

## Abdomen and Pelvis

### US Abdomen Limited (RUQ, GB, LIVER, PANCREAS)

- Transverse images of as much of the pancreas as can be seen
  - measure the pancreatic duct if able to see it
- sagittal and transverse liver
  - image the IVC with left lobe of liver
  - image the portal vein
  - image the hepatic veins
  - image of the liver and right kidney together to show echogenicity (sagittal only)
  - doppler the portal vein to show correct direction
  - single longitudinal measurement of the liver if enlarged
- sagittal and transverse right kidney
  - measure in three dimensions
  - color image to prove blood flow in kidney. Use power Doppler if necessary.
- sagittal and transverse gallbladder supine *and* decubitus
  - decubitus to show movement of any stones or sludge
  - color on sludge to show any flow
  - measure the wall if abnormal (>3mm is abnormal)
- common bile duct
  - measure the bile duct
  - measure cbd at pancreas if possible

### US Abdomen Limited (RLQ, APPENDIX)

- if able to visualize the appendix, measure the diameter in two planes
- color image of appendix
- image any associated fluid collections or masses
- if unable to visualize the appendix, obtain representative images of the area of pain
- \*if imaging the right ovary as well then a complete pelvic ultrasound should be included\*

### US Abdomen Limited (SPLEEN)

- order must state to image the spleen only
- sagittal and transverse images with measurement in three planes

## US Abdomen Complete

- same as abdomen limited with these additions
- aorta
  - sagittal proximal aorta
  - sagittal or transverse distal aorta to demonstrate an aneurysm
  - if aneurysm is seen then follow protocol for aorta (no need for additional order or charge)
- sagittal measurement of the spleen (sagittal plane only)
- sagittal and transverse left kidney
  - measure in three dimensions
  - color image to prove blood flow in kidney

## US Abdomen w Dopplers

- same as abdomen complete with these additions
- can do just dopplers if patient has had complete abdomen in the past thirty days. If an abdominal ultrasound has not been performed in the last thirty days then a complete abdomen exam must be ordered and performed.
- doppler the portal vein in three different places
  - at the confluence
  - mid portal vein
  - just before bifurcates into left and right portal vein
- doppler the left and right portal vein
- doppler the left, middle and right hepatic veins
- doppler the hepatic artery
- doppler the splenic vein in two places
  - near the confluence
  - near the spleen
- doppler the splenic artery

## US TIPS

- Grey scale and color images of the stent itself
- Obtain pulsed Doppler velocities at the portal end, mid portion and hepatic vein end of the stent
- Doppler main portal vein and show direction and velocity of flow
- Also Doppler the branch of the portal vein without the stent and show direction and velocity of flow

## US Retroperitoneum

- sagittal and transverse right kidney
  - measure in three dimensions
  - color image to prove blood flow to kidney
- sagittal and transverse left kidney
  - measure in three dimensions
  - color image to prove blood flow to kidney
- sagittal and transverse bladder
  - document left and right urine jets if possible
  - document enlarged prostate and measure in three dimensions if enlarged
- EVEN IF PATIENT ONLY HAS ONE KIDNEY, THIS IS THE APPROPRIATE EXAMINATION. ALWAYS OBTAIN IMAGES OF THE RENAL FOSSA EVEN IF THE KIDNEY IS ABSENT. THIS IS TO CONFIRM ABSENCE AND EVALUATE FOR POSSIBLE RECURRENT OR RESIDUAL MALIGNANCY.
- If patient is a child, please obtain pre- and post-void bladder volumes if possible
- If the history provided is hypertension or renal artery stenosis, you must perform a retroperitoneum *with Doppler*. If it is not ordered correctly, you must contact the referring physician to have the order changed.

## US Retroperitoneum w Dopplers

- same as retroperitoneum with these additions
- doppler the main renal artery at renal hila bilaterally
- doppler the main renal vein at renal hila bilaterally
- doppler the interlobular artery at the superior, mid, and inferior poles bilaterally
- follow renal arteries back to the aorta and show their origins *if possible*
- If the history provided is hypertension or renal artery stenosis, this is the appropriate examination.

## US Retroperitoneum, Limited (AORTA)

- sagittal and transverse images of the proximal, mid, and distal aorta
- document the bifurcation of the aorta and measure the right and left iliac arteries
- if an aneurysm is found
  - measure in AP and transverse dimensions. It is not necessary or usually accurate to measure a sagittal dimension of an aortic aneurysm.

- document the renal arteries and location of the aneurysm in relation to the renal arteries
- color image of AAA to show flow and amount of mural thrombus
- show relation of aneurysm to the iliacs and if there is iliac aneurysm present

## US Pelvic w Transvaginal (transabdominal and transvaginal images)

- sagittal and transverse cervix
- sagittal and transverse uterus
  - measure in three dimensions
  - be sure to include sagittal image of the lower uterine segment
- sagittal measurement of endometrium
  - color image of endometrium if abnormality is present
- sagittal and transverse right ovary
  - measure in three dimensions
  - color image to prove blood flow to ovary
  - pulsed doppler image if possible
- sagittal and transverse left ovary
  - measure in three dimensions
  - color image to prove blood flow to ovary
  - pulsed Doppler image if possible
- Ideally, perform Transabdominal images first with full bladder. Then, empty bladder and perform endovaginal images

## US Pelvis (TRANSABDOMINAL ONLY)

- this exam should only be done on patients that are too young (not sexually active and have never had a pelvic exam) or patients that refuse. Otherwise, all efforts should be made to obtain transvaginal images
- obtain the same images as a pelvic with transvaginal ultrasound.
- make sure the bladder is full to obtain optimal images

## US OB w Transvaginal

- \*this exam should be done on patients that have a positive pregnancy test and are less than 12 weeks pregnant\*
- obtain same images as pelvic with transvaginal with these additions
  - image gestational sac

- if no embryonic pole seen then measure the gestational sac in three dimensions to document age
- image yolk sac
- image embryonic pole and get a crown rump length to document age
- document cardiac activity using M-mode only
  - if no cardiac activity seen document with M-mode and color doppler
- do not have to measure the endometrium unless there is no gestational sac seen
- Routine imaging of the embryo with color Doppler should be avoided if possible.

### US OB Limited

- \*this is a very limited exam that does not include imaging fetal anatomy and should only be done if patient is >12 weeks\*
- document fetal cardiac activity with M-mode only
- measure fluid (AFI)
- image the placenta making sure to image the most inferior aspect of placenta to show any degree of previa

### US OB Complete

- \*this is an exam that is done on a non-emergent basis on a patient that is >12 weeks to document fetal anatomy\*
- sagittal image of the cervix
- sagittal image of the fundus to show presentation of fetus
- images of the placenta to show location
- AFI
- images of the right and left adnexa
- fetal biometry to include
  - Biparietal diameter (BPD)
  - Head circumference (HC)
  - Abdominal circumference (AC)
  - Femur length (FL)
- document the following anatomy
  - Head
    - ❖ choroid plexus bilaterally (CHP)
    - ❖ cerebellum
    - ❖ cisterna magna

- ❖ cavum septum pellucidum (CSP)
- ❖ measurement of the atrium of the lateral ventricle
- Chest
  - ❖ four chamber heart
  - ❖ document cardiac activity using M-mode only
  - ❖ diaphragm
- Abdomen
  - ❖ stomach
  - ❖ kidneys
  - ❖ bladder
  - ❖ 3VC (can obtain from a transverse image of the cord or by documenting both umbilical arteries going around bladder)
  - ❖ cord insertion
- Extremities
  - ❖ legs (showing tibia and fibula)
  - ❖ feet
  - ❖ arms (showing radius and ulna)
  - ❖ hands
- Spine
  - ❖ sagittal and transverse images of the spine at representative levels
- Miscellaneous
  - ❖ face
  - ❖ lips
  - ❖ profile
  - ❖ gender

# Vascular

## US Carotid Bilateral

- \*both carotids should be imaged and there are very few exceptions to this\*
- Proximal CCA
  - sagittal and transverse gray scale images demonstrating any plaque
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Distal CCA
  - sagittal and transverse gray scale images demonstrating any plaque
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Bulb
  - sagittal and transverse gray scale images demonstrating any plaque
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Proximal ICA
  - sagittal and transverse gray scale images demonstrating any plaque
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Distal ICA
  - sagittal and transverse gray scale images demonstrating any plaque
  - sagittal pulsed doppler image with color obtaining the highest velocity
- ECA
  - sagittal and transverse gray scale images demonstrating any plaque
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Vertebral artery
  - sagittal pulsed doppler image with color documenting velocity and flow direction
- \*if a stenosis is found the following images should be obtained\*
  - sagittal and transverse gray scale images
  - sagittal and transverse color images
  - sagittal pulsed doppler with color obtaining the highest velocity
- \*if an occlusion is suspected be sure to image with power doppler\*
- \*if retrograde flow is seen in the vertebral artery then include a pulsed doppler image of the ipsilateral subclavian artery looking for a stenosis\*

## US Carotid Limited

- this exam would be limited images of a specific carotid to document flow
- \*this exam should only be done under certain circumstances such as in surgery to document flow or immediately after surgery\*. This should be very rare

## US Venous LE Bilateral

- Common femoral vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler image with color showing spontaneity, phasicity, and augmentation
- Proximal superficial femoral vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler image showing spontaneity, phasicity, and augmentation
- Mid superficial femoral vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler image showing spontaneity, phasicity, and augmentation
- Distal superficial femoral vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler image showing spontaneity, phasicity, and augmentation
- Popliteal vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler image showing spontaneity, phasicity, and augmentation
- Posterior tibial vein (if able to visualize)
  - transverse gray scale
  - transverse gray scale with compression
- \*if DVT is seen then obtain the following images as well\*
  - transverse color image
  - sagittal gray scale image
  - sagittal color image
  - sagittal pulsed doppler image demonstrating and flow
- Venous flow and augmentation should be performed in the longitudinal/sagittal plane\*\*\*

## US Venous LE Limited (RT or LT)

- same as bilateral venous doppler only done on one leg

## US Arterial LE Bilateral

- \*this exam is done to evaluate for a stenosis in the arterial system of the legs\*
- Common femoral artery
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Proximal superficial femoral artery
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Mid superficial femoral artery
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Popliteal artery
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Proximal posterior tibial artery
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Distal posterior tibial artery at ankle
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- Dorsalis pedis artery
  - sagittal gray scale image demonstrating any plaque
  - sagittal color image
  - sagittal pulsed doppler image with color obtaining the highest velocity
- \*if a stenosis is found then the following images should be obtained as well\*
  - sagittal and transverse gray scale images
  - sagittal and transverse color images
  - pulsed doppler image with color obtaining the highest velocity
- Again, all velocities should be obtained in the longitudinal/sagittal plane\*\*\*

## US Arterial LE Limited (RT or LT)

- same as bilateral arterial only done on one leg
- same as bilateral UE arterial just done on one arm
- this is also the exam to do if looking for a pseudoaneurysm

- if pseudoaneurysm found then measure in three dimensions
  - document the aneurysm neck and measure its width
  - also document the common femoral artery with a gray scale image, a color doppler image, and pulsed doppler image
  - obtain image of the adjacent common femoral vein with color and pulsed Doppler to evaluate for av fistula.
- \*If a popliteal aneurysm is found then image contralateral popliteal artery for co-existing aneurysm

## US ABI

- Just do ABI

## US Physiologic Extremity Arterial

- ABI and PVR
- If normal then stop. If abnormal, perform color flow Doppler of abnormal extremity to evaluate exact location and morphology of stenosis/occlusion

## US Venous UE Bilateral

- Jugular vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler with color image showing phasicity
- Subclavian vein
  - sagittal gray scale image
  - sagittal color image
  - sagittal pulsed doppler with color image showing phasicity
  - transverse gray scale (if possible)
  - transverse gray scale with compression (if possible)
- Axillary vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler with color image showing phasicity and augmentation
- Brachial vein
  - transverse gray scale
  - transverse gray scale with compression
  - sagittal pulsed doppler with color image showing phasicity and augmentation
- Brachial artery in antecubital fossa

- transverse gray scale
- transverse gray scale with compression
- sagittal pulsed doppler with color image showing phasicity and augmentation
- Cephalic vein (image at representative levels)
  - transverse gray scale
  - transverse gray scale with compression
- Basilic vein (image at representative levels)
  - transverse gray scale
  - transverse gray scale with compression

### US Venous UE Limited

- same as bilateral upper extremity venous only done on one arm

### US Arterial UE Bilateral

- Subclavian artery
  - sagittal gray scale
  - sagittal color image
  - sagittal pulsed doppler image measuring the velocity
- Axillary artery
  - sagittal gray scale
  - sagittal color image
  - sagittal pulsed doppler image measuring the velocity
- Brachial artery at proximal, mid, and distal portion
  - sagittal gray scale
  - sagittal color image
  - sagittal pulsed doppler image measuring the velocity
- Radial artery at proximal, mid and distal portion
  - sagittal gray scale
  - sagittal color image
  - sagittal pulsed doppler image measuring the velocity
- Ulnar artery at proximal, mid, and distal portion
  - sagittal gray scale
  - sagittal color image
  - sagittal pulsed doppler image measuring the velocity

### US Arterial UE Limited

- same as bilateral UE arterial just done on one arm

### US Vein Mapping – if performed for the radiologist to interpret

- document patency and diameter of all superficial veins of the extremity.
- Pay attention to any vein duplication or anomalies

## MISC

### US Thyroid

- right thyroid
  - transverse images of superior, mid, and inferior thyroid
  - sagittal images of lateral, mid, and medial thyroid
  - measure in three dimensions
  - color flow image
- left thyroid
  - transverse images of superior, mid, and inferior thyroid
  - sagittal images of lateral, mid, and medial thyroid
  - measure in three dimensions
  - color flow image
- isthmus with measurement
- image containing both lobes of thyroid to show comparison
- measure any masses in three dimensions and obtain color flow image
- if a lobe has been removed then image the area at representative levels looking for any residual thyroid tissue or mass
- Also, to be used for other neck structures including parathyroid, lymph nodes/masses, etc.

### US Testicular

- Right testicle
  - transverse images of superior, mid, and inferior testicle
  - sagittal images of lateral, mid, and medial testicle
  - measure in three dimensions
  - color flow image
  - pulsed doppler image demonstrating flow
- Right epididymis
  - sagittal and transverse images
  - measure in three dimensions
  - color flow image
- Left testicle
  - transverse images of superior, mid, and inferior testicle
  - sagittal images of lateral, mid, and medial testicle
  - measure in three dimensions
  - color flow image
  - pulsed doppler image demonstrating flow
- Left epididymis
  - sagittal and transverse images
  - measure in three dimensions
  - color flow image

- image containing both testicles to show comparison

## US Extremity (LT or RT)

- This would be used to evaluate a single extremity, upper or lower, for a fluid collection, abscess, or hematoma
  - sagittal and transverse views of the area of interest
  - if abnormality found then measure in three dimensions and take and document any blood flow

## Neonatal

### US Neonatal Head

- Begin with anterior fontanelle and obtain the following:
  - Coronal - images at representative levels to include ant, middle and posterior cranial fossa
  - Sagittal – images at representative levels to include midline and laterally both right and left
  - Attempt a mastoid view with attention to the cerebellum
  - Posterior fontanelle views

\*eval for ventricular symmetry, intracranial hemorrhage and congenital anomalies

\*true midline sagittal image is important

\*pay special attention to the caudothalamic grooves

### US Pylorus

- Sagittal and transverse images of the pylorus with the following:
  - Pyloric channel length
  - Pyloric muscle single and double wall thickness in the TRANSVERSE plane
  - Obtain images of the distal stomach/gastric outlet in the sagittal plane
  - Give child formula or sterile water and image pylorus 2-3 minutes looking for passage of fluid through pylorus

\*all imaging planes are in relation to the pylorus, not external transducer position

## US Spine

- Sagittal and transverse images of the lumbar spinal canal beginning at T12 and extending caudally as far as can be seen
- Label the vertebrae on all images (at least one per image for reference)
- Pay special attention to the level of conus medullaris and level at which it terminates
- Attention to the filum terminale for any abnormality
- Attention to the posterior elements of the vertebrae for congenital fusion anomalies
- Attention to the skin and subcutaneous region for dimples, sinus tracts, etc.

## US neonatal/pediatric hip

- If exam is to evaluate for effusion, sagittal and transverse images at representative levels. Image the opposite hip for comparison as well
- If exam is to evaluate for congenital hip dislocation, then consult radiologist

## US temporal artery

- Used to evaluate temporal arteritis.
- Evaluate temporal artery in the region of the temporal fossa
- Gray scale and color Doppler images in two planes
- Measure the wall thickness of the artery
- Pay special attention to a hypoechoic halo surrounding the vessel.

## US chest

- Used to evaluate chest wall abnormalities (not including breast)
- Used to evaluate pleural fluid
- Obtain representative images in two planes with measurements of all abnormalities

## US Breast

- For abnormality seen on mammography: If unclear about the areas to evaluate, please ask the radiologist to clarify. Rarely is an entire breast ultrasound needed. Only perform an entire breast ultrasound if specified by the radiologist.
- If no abnormalities are detected, then take a few representative images of the requested areas of interest

- If an abnormality is found take static images in the radial (RAD) and anti-radial (ARAD) positions with corresponding annotations, with and without measurements. On all static images annotate the o'clock position, orientation of the transducer, and the distance from the nipple to the center of the transducer when the abnormality is centered on the screen, i.e. (5:00 ARAD 6 CM FN)
- Also include color flow interrogation images of the abnormality to assess for internal vascularity
- *For area of palpable concern:* only scan over the area of interest, usually indicated by a skin marker, unless otherwise specified by the radiologist, otherwise, same guidelines as above
- *For area of tenderness:* this should also be a targeted exam. If the tenderness is diffuse and involves the entire breast, an ultrasound exam is not usually indicated unless there is an abnormality seen on mammography, otherwise, same guidelines as above
- *Nipple discharge:* perform targeted exam of the retroareolar region, unless otherwise specified by the radiologist, with close evaluation for any intraductal mass(es), otherwise, same guidelines as above.