aortic bifurcation
    - Right common iliac artery
    - Left common iliac artery
- (L) color and/or spectral Doppler waveform of the distal aorta
- (T) images perpendicular to the long axis of the aorta/iliac artery. If the vessel is tortuous, the (T) image should be angled relative to the artery, not the patient.
    - Proximal – below diaphragm near the celiac axis
    - Mid – near the level of renal arteries, show RAs if possible
    - Distal – near the aortic bifurcation
    - Right common iliac artery
    - Left common iliac artery
- Obtain measurements at the reference levels above.

  - Measure AP diameter from outer wall to outer wall
  - Measure AP diameter on (L) images
  - Measure AP diameter and TV diameter on (T) images and note which is which on worksheet.
  - If an aortic aneurysm is identified:
    1) Measure it at its widest point.
    2) Obtain images to show if it is fusiform, eccentric, or saccular.
    3) Try to show neck with measurement and measure distance from neck to the renal arteries (left renal vein if arteries not resolved).
    4) Show if it involves the bifurcation, common iliac arteries.
- Result classification
  - Positive: Infrarenal AAA $\geq$ 3.0 cm OR $\geq$ 1.5x the diameter of the more proximal infrarenal aorta
  - Negative: No infrarenal AAA
  - Indeterminate: Nonvisualization or partial visualization of infrarenal aorta and/or bifurcation
  - Suprarenal aorta normal or abnormal (suprarenal aorta abnormal if $\geq$ 3 cm; supraceliac aorta abnormal if > 3.9 cm for males, 3.1 cm for females)
- Follow up recommendations
  - AAA 3.0-3.9 cm US every 3 years
  - AAA 4.0-4.9 cm US annually
  - AAA 5.0-5.4 cm US every 6 months

IVC – 3-5 MHz curved array
- As part of another exam (e.g. liver, abdomen complete)
  - Intrahepatic IVC survey gray scale (L) image and (T) image
  - Document any abnormalities
- As part of a requested dedicated IVC exam
  - (T) images at hepatic venous confluence, at mid liver, at caudal liver
  - Color Doppler image and spectral Doppler image for patency
  - Document any stenosis, thrombus, or other pathology
  - If a filter or other device is present, try to document position relative to hepatic veins and/or renal veins

Ascites survey exam – 3-5 MHz curved array
- Document all 4 quadrants and pelvic midline around bladder.
- Note if fluid is free or loculated.
- Note any nodularity of the peritoneal cavity.

Appendicitis exam – 3-5 MHz curved array adult; 18 MHz linear array pediatric (or whatever works for body size)
- Start with 5 MHz probe and scan supine right abdomen from Morison's pouch to groin and midline to right flank.
- Turn patient left lateral oblique and scan entire anterior surface of right psoas muscle.
- Turn patient supine and rescan with 3 MHz probe to check deeper in abdomen.
- If the patient has a point of maximal tenderness (PMT)

  - Put transducer over PMT
  - Gradually increase transducer pressure to displace bowel until the appendix comes into view If an adnexal mass is seen, obtain color Doppler image of the mass.
- Obtain (T) and (L) images of the appendix
  - Measure outer wall to outer wall diameter (T)
  - Measure wall thickness (T)
  - Document compressibility (T)
- Document any other abnormalities – appendicolith, hazy periappendiceal fat, free fluid, fluid collections/abscess

Intussusception exam – 18 MHz linear array pediatric (or whatever works for body size)

- Do a 4-quadrant survey of the abdomen with extra attention to any tender areas.
- Look for signs of intussusception:
  - Donut sign/target sign
  - Pseudokidney sign
  - Crescent in a doughnut sign
- If an intussusception is identified, obtain (T) and (L) images and document:
  - Outer diameter measurement (< or > 2.5 cm)
  - Length of intussusception measurement (< or > 3 cm)
  - Lead point/lesion yes or no
  - Peristalsis of involved bowel yes or no
- If no abnormality is seen, obtain 4 images to document imaging of all 4 quadrants

Pyloric stenosis exam – 18 MHz linear array

- NPO x 3 hours
- To find pylorus, start with supine (T) scanning and locate gallbladder. Pylorus is medial and deep to GB. Can turn probe to oblique sagittal plane to identify (L) view of pylorus.
- If gassy stomach, try scanning with patient in RPO position. Give patient water.
- Complete gray scale documentation of the antrum and duodenal bulb in (L)
  - Can be all static images OR
  - Can be (L) cine clip through anatomy and at least one (L) static image
- Complete gray scale documentation of the pylorus in (T)
  - Can be all static images or
  - Can be (T) cine clip through anatomy and at least one (T) static image
- Hypertrophied muscle layer is hypoechoic
- Mucosa is hyperechoic
- Document these measurements (provided measurements are normal range)
  - Pyloric muscle thickness – (T), diameter of single muscular wall $\leq$ 3 mm
  - Pyloric length – (L), < 15-17 mm
  - Pylorus transverse diameter – (T), $\leq$ 13 mm
- Document any signs, if seen:
  - Target sign – (T) ,thickened hypoechoic muscle around echogenic mucosa
  - Cervix sign – (L), indentation of hypertrophied pylorus into gastric lumen

  - Antral nipple sign – (L), central protrusion of hypertrophied pyloric mucosa into gastric lumen
  - Peristalsis of involved bowel yes or no
- Turn patient right side down and not whether or not pylorus opens / gastric contents pass into the duodenum

PELVIC EXAMS

Bladder exam – 3-5 MHz curved array

- At least 3 (L) and 3 (T) images
- Measure wall thickness
- For bladder volume, measure in 3 dimensions for volume calculation (L cm x W cm x H cm x 0.52 = volume mL); pre-void and/or post-void as requested
- Measure bladder volume if bladder looks dilated (an average full bladder is approximately 350 mL)
- Document any lesions
- Optional color Doppler images to document bilateral ureteral jets if suspected ureteral obstruction
- In male patients, measure prostate if visible

Female pelvis exam – 3-5 MHz curved array, 7 MHz or higher endovaginal

- Document on worksheet
  - G P M A E status of patient
  - LMP. If irregular, also note LNMP (last normal MP).
  - If postmenopausal
    - How many years ago was menopause
    - Is patient on hormone therapy
  - Is patient on OCP or other birth control method
  - PSH – C-section, hysterectomy, oophorectomy, endometriosis surgery
- Uterus
  - At least 3 (L) and 3 (T) views
    - Document right lateral, midline, and left lateral on (L)
    - Document fundus, body, and lower uterine segment on (T)
    - Document size, shape, and orientation
    - Document appearance of endometrium, myometrium, and cervix
  - Measure uterine length from fundus to external cervical os and AP depth on (L) view. If uterus is angled, use two or more linear measurements and add to get total length or do curved reformation measurement.
  - Measure widest point of uterus on (T) view.
  - If a uterine volume is requested, subtract cervix from length measurement.
  - Document any lesions.
  - For multiple fibroids make note of all locations of the fibroids (endometrial, myometrial, serosal, exophytic), but only need to measure the 3 largest fibroids.
  - Endometrium
    - Measure endometrial stripe on midline (L) image from outer echogenic wall to outer echogenic wall.

        - Document any fluid. Do not include fluid in stripe thickness (either measure each wall separately and add them up, or subtract thickness of fluid from stripe measurement).
        - Document any lesions.
        - If stripe is not adequately seen in its entirety or is ill-defined, make a note of this. The stripe measurement should not be included in the report in this case.
        - If an IUD is in place, demonstrate all 3 tips to prove it is in proper position.
    - Cervix
        - At least 1 (L) view and 1 (T) view. Usually better seen on endovaginal exam.
        - Measure transverse diameter of cervix if greater than 3 cm

- Ovaries gray scale exam OPTION 1
    - At least two (L) and two (T) gray scale views of each ovary
    - Evaluate size, shape, contour, echogenicity
    - Document position relative to uterus. If ovary is adjacent to uterus, document if ovary appears fixed to the uterus (does not slide against it).
    - Measure each ovary in 3 dimensions and calculate volume (L cm x W cm x H cm x 0.52 = volume in cc or mL)
    - Document any cysts greater than 3 cm in size.
    - Document any solid or cystic-solid lesions. Measure in 3 dimensions. Color Doppler and spectral Doppler of any solid components, especially septations and nodules in cysts.
- Ovaries gray scale exam OPTION 2
    - At least one (L) cine clip from medial to lateral through entire ovary and at least one (T) cine clip from superior to inferior through entire ovary for each ovary
    - At least one static (L) image and one static (T) image of each ovary with no measurements and no color/spectral Doppler
    - Evaluate size, shape, contour, echogenicity
    - Document position relative to uterus. If ovary is adjacent to uterus, document if ovary appears fixed to the uterus (does not slide against it).
    - Measure each ovary in 3 dimensions and calculate volume (L cm x W cm x H cm x 0.52 = volume in cc or mL)
    - Document any cysts greater than 3 cm in size.
    - Document any solid or cystic-solid lesions. Measure in 3 dimensions. Color Doppler and spectral Doppler of any solid components, especially septations and nodules in cysts.
- At least one color Doppler image of each ovary. This is separate from gray scale images.
- Spectral Doppler exam of ovaries if ordered. Add spectral Doppler exam (if not ordered and if outpatient, ask radiologist) if an enlarged ovary is found, if an ovarian mass is found, or if the patient has pelvic pain referable to the ovary.

  - Place Doppler gate within the central two-thirds of ovarian stroma. Tracings from the edge of an ovary (capsular flow) do not count. Do not need angle correction unless gross asymmetry detected.
  - Obtain arterial tracing and venous tracing from each ovary.
  - Supplement with power Doppler images as needed if abnormal spectral Doppler suspicious for torsion.
- Image adnexal regions for lesions, fluid. Note relationship of any abnormalities to the ovary/uterus.
- Image cul-de-sac area for lesions, fluid.
- For R/O ectopic also do:
  - If an IUP is seen, do first trimester exam

Female pelvis – OB first trimester exam – 3-5 MHz curved array transabominal, 7 MHz or higher endovaginal

- Document on worksheet
  - G P M A E status of mother
  - LMP
  - If mother had prior OB US with EDD determined by CRL, record EDD and today's EGA based on that EDD
- Uterus, cervix, ovaries, adnexa and cul-de-sac as for non-OB female pelvis
- If an IUP is seen, document:
  - Location of sac
    - Measure mean sac diameter
    - Use to assess EGA if no CRL
  - Presence of yolk sac – measure size
    - Place caliper in center of echogenic walls at either end of largest diameter
  - Fetal pole
    - Measure crown-rump length CRL
    - Calculate EGA (use for growth if patient has an EDD)
    - Calculate EDD if patient does not have an EDD
    - Evaluate fetal cardiac activity with M-mode
- If hemorrhage identified involving the gestational sac, document:
  - Type – subchorionic, subamniotic, retroplacental
  - Location – cranial, caudal, lateral
  - Size
- Multiple gestations
  - Number of gestions
  - Location in uterus (cranial, caudal, maternal right, maternal left)
  - Amnionicity and chorionicity
  - Separate worksheet for each fetus
- If no IUP is seen, obtain color Doppler image of the endometrial cavity to assess for trophoblastic blood flow
- If an adnexal mass is seen:
  - Obtain (L) and (T) images of the mass
  - Look for a gestational sac, yolk sac, fetal pole, fetal cardiac activity

Female pelvis – OB 2nd trimester exam (between 18 and 26 weeks) – 3-5 MHz curved array transabdominal, 7 MHz or higher endovaginal for cervix

- Document on worksheet
  - G P M A E status of mother
  - LMP. If irregular, also note LNMP (last normal MP).
  - If mother had prior OB US with EDD determined by CRL, record EDD and today's EGA based on that EDD
- Survey uterus for fibroids, other abnormalities
- Fetus:
  - Fetal presentation
  - Fetal cardiac activity
    - Use M-mode
    - Record rate
    - Note if rhythm regular or irregular
  - BPD
    - At level of thalami and cavum septi pellucidi
    - Cerebellum should not be visible
    - Outer table proximal skull to inner table distal skull
  - HC
    - Same level as BPD
    - Outer perimeter
  - Abdominal circumference
    - At junction of umbilical vein and portal sinus
    - Stomach in view
    - Outer skin surface
  - Femoral diaphysis
    - Reliable after 14 weeks
    - Exclude epiphysis
  - Calculate EFW, LMP percentile, AUA percentile
    - Same level as BPD
    - Outer perimeter
  - Anatomic survey – we only do limited surveys in our department, shown at end of full survey list. Most anatomy visible by 18 weeks. *Anatomy is minimum for ACR accreditation
    - Head, face, neck
      - Lateral ventricles*
      - Choroid plexus
      - Midline falx
      - Cavum septi pellucidi
      - Cerebellum*
      - Cisterna magna*
      - Upper lip/philtrum*
      - Nuchal fold only at 16-20 weeks
    - Heart
      - Four-chamber view – heart size and situs*
      - RVOT right ventricular outflow tract – static image or cine clip*

        - LVOT left ventricular outflow tract – static image or cine clip*
    - Abdomen
        - Stomach – size and situs*
        - Kidneys*
        - Urinary bladder*
        - Umbilical cord insertion into fetal abdomen*
        - Umbilical cord vessel number* – TV view of cord. Umbilical arteries in pelvis rules out 2 vessel cord but does not rule out 4 vessel cord; does not replace umbilical cord view.
    - Spine (T) and (L) views*
        - Cervical*
        - Thoracic*
        - Lumbar*
        - Sacral*
    - Extremities*
        - Two arms*
        - Two legs*
    - External genitalia – in multiple gestations and when medically indicated
    - Limited anatomic survey
        - Lateral ventricles
        - Choroid plexus
        - Midline falx
        - Upper lip/philtrum
        - Four-chamber view – heart size and situs
        - Kidneys
        - Urinary bladder
        - Umbilical cord insertion into fetal abdomen
        - Umbilical cord vessel number – TV view of cord. Umbilical arteries in pelvis rules out 2 vessel cord but does not rule out 4 vessel cord; does not replace umbilical cord view.
        - Cervical spine
        - Thoracic spine
        - Lumbar spine
        - Sacral spine
- Amniotic fluid:
    - Up to 20 weeks – measure single pocket
    - After 20 weeks – obtain AFI
- Multiple gestations
    - Number of gestions
    - Location in uterus (cranial, caudal, maternal right, maternal left)
    - Amnionicity and chorionicity
    - Number and location of placenta(s)
    - Separate worksheet for each fetus
- Placenta
    - Location in uterus
    - Relation to internal cervical os. Measure distance if close.

  - Appearance
  - Document any fluid collections – size, location, color Doppler for internal flow
- Cervix
  - Imaging as for nonOB exam
  - Note if closed or open
  - Assess length
  - Do endovaginal exam of cervix if:
    - Cervix not adequately visualized on transabdominal exam
    - Cervix appears short on transabdominal exam
    - Cervical length is specifically requested
- Criteria for cervical length measurement
  - Bladder empty, endovaginal scan
  - Cervix fills 75% of image space
  - Anterior and posterior cervix are of equal thickness
  - Internal and external cervical os seen
  - Endocervical canal seen throughout
  - Calipers placed at the internal and external cervical os where the anterior and posterior walls of the cervix meet
  - If the canal curves, use two or more linear measurements and add to get total length or do curved reformation measurement.
  - Use shortest best measurement
- Evaluate ovaries as for non-OB female pelvis, if seen.
- Evaluate adnexa, cul-de-sac in second trimester.

Female pelvis – OB 3rd trimester exam (greater than 26 weeks) – 3-5 MHz curved array transabdominal, 7 MHz or higher endovaginal for cervix

- Document on worksheet
  - G P M A E status of mother
  - LMP. If irregular, also note LNMP (last normal MP).
  - If mother had prior OB US with EDD determined by CRL, record EDD and today's EGA based on that EDD
- Survey uterus for fibroids, other abnormalities
- Fetus:
- Fetal presentation
  - Fetal cardiac activity
    - Use M-mode
    - Record rate
    - Note if rhythm regular or irregular
  - BPD
    - At level of thalami and cavum septi pellucidi
    - Cerebellum should not be visible
    - Outer table proximal skull to inner table distal skull
  - HC
    - Same level as BPD
    - Outer perimeter
  - Abdominal circumference
    - At junction of umbilical vein and portal sinus

        - Stomach in view
        - Outer skin surface
    - Femoral diaphysis
        - Reliable after 14 weeks
        - Exclude epiphysis
    - Calculate EFW, LMP percentile, AUA percentile
        - Same level as BPD
        - Outer perimeter
    - Fetal anatomic survey – do as much as possible from 2nd trimester list. If visualization is limited by advanced gestational age, obtain at least
        - 4-chamber view of heart
        - Stomach
        - Kidneys
        - Urinary bladder
- Amniotic fluid – AFI
- Multiple gestations
    - Number of gestions
    - Location in uterus (cranial, caudal, maternal right, maternal left)
    - Amnionicity and chorionicity
    - Number and location of placenta(s)
    - Separate worksheet for each fetus
- Placenta
    - Location in uterus
    - Relation to internal cervical os. Measure distance if close.
    - Appearance
    - Document any fluid collections – size, location, color Doppler for internal flow
- Cervix
    - Imaging as for nonOB exam
    - Note if closed or open
    - Assess length
    - Do endovaginal exam of cervix if:
        - Cervix not adequately visualized on transabdominal exam
        - Cervix appears short on transabdominal exam
        - Cervical length is specifically requested
- Criteria for cervical length measurement
    - Bladder empty, endovaginal scan
    - Cervix fills 75% of image space
    - Anterior and posterior cervix are of equal thickness
    - Internal and external cervical os seen
    - Endocervical canal seen throughout
    - Calipers placed at the internal and external cervical os where the anterior and posterior walls of the cervix meet
    - If the canal curves, use two or more linear measurements and add to get total length or do curved reformation measurement.
    - Use shortest best measurement
- Evaluate ovaries, adnexa as for non-OB female pelvis only if abnormality seen.

Scrotal exam – 18 MHz linear or curved linear

- Whenever possible, use similar gray scale, color Doppler, and spectral Doppler settings for both testes. This is especially important in cases of acute testicular pain. If necessary, start with and optimize settings for the painful testis then do the normal testis. Do repeat images if settings need to be changed significantly. Use low flow settings as needed to optimally show flow.
- Start with side by side imaging of both testes (may use sector FOV if needed to see both testes on one image)
  - Gray scale image of both testes
  - Color Doppler image of both testes
  - If concern for torsion, consider power Doppler image of both testes
- Testes gray scale exam
  - 3 (T) images upper, middle and lower pole each testis **OR** (T) cine clip of each testis from medial to lateral plus one static (T) image without measurements
  - 3 (L) images medial, midline, and lateral aspect each testis **OR** (L) cine clip of each testis from superior to inferior plus one static (L) image without measurements
  - Measure each testis. Calculate testicular volumes (L cm x W cm x H cm x 0.52 = volume in cc or mL).
  - Document any lesions with (T) and (L) views.
  - Dedicated imaging of any palpable abnormality. Place transducer directly over the palpable abnormality.
  - Color Doppler image of each testis.
  - Spectral Doppler image of each testis.
    - Obtain spectral tracings from central two-thirds of testis. Tracings from the edge of a testis (capsular flow) do not count.
    - Do not need angle correction unless gross asymmetry detected.
    - Arterial tracing and venous tracing from each testis.
  - Supplement with power Doppler images as needed if abnormal spectral Doppler exam suspicious for torsion.
- Testes Doppler exam (always part of the exam)
  - Color Doppler image of each testis.
  - Spectral Doppler image of each testis.
    - Obtain spectral tracings from central two-thirds of testis. Tracings from the edge of a testis (capsular flow) do not count.
    - Do not need angle correction unless gross asymmetry detected.
    - Arterial tracing and venous tracing from each testis.
  - Supplement with power Doppler images as needed if abnormal spectral Doppler exam suspicious for torsion.
- Epididymides
  - At least one (L) and one (T) image of each epididymal head
    - Measure epididymal head thickness (from cranial testicular capsule to top of epididymal head)
  - (L) image of each body/tail
  - Color Doppler image of each epididymis with same settings as for testes.
  - Document any lesions.
- Evaluate spermatic cord and supratesticular area if concern for torsion

- Evaluate scrotal sac including skin. Document any abnormal findings. May use 3-5 MHz probe for scrotum if very enlarged. Look for:
  - Hydrocele
  - Varicocele – image neutral and with Valsalva. If varicocele identified, measure maximum vessel diameter on gray scale images on neutral and Valsalva images.
  - Hernia
  - Other masses
  - Scrotal wall thickening, scrotal wall gas

Transrectal prostate exam – 7 MHz or higher endorectal probe

- Prostate
  - At least 3 (T) images through apex, mid gland and base
  - At least 5 (L) images through right lateral, midline, and left lateral gland
  - Include (T) and (L) images of urethra
    - Note any asymmetry around urethra
  - Note any projection of prostate into bladder base
  - Consider (T) cine loop and (L) cine loop of prostate if helpful
  - Measure the prostate. Calculate volume from greatest dimensions (L cm x W cm x H cm x 0.52 = volume in cc or mL).
  - Survey color Doppler (T) and (L) images of prostate.
  - Document any focal masses.
  - Document any focal abnormal echogenicity or focal hypervascularity.
  - Document any asymmetry, discontinuity of margins or other abnormalities.
- Seminal vesicles
  - Gray scale (T) and (L) images of each seminal vesicle.
  - Evaluate seminal vesicles from insertion on prostate out to tips.
  - Evaluate size, shape, echogenicity, position, and symmetry.
  - Pay special attention to show normal tapering toward the prostate.
  - Document any abnormalities.
  - (Evaluate vasa deferentia only for infertility work up.)
- Surrounding areas
  - Evaluate periprostatic fat and neurovascular bundles for symmetry and echogenicity.
  - Evaluate anterior perirectal space for tumor involvement, adenopathy.

SMALL PARTS AND MISCELLANEOUS EXAMS

Thyroid exam – 18 MHz linear array

- Neck as hyperextended as possible. If patient unable to tolerate extension while supine, consider upright imaging.
- 3 (L) images each lobe (superior, middle, inferior) and 3 (T) images each lobe (medial, middle, lateral) **OR** (T) cine clip of each lobe from superior to inferior plus one static (L) image without measurements

- 3 (L) images each lobe (superior, middle, inferior) and 3 (T) images each lobe (medial, middle, lateral) **OR** (T) cine clip of each lobe from superior to inferior plus one static (L) image without measurements
- Measure each lobe
- Document any substernal extension
- Isthmus (T) measure AP thickness
- Color Doppler image of each lobe with same settings (to evaluate for thyroiditis)
- If thyroid nodules present, document the 4 most suspicious nodules based on T-RADS criteria regardless of location
    - Document size in 3 dimensions – images must have TRV and LNG labels
    - Document composition – cystic / spongiform / cystic and solid / solid / indeterminate
    - Document echogenicity – anechoic / isoechoic / hypoechoic / very hypoechoic / intermediate
    - Document shape – wider than taller / taller than wider
        - "wider" is for transverse diameter on (T) or (L) image
        - "taller" is longitudinal diameter on (T) or (L) image
    - Document margin – smooth / iii-defined / lobulated / extrathyroidal / indeterminate
    - Document echogenic foci – none / macrocalcifications / peripheral / punctate
- Survey jugular chains for nodes
    - Measure any nodes in at least two planes. Measure in 3 planes if short axis diameter is > 1 cm
    - Note if any cystic change or calcification in nodes
- Document any other extrathyroidal abnormalities (parathyroid nodules, vascular pathology)
- For thyroidectomy, lobectomy or other partial resection
    - Evaluate thyroid bed in (T) and (L) planes
    - Document any cystic or solid masses in (T) and (L) planes with measurements
    - Do rest of standard thyroid exam as above

Parathyroid exam – 18 MHz linear array

- Neck hyperextended
- (L) imaging from right and left carotid arteries to midline
    - Document at least 2 images
- (T) imaging from carotid bifurcation to thoracic inlet on either side
    - Document at least 2 images
- Pay particular attention to posterior and inferior to thyroid gland with image documentation of these areas bilaterally (at least 4 images)
- Use swallow maneuvers as needed
- Try to see behind trachea if possible
- Survey thyroid gland (PTH nodules may be intrathyroidal)
- Document any nodules in (T) and (L) planes
    - Location in neck, location relative to thyroid gland

    - Measure any nodules
    - Color Doppler images to look for polar flow (PTH) v central flow (node)
- Survey jugular chains for nodes as for thyroid exam

Parotid/Submandibular Gland exam – 18 MHz linear array
- Image glands in 2 planes
- Note if echotexture homogeneous or heterogeneous
- Color Doppler to show any focal or diffuse hyperemia
- Document any ductal dilatation
    - Try to trace dilated duct to point of obstruction
- Document and measure any calculi
- Document any focal lesions/abnormalities
- Document any lymph nodes

VASCULAR EXAMS

Lower extremity DVT exam – 12 MHz linear array
- The deep veins should be imaged from the inguinal ligament to the ankle when feasible. If not seen in their entirety, record what is not visualized and why.
- Gray scale compression maneuver performed (T) every 2 cm or less. Document at landmarks.
- Gray scale option 1
    - Can use color Doppler to find vessels; turn OFF when storing the images
    - (T) views with and without compression
    - Label artery and vein(s) on images if difficult to see
    - Vein must compress completely so walls form a single line, no lumen visible
- Gray scale option 2
    - Can use color Doppler to find vessels; turn OFF when storing the images
    - (T) cine clips with and without compression
    - Label artery and vein(s) on images if difficult to see
    - Vein must compress completely so walls form a single line, no lumen visible
- Landmarks to document for compression views
    - Common femoral vein
    - Saphenofemoral junction (this is a separate image from CFV)
    - Deep femoral vein at confluence with femoral vein or separate alongside the femoral vein
    - Femoral vein at upper thigh – separate from DFV image
    - Femoral vein at mid thigh
    - Femoral vein at distal thigh
    - Popliteal vein
    - Anterior tibial veins
    - Posterior tibial veins
    - Peroneal veins
- For unilateral exams, evaluate the contralateral CFV
- If an abnormality is seen, document level and extent with (T) and (L) images
- If the patient has focal pain, image the area of pain to assess for thrombosed branch veins, varicose veins. If other vascular or nonvascular abnormalities are

identified, the patient may need additional imaging for diagnosis (e.g. may need to charge a soft tissue ultrasound exam for a hematoma or mass lesion).

- (L) color Doppler images and/or spectral Doppler images
  - Saphenofemoral junction
  - Proximal deep femoral vein
  - Femoral vein – proximal, mid and distal
  - Show augmentation of color and/or spectral flow with augmentation (with calf pressure; thigh pressure if needed).
  - Show respiratory variation.
  - Technical notes:
    - Use highest velocity and gain settings that give signal without aliasing or color "bleed"
    - Vein must fill in completely with color signal
- (L) spectral Doppler images
  - Common femoral vein or external iliac vein
  - Popliteal vein
  - Show spontaneous flow and respiratory phasicity.
  - Optional augmentation of flow with calf pressure or thigh pressure.

- COVID limited gray scale study
  - (T) views with and without compression
  - Label artery and vein
  - Vein must compress completely so walls form a single line, no lumen visible
  - Can use color Doppler to find vessels; turn OFF when storing the images
  - Image from CFV to popliteal vein bilaterally. Stop as soon as a DVT is identified.

Upper extremity DVT exam – 12 MHz linear array

- The veins should be imaged to the fullest extent. If not seen in their entirety, record what is not visualized and why.
- (T) Gray scale images without and with compression – G
- (L) Color and spectral Doppler images to assess for laminar flow – C
- (L) Spectral Doppler images to assess for pulsatility and respiratory phasicity – S
- Exam is easier if the patient can be done in Trendelenberg position.
- Landmarks to document
  - Jugular vein – G, C, S
  - Subclavian vein proximal/above clavicle – G (no compression), C, S
  - Subclavian vein distal/below clavicle – G (no compression), C, S
  - Axillary vein – G, C, S
  - Brachial veins – G, C, (S optional)
  - Basilic vein – G, C in the upper arm
  - Cephalic vein – G, C in the upper arm
- For unilateral exams, evaluate the contralateral subclavian vein
- If an abnormality is seen, document level and extent with (T) and (L) images
- If the patient has focal pain, image the area of pain to assess for thrombosed branch veins, varicose veins. If other vascular or nonvascular abnormalities are

identified, the patient may need additional imaging for diagnosis (e.g. may need to charge a soft tissue ultrasound exam for a hematoma or mass lesion).

- COVID limited gray scale study
  - Gray scale exam as above. Stop as soon as a DVT is identified.

Carotid Doppler exam – 12 MHz linear array

- Gray scale exam
  - Survey (T) views on each side of:
    - CCA – proximal and distal
    - Carotid bifurcation
  - Survey (L) views on each side of:
    - CCA – proximal and distal
    - Carotid bifurcation
    - Proximal ICA to include origin
    - Proxiimal ECA
  - Document if high bifurcation at or above mandibular angle
  - Document extent, location, and characteristics of any plaque, including calcifications
  - Document if shadowing from calcifications obscures more than 5 mm of vessel lumen
- Color Doppler exam
  - Survey (L) images on each side of:
    - CCA – proximal and distal
    - Proximal ICA
    - Proximal ECA (with identification of a branch artery if possible)
    - Vertebral artery in mid neck
  - Additional images of any abnormalities:
    - See below for plaque assessment
    - If occlusion present, color and/or power Doppler image of occluded artery
    - Other vascular or perivascular abnormalities should also be documented
- Spectral Doppler exam (with color)
  - (L) images on each side of:
    - CCA - proximal
    - CCA – distal (2-3 cm proximal to bulb, walls parallel)
    - ICA – proximal
    - ICA – mid cervical
    - ICA – distal cervical
    - Proximal ECA (with identification of a branch artery if possible)
    - Vertebral artery in mid neck
  - Measure PSV and EDV at each reference level
  - For ICA, calculate ICA/CCA ratio (using highest ICA PSV and distal CCA PSV)
  - For ECA, obtain tracing with and without “temporal tap”
  - For vertebral artery document direction of flow, note if waveform abnormal
  - For any stenosis, additional imaging required:
    - Determine location of stenosis
    - Repeat assessment with arm activity if “subclavian steal” suspected

- For any stenosis
  - Document location
  - Note plaque characteristics, calcifications
  - Color Doppler images to show extent and effect on lumen
  - Spectral Doppler image at the site of maximal PSV due to the stenosis
  - Distal to the site of maximal PSV to assess for presence or absence of post stenotic turbulent flow
- For carotid stent
  - (L) and (T) gray scale images of stent
  - Note if proximal and distal ends of stent are apposed against wall of carotid
  - (L) color Doppler images of stent lumen
  - Spectral Doppler image of flow proximal to stent, within the stent, and distal to the stent

Upper extremity arterial Doppler exam – 12 MHz linear array

- Survey gray scale (L) views of the arteries. The arteries should be imaged to the fullest extent. If not seen in their entirety, record what is not visualized and why. Document extent of any calcified or noncalcified plaque.
- (L) Color Doppler imaging of the arteries in their entirety. Document a color Doppler image at each artery reference point.
- (L) Spectral Doppler imaging of the arteries in their entirety. Document a spectral Doppler tracing at each artery reference point.
- For each spectral tracing:
  - Note if multiphasic v monophasic
  - Measure PSV
  - If systolic upstroke is not vertical, measure AT (> 140 ms is abnormal)
- Reference points
  - Subclavian artery proximal (above clavicle)
  - Subclavian artery distal (below clavicle)
  - Axillary artery
  - Brachial artery
  - Radial artery
  - Ulnar artery
- If an abnormality is seen, obtain additional gray scale images, color Doppler images and color with spectral Doppler images for the abnormality.

Lower extremity arterial Doppler exam – 12 MHz linear array

- Survey gray scale (L) views of the arteries. The arteries should be imaged to the fullest extent. If not seen in their entirety, record what is not visualized and why. Document extent of any calcified or noncalcified plaque.
- (L) Color Doppler imaging of the arteries in their entirety. Document a color Doppler image at each artery reference point.
- (L) Spectral Doppler imaging of the arteries in their entirety. Document a spectral Doppler tracing at each artery reference point.
- For each spectral tracing:
  - Note if multiphasic v monophasic
  - Measure PSV

  - If systolic upstroke is not vertical, measure AT (> 140 ms is abnormal)
- Reference points
  - Visualized distal external iliac artery
  - Common femoral artery
  - Deep femoral artery
  - Superficial femoral artery – proximal, mid and distal
  - Popliteal artery – proximal (above knee joint)
  - Popliteal artery – distal (below knee joint)
  - Tibioperoneal trunk
  - Posterior tibial artery
  - Anterior tibial artery
  - Dorsalis pedis artery
- If an abnormality is seen, obtain additional gray scale images, color Doppler images and color with spectral Doppler images for the abnormality.

Hemodialysis access exam – 12 MHz linear array
- Note whether access is an arteriovenous fistula (AVF) or graft. Note which artery/vein it connects and where it is located in the arm/leg
- Reference points
  - Inflow artery 2 cm proximal to anastomosis
  - Inflow artery 2 cm distal to anastomosis
  - Arterial anastomosis
  - AVF/graft – proximal, mid and distal
  - Any puncture sites
  - Venous anastomosis – graft only
  - Outflow axillary vein (femoral vein for leg access)
  - Outflow subclavian vein (common femoral vein for leg access)
- Survey gray scale (L) and (T) images of each vascular landmark.
- Survey color Doppler (L) images of each vascular landmark.
- Spectral Doppler image of each vascular landmark.
  - Measure PSV at each site. Measure EDV for AVF/graft sites, outflow veins.
- For the AVF/graft reference points spectral Doppler images:
  - Measure depth from skin surface (ideal is 0.6 cm or less over a length of at least 10 cm)
  - Measure vessel diameter (ideal is at least 0.4 cm)
  - Measure PSV (should be fairly constant)
  - Measure EDV (low EDV may be early sign of graft failure)
  - Flow volume in ml/min (need at least 500 ml/min). If you cannot clearly see the vessel walls on the color Doppler image (color signal extends beyond lumen and obscures the wall on the gray scale part of image), the color signal should be turned OFF to allow accurate wall measurement.
- Obtain additional gray scale, color Doppler and spectral Doppler imaging of any areas of stenosis (unusual PSV increase or focal turbulence). For each location:
  - Measure PSV at, proximal and distal to the area of stenosis
- Obtain additional gray scale, color Doppler images and (if positive color signal) spectral Doppler images of any other abnormalities identified. This includes fluid

around the AVF/graft, hematomas, and pseudoaneurysms. Documentation should include at least:

- Relationship to AVF/graft
- Measurement of size