

Contrast



Contrast Ultrasound

Images

- ⇒ Confirm with sedation that they are available to administer contrast during exam time.
- ⇒ Block schedule for the confirmed one hour time slot.
- ⇒ Let Radiologist know planned time.
- ⇒ Radiologist to place order for Contrast, based on patient weight.
- ⇒ Proceed with study.

PROTOCOL:

- Localize lesion and find the best window (long or trans)
- Click contrast button on machine
- Nurse will administer contrast (.03mL/kg, rate of about 1mL/second, followed by saline flush)
- IMMEDIATELY press "Contrast Clock 1" as soon as contrast is administered to start the clock.
- IMMEDIATELY press mark cine and capture cine at 30 seconds and 1 minute, sweeping slowly through area of interest in long and trans (or however best visualized). Remove probe from skin, take optimized image every 30 seconds for minimum of 6 minutes, until hepatic parenchyma bubble washout is complete or near complete.
- If an additional contrast dose is needed (10 minutes must pass between doses), start "Contrast Clock 2" once the 2nd dose is administered and repeat the 1 minute cine and still images every 30 sec. for 6 minutes.

Age: Any

Purpose:

A contrast ultrasound is performed to help localize lesions and evaluate venous and arterial phases, as well as perfusion to the lesion. This helps further aid in diagnosis.

Prep:

If Contrast only, no prep

If a diagnostic exam needed, follow prep for that exam.

Items to have on-hand:

- Contrast
- Saline flush
- 4-way stopcock

IV line, 22G or 20G

Dose .03cm/kg, 2.4 ml max

Follow w/5 ml Saline flush

Transducer:

Transducer use depends on age and the size of the patient. A good guideline is:

9L: Infants and small children

C2-9: Small children

Additional Images

| If: | Then |
|--------------------------------------|------------------------------------|
| Additional contrast doses are needed | 10 minutes must pass between doses |
| | |
| | |

Abdomen



Abdomen Complete

Images

Long Aorta: prox, mid, distal

Trans Pancreas– Head, body, tail

Midline Transverse:

Left liver– lhv, lpv, lig teres

Right Transverse:

Right liver Dome, HV's(bunny), Rt PV/MPV sup to renal, liver with top of rt kidney

Midline Long:

Left liver—lat, w/ao, caudate, IVC

Right Long: GB/PV, mid, mid clavicular measure, lat, liver/renal interface

Trans cini porta hepatis– include rpv,mpv, cbd, smv/sma

MPV dual screen w/wo color

CBD– extrahepatic cbd elongated w/wo color/measure, cbd in hd of pancreas

GB –long(mid, med, lat) , and transverse (neck, body, fundus) . LLD GB long and trans

Right kidney long –adrenal area, mid, measure x2, med, lat, cini, color

Right kidney trans– sup, mid, mid w/color, inf

Spleen-long– med, mid (measure), lat

Adrenal area/ kidney spleen interface

Left kidney long–adrenal area, mid, measure x2, med, lat, cini, color

Left kidney trans– sup, mid, mid w/color, inf

Spleen trans-- sup, mid

Left kidney trans– sup, mid, mid color, inf

Bladder: trans and long

*USE SCAN ASSIT PROTOCOL

Print report page

Age: Any

Purpose:

An abdominal ultrasound is performed to survey the liver, gallbladder, bile ducts, pancreas, spleen, kidneys, and major blood vessels. If any abnormality is seen, more images may be needed to clarify completely.

Prep:

Abdominal US patients are required to be NPO. Length of time NPO is based on age:

0-3rs: NPO 4 hours

4-7 yrs: NPO 6 hours

8 yrs & up: NPO 8 hours

These requirements are waived for ER patients and some NICU/PICU patients and s/p liver tx and Kasai.

Transducer:

Transducer use depends on age and the size of the patient. A good guideline is:

C3-10 or 9L: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

If:

Then

| | |
|---|--|
| Liver measures large | Color Doppler of MPV to r/o hepatofugal flow |
| Any mass is found | Measure mass in long and transverse DUAL SCREEN (if possible) and use Doppler to document blood flow |
| If scanning infant (less than 1 year old) | Document SMA/SMV location and pylorus |
| If fluid within renal collecting system | Document a transverse cine clip |



Abdomen Complete Less than 1 yr

Images

Long Aorta: prox, mid, distal

Trans Pancreas– Head, body, tail

Pylorus– long and trans

SMV/SMA– labeled

Midline Transverse:

Left liver– lhv, lpv, lig teres

Right Transverse:

Right liver Dome, HV's(bunny), Rt PV/MPV sup to renal, liver with top of rt kidney

Midline Long:

Left liver—lat, w/ao, caudate, IVC

Right Long: GB/PV, mid, mid clavicular measure, lat, liver/renal interface

Trans cini porta hepatis– include rpv (eval for triangular cold sign), cbd, smv/sma

MPV dual screen w/wo color

CBD– extrahepatic cbd elongated w/wo color/measure, cbd in hd of pancreas

GB –long(mid, med, lat) , and transverse (neck, body, fundus)

Right kidney long –adrenal area, mid, measure x2, med, lat, cini, color

Right kidney trans– sup, mid, mid w/color, inf

Spleen-long– med, mid (measure), lat

Adrenal area/ kidney spleen interface

Left kidney long–adrenal area, mid, measure x2, med, lat, cini, color

Left kidney trans– sup, mid, mid w/color, inf

Spleen trans-- sup, mid

Left kidney trans– sup, mid, mid color, inf

Bladder: trans and long

*USE SCAN ASSIT PROTOCOL

Age: Any

Purpose:

An abdominal ultrasound is performed to survey the liver, gallbladder, bile ducts, pancreas, spleen, kidneys, and major blood vessels. If any abnormality is seen, more images may be needed to clarify completely.

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Transducer:

Transducer use depends on age and the size of the patient. A good guideline is:

C3-10 or 9L: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

If:

Then

| | |
|---|--|
| Liver measures large | Doppler of MPV to r/o hepatofugal flow |
| Any mass is found | Measure mass in long and transverse DUAL SCREEN (if possible) and use Doppler to document blood flow |
| If scanning infant (less than 1 year old) | Document SMA/SMV location and pylorus |
| If fluid within renal collecting system | Document a transverse cine clip |



Abdomen Limited: RUQ/ Gallbladder

Images

Midline Transverse:

Left liver (abd protocol images)

Pancreas

Right Transverse:

Right liver (abd protocol images)

Color of MPV

Cine of porta hepatitis , rpv, cbd, smv/sma

Right kidney : sup, mid, inf

Midline Long:

Left liver (abd protocol images)

Caudate lobe

AO and IVC (Label these)

Right Long:

GB (abd GB protocol images)

CBD * (measure extrahepatic cbd)

Right liver (abd protocol images) *measure liver

Adrenal area/liver kidney interface

Right kidney * (measure x2)

Right kidney cine

Print report page

A body marker is used to indicate which images you are taking. The only annotations required are of the AO,IVC, pancreas and CBD.

Normal Measurements: Varies based on age. See full documents posted in the Ultrasound dept. office.

Age: Any

Purpose:

An abdominal ultrasound is performed to survey the liver, gallbladder, bile ducts, pancreas, right kidney, and major blood vessels for pathology. If any abnormality is seen, more images may be needed to clarify completely.

Prep: (For all Non-Stat Patients)

Abdominal US patients are required to be NPO. Length of time NPO is based on age:

0-3rs: NPO 4 hours

4-7 yrs: NPO 6 hours

8 yrs & up: NPO 8 hours

These requirements are waived for ER patients and some NICU/PICU patients.

Transducer:

Transducer use depends on age and the size of the patient. A good guideline is:

C3-10 or 9L: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

If:

Then

| | |
|---|--|
| Liver measures large | Show color and Doppler of MPV to r/o hepatofugal flow |
| Any mass is found | Measure the mass in long and transverse and use Doppler to document blood flow |
| Gallstones are present or reason for exam is cholelithiasis | Decub patient to see if stones are mobile |
| If fluid within renal collecting system | Document a transverse cine clip |



Abdomen Limited: Intussusception

Images

Perform a nine quadrant scan in transverse and long, make sure this includes images posterior to bladder.

Right Transverse Ascending colon from ileocecal valve in RLQ to the hepatic flexure in RUQ

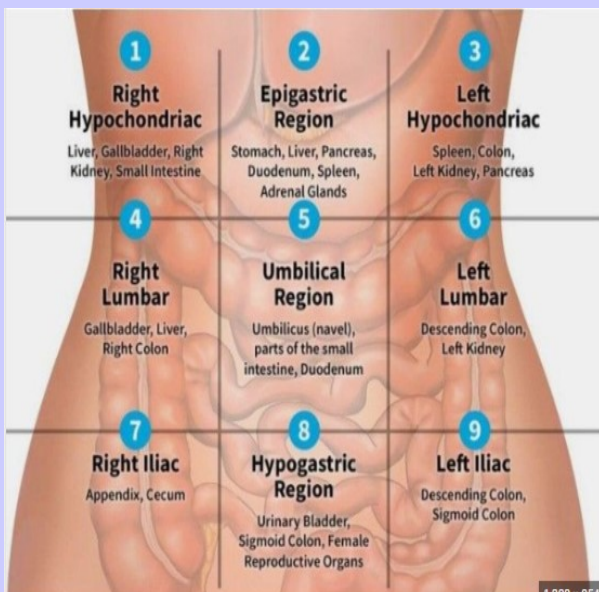
Midline Transverse Transverse colon

Small bowel superior to the umbilicus down to the bladder

Left Transverse Descending colon from splenic flexure in the LUQ to the LLQ

Long: Right to left images

Superior Long Ascending colon from ileocecal valve to the hepatic flexure across the entire transverse colon through the descending colon



Age: Most common between 3 months and 3 years * but can be ordered on any age.

Purpose:

An abdomen limited is performed to survey the large bowel for intussusception.

* Sigel, Marilyn Pediatric Sonography

Prep:

Intussusception patients are not required to be NPO. This should be considered an urgent exam, even if not ordered that way by the physician.

****If patient had a negative study, a complete abdomen study is not needed unless requested by ordering physician.**

Transducer:

9L

Remove virtual convex

Additional Images

If:

Then

| | |
|--|---|
| | <ul style="list-style-type: none"> |
| There is a large bowel intussusception | <ul style="list-style-type: none">Evaluate the extent of the colon involvedTake long, trans and color images |
| There is a small bowel intussusception | <ul style="list-style-type: none">Document size and locationRe-check small bowel to see if intussusception was transient |



Abdomen Limited: Pylorus

Images

Transverse:

Midline: Min of 2 long axis images of the pylorus with and without measurements

Several AP measurements of muscle wall (be sure not to include mucosal lining)

If pylorus is positive measure the channel length.

Cine of fluid moving through pyloric channel

Greyscale still image of labeled SMV/SMA relationship.

Obtain transverse cine superior to inferior at level of pancreas showing relationship of SMV/SMA and 3rd portion of the duodenum.

Third portion of the duodenum runs between the SMA and the AO

Long

Midline:

Cross sectional view of pylorus

Min of 2 images of pylorus with and without measurement of muscle wall in short axis

Right and Left lateral:

Evaluate each kidney to assess for hydronephrosis and take at least one image of each

Re-image pylorus to check for spasm.

Normal Measurements:

Pyloric wall < 3mm

Pyloric channel < 17 mm

Age: Infants

Purpose:

To evaluate the pylorus for hypertrophic pylorus stenosis, malrotation or volvulus as a cause for projectile vomiting and weight loss in infants.

Prep:

Pylorus patients do NOT need to be NPO, but a full stomach may make exam more difficult.

Outpatients should be kept NPO 1-2 hours prior to exam

Transducer:

ML 6-15 or 9L

Additional Images

| If: | Then: |
|---|---|
| Patient is gassy midline | <ul style="list-style-type: none">Roll patient onto their right sideReduce frequency or try 9L transducer |
| Stomach is empty and there is no fluid moving through the channel | <ul style="list-style-type: none">Have parent feed patient or give glucose water |
| Pylorus measures positive | <ul style="list-style-type: none">Hold patient, call report to ordering physician.Make sure the radiologist checks the images.Patient needs to remain NPO |



Abdomen Limited: NEC

Images

Scan all FOUR quadrants

(start RLQ >> RUQ >> LUQ >> LLQ)

Obtain images in sagittal and transverse

Assess thickness of wall (thickened early, thin <1 mm later) (zoom, decrease depth)

If see air in bowel in supine position, change to decubitus to see if air shifts or remains in bowel wall

Color Doppler:

-Decreased PRF to see subtle hyperemia or lack of flow in all quadrants

-SMV/SMA, Portal Vein– assess for portal venous gas

Cine clips for peristalsis in each quadrant (may have to watch >1 minute)

Spectral Doppler

- PVG= typical artifact sharp bidirectional spikes of Doppler shift superimposed on the portal venous waveforms

Can do without compression, graded compression, or graded anterior and posterior compression

Harmonics= decreased artifacts and better resolution

Panoramic images can be obtained for long segment

Age: Most commonly ordered on infants or heart patients; could be ordered on older patient also

Purpose:

To evaluate for air in the intestinal wall, bowel wall thickness, assess bowel wall perfusion, and flow in SMV/SMA and MPV

Prep:

Patient does NOT have to be NPO

Look up same day xray KUB to see if and where air is noted on report

Transducer:

ML 6-15 (9L can be used to document MPV, SMV/ SMA if needed)

High frequency transducer for detail of wall, ZOOM up and decrease depth

Have US beam perpendicular to bowel wall for best detail (do not tilt transducer)

Additional Images

If:

Then:

| | |
|--|--|
| Air noted in the bowel wall in supine | <ul style="list-style-type: none">Decub patient to see if air persists |
| Having difficulty assessing for air in MPV | <ul style="list-style-type: none">Use B flow |
| If limited acoustic window and ML6-15 too large of footprint | <ul style="list-style-type: none">Try L6-24 transducer |



Abdomen Limited Doppler– Renal Vein Entrapment

Images

Long:

Long AO at SMA origin (supine)

- Grayscale (2-3 images)
- Color
- Doppler w/ measurement
 - AO superior to origin of SMA
 - SMA

Long IVC prox, mid, distal

- Grayscale
- Color
- Doppler w/ measurement

Trans:

Left renal vein prox, mid, distal (eval for course of renal vein and entirety for stenosis)

- Grayscale
- Color
- Doppler w/ measurement
- Eval for collaterals

Left Inguinal Canal:

- Eval for enlarged vessels (males)

Left Scrotum/Left adnexa for females:

- Use Valsalva
- Eval for varicoceles in left scrotum for males
- Eval for Lt ovarian vein incompetence in females

***Note: US Renal MUST also be ordered to evaluate the kidneys.**

Age: Any

Renal Vein Entrapment: compression of the left renal vein between the aorta and the superior mesenteric artery.

NCS is generally divided into 2 types: anterior and posterior.

- Anterior NCS, which is the most common form, occurs when the normally-placed left renal vein is compressed between the aorta and the SMA.
- Posterior NCS generally occurs when the left renal vein is compressed between an artery (usually the abdominal aorta) and the bones of the spine.

Also Known As: Nutcracker phenomenon, renal vein entrapment syndrome, mesoaortic compression of the left renal vein.

Ultrasound features consistent with NCS:

- Reduced aortic/SMA angle (normal = 38–65)
- LRV compression at the origin of aorta and SMA
- Increased flow velocity at LRV defect >5:1
- Left-sided varicocele with a vein lumen diameter of greater than 3 mm

Prep: VERY important to make patient NPO

Length of time NPO is based on age:

0-3rs: NPO 4 hours

4-7 yrs: NPO 6 hours

8 yrs & up: NPO 8 hours

Transducer: Transducer use depends on age and the size of the patient. A good guideline is:

C3-10 or 9L: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults



Abdomen Limited/ Abdomen Limited Doppler– SMA

Images

Supine **AND** Upright:

Long:

Long AO at SMA origin

- Grayscale (multiple images)
- Color (multiple images)
- Doppler

-AO superior to
origin of SMA

-SMA and along
the length of vessel

Radiologist will measure the angle the
SMA comes off the AO

Trans:

Trans AO with SMA

- Grayscale (multiple images)

Need to see first part of duodenum
(area of pylorus channel)

Demonstrate D3 located between AO
and SMA (same as on pylorus protocol)

Age: Any

SMA syndrome: A digestive condition that occurs
when the duodenum is compressed by the AO and
the SMA. This causes partial or complete blockage of
the duodenum.

Prep: VERY important to make patient NPO

Length of time NPO is based on age:

0-3rs: NPO 4 hours

4-7 yrs: NPO 6 hours

8 yrs & up: NPO 8 hours

Transducer: Linear - if patient body habitus will
allow

Curved-if penetration is needed for body habitus

NOTE:

ALL IMAGES DONE PRE-PRANDIAL,
NO POST-PRANDIAL IMAGES



Abdomen Limited/Limited Doppler– MALS syndrome

Images

Supine:

Long:

Grayscale/color dual screen & Doppler all of the following in

- Neutral
- End-Inspiration
- End-Expiration

- Proximal AO
- Proximal Celiac Axis
- SMA

Upright:

Long:

Grayscale/color dual screen & Doppler all of the following in

- Neutral
- End-Inspiration
- End-Expiration

- Proximal AO
- Proximal Celiac Axis

AO/Celiac Axis

Grayscale/color dual screen
Cine inspiration through expiration

Age: Any

MALS Syndrome: Median Arcuate Ligament syndrome or Celiac Artery Compression syndrome (CACS) - presents clinically w/postprandial abd pain and weight loss. Diagnosed by showing extrinsic compression of the proximal part of the celiac artery by the median arcuate ligament.

Prep: VERY important to make patient NPO

Length of time NPO is based on age:

0-3rs: NPO 4 hours

4-7 yrs: NPO 6 hours

8 yrs & up: NPO 8 hours

Transducer: Linear - if patient body habitus will allow

Curved-if penetration is needed for body habitus

NOTE:

Criteria for diagnosis of MALS include (but not limited to):

*Expiration: PSV >200cm/sec +/- EDV >55cm/s

*>60 cm/sec decrease in PSV w/inspiration or erect positioning

*No systemic vascular abnormality

If scanning for both MALS and SMA, charge as one Abd Lim/Ltd Doppler and one Ltd Doppler



Abdomen Doppler

Images

Include Color and Grayscale of the following vessels (dual screen if possible):

Midline Long *Measure velocity

AO *

IVC

Midline Transverse

Left portal vein *

Left hepatic artery *

Right Transverse:

Left hepatic vein

Middle hepatic vein

Right hepatic vein

Right anterior portal vein *

Right posterior portal vein *

Right anterior hepatic artery *

Right posterior hepatic artery *

Main portal vein—intra and extra hepatic *

Main hepatic artery—intra and extra hepatic *

Left

Splenic artery *

Splenic vein (at pancreas tail)

****** liver transplant and Kasai procedure pt's do**

Not need to be NPO.

*angle correct on all vessels except for IVC, HV's and SplV.

Age: Any

Purpose: To evaluate the major blood vessels of the liver and spleen.

Prep: Should be NPO

Length of time NPO is based on age:

0-3rs: NPO 4 hours

4-7 yrs: NPO 6 hours

8 yrs & up: NPO 8 hours

These requirements are waived for ER patients and some NICU/PICU patients and s/p liver tx and Kasai.

Transducer:

Same as abdomen

Additional Images

| If: | Then: |
|---------------------------------|---|
| Being done for liver transplant | <ul style="list-style-type: none">• Additional MPV/MHA velocities (intra-hepatic, extra-hepatic, anastomosis if possible) |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Liver Transplant

Images

Perform doppler images FIRST!

- AO/IVC
- Hepatic Veins (right, middle, left)
- MPV/MHA (intrahepatic, anastomosis, extrahepatic)
- LPV, LHA
- RPV, RHA (do NOT need ant/post)

Four quadrants for ascites/fluid check

Liver grayscale imaging

- Measurement of liver

The liver transplant anastomosis drawing should be in the patient's power chart under "surgical documentation" or "immediate procedure note"

***Have the radiologist read right away**

- If before 7 am, overnight Dr.
- If between 7-8a, early Dr.
- If after 8a, US Dr.

Age: Any

Purpose: To evaluate the major blood vessels of the liver and spleen.

Prep:

NOT required to be NPO

Transducer:

Same as abdomen

Additional Images

| If: | Then: |
|---------------------|--|
| Immediately post op | <ul style="list-style-type: none">• transplant surgeons want to be bedside |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Images

Bilateral Always

Long and transverse images

Age: Any

Purpose: Eval for hematoma, solid masses, absence, adrenal hyperplasia (ambiguous genitalia or if patient has a uterine anomaly).

Prep: None, though NPO will help better eval Lt side

Transducer: Age dependent

3-10C, 9L, 2-9C, 1-6C

Additional Images

| If: | Then: |
|----------------------------|--|
| Hematoma/Mass/Absent | <ul style="list-style-type: none">Cine Sag/Trv |
| Hematoma/Mass | <ul style="list-style-type: none">Color Doppler |
| Internal flow seen on mass | <ul style="list-style-type: none">Spectral Doppler |



Appendicitis Abdomen Limited

Images

LABEL, LABEL, LABEL– cecum, Terminal ilium, iliacs, compression, retrocecal, appendix, free fluid, quadrants.

Transverse: image low in RLQ at level of the iliacs. Try to locate TI and label it. Assess ascending colon up to hepatic flexure for enlarged lymph nodes, free fluid, appendix, or abscess collection.

Sagittal: document cecum/ascending colon and label it. Scan medial to see appendix in cross-section.

Appendix: With graded compressions locate the appendix and take multiple cross section and length images. Document appendix in with and without compression in dual screen. Locate and label the tip. Document compressibility with dual screen. Eval with color. If appendix is seen, take a cine clip with evaluation from cecum to tip. If the appendix is not seen take cine superior to inferior.

Bladder: Pay special attention to the area posterior to the bladder. Look for a fluid/debris collection from possible ruptured appendix.

Signs of a RLQ inflammatory process: Echogenic

Normal Measurements: The appendix should measure under 0.6cm in AP (some sources prefer 0.7cm).

Age: Any age (although under 1y/o is very rare)

Purpose: This exam is used to identify the source of abdominal pain, and to look for signs of appendicitis and associated abscess.

*Be sure to interrogate from RLQ to hepatic flexure

Prep: None

Transducer: 9L for bowel eval on most patients, C1-6 or the C2-9 for bladder eval.

Additional Images

If:

Then:

...the appendix can't be located near the TI/iliac vessels,

- Interrogate from RLQ to hepatic flexure
- LLD patient– look retrocecal and label
- Place Patient in trendelenburg

Exam is positive

- Then document RUQ, RLQ, LUQ, and LLQ and assess for free fluid. Surgery uses this information to determine if can be done laparoscopic removal

Cannot find appendix and patient's bladder is full,

- Post void patient and re-assess for appendix; full bladder can displace/obscure appendix



Renal Complete

Images

- **LONG-** images-adrenal area, mid greyscale, 3 images of mid right kidney with measurement, medial, lateral, Cini, color (power doppler can be useful to show perfusion)
- If stones are visualized, use dual screen to show gray scale/color simultaneously, label stones #1, #2, (no more than 3) and measure (show in trans also)
- **TRANS-** images
 - Superior
 - Mid (w/ and w/o color)
 - Only measure if pelvis dilated, >10mm
 - Inferior
- Repeat for left kidney
- Transverse image of bladder (measure width), inferior bladder (UVJ area)
- Long image of bladder (measure length/height)
- If evaluating for renal stones, hematuria, etc. look for bilateral bladder jets using color or power Doppler.

** Image liver/kidney and kidney/spleen interface/adrenal area in AT LEAST one image.

- For infants or small children you may scan prone instead of supine.
- USE SCAN ASSIST

Normal Measurements: Per Doctor Kucera

1-3 months: 3.8-6.2cm R 3.9-6.1cm L
4-6 months: 4.2-6.4cm R 4.5-6.7cm L
7-9 months: 4.9- 6.9cm R 4.5.2-7.0cm L
1- 3 years: 5.4-6.8cm R 5.5-7.7cm L
3- 5 years: 5.7-7.7cm R 6.2-8.0cm L
5-9 years: 6.3-9.3cm R 6.7-9.7cm L
9-13 years: 6.6-10.1cm R 6.9-10.8cm L
13- 17 years: 8.2-10.6cm R 7.8-11.4cm L

Age: Any (infant to adult)

Purpose: To evaluate the kidneys and bladder for any abnormalities due to trauma, congenital anomaly, mass/tumor, stones, or infection.

Prep: Preparation for this exam differs by age. A full bladder is recommended for optimal renal imaging. Designated amount of water needs to be consumed 1 hour prior to the ultrasound. If the patient is in diapers, incontinent, or has a urodynamics or VCUG study, they are not required to fill their bladder.

- 0-5 years old: 8 ounces of water
- 6-9 years old: 16 ounces
- 10-14 years old: 24 ounces
- 15-18 years old: 32 ounces

Urine samples for all potty-trained children going to urology/kidney center (affix label and write time on cup)

Transducer: C3-10 or 9L for infants/small children, C2-9 for small children, C1-6 teens/young adults, adults.

Additional Images

| If: | Then: |
|--|--|
| Pelviectasis larger than 10 mm | <ul style="list-style-type: none">• Measure renal pelvis in transverse• Take a transverse cine |
| Stones/hematuria or mass (es) visualized | <ul style="list-style-type: none">• Use dual screen to show gray scale/color simultaneously, label stones #1, #2, (no more than 3) and measure• Show in trans |
| If distal ureter(s) are dilated or you see a ureterocele | <ul style="list-style-type: none">• Image in long and transverse, elongating ureter into bladder; measure ap, show w/color to show not vessels. |
| If order is for "Renal Vein Entrapment: | <ul style="list-style-type: none">• See "Abdomen Limited Doppler—Renal Vein Entrapment" on pg 8 |



Images

- Document at least one image in long and transverse to show presence of kidneys/ interface with liver or spleen.
- Document color flow.
- Document the area of clinical concern:
 - For hematoma s/p bx: document presence, size, assess for active bleeding, etc.
 - For patent urachus: transverse and long images from umbilicus to dome of bladder. Evaluate for tract that communicates between umbilicus and bladder.
 - evaluate for patent tract/ abscess from the bladder to the umbilicus. Patient will usually present with drainage from the belly button.
- Bladder only request- Document pre and post void if necessary
- Native kidneys on s/p tx patient Renal limited to eval for tumors in native kidneys.

Patent urachus, urachal remnant, native kidneys in s/p transplant, bladder ONLY request, hematoma s/p transplant to eval for size/ active bleeding

Age: any

Purpose: this order can be used when the ordering physician is looking for something specific. This can also be used for ie: Patent Urachus, post bx hematoma.

Prep:

Varies based on what the clinical concern is.

Full bladder is helpful to distend the bladder and possibly force fluid into tract for patent urachus.

Transducer: Transducer use depends on age and the size of the patient. A good guideline is:

C3-10 or 9L: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

9L or ML6-15 for more superficial structures



Renal Doppler

Images

Interrogated Vessels:

Right/Left Segmental Arteries: Superior, Mid, Inferior Pole of Kidney (best visualized in long plane of kidney). Measure RI and AT

Right/Left renal vein (proving patency) usually best visualized in transverse

Right/Left renal artery: hilum, mid, origin (hilum and mid typically best visualized in transverse, origin may be imaged in long or transverse)
Measure RI ***Angle correct

Aorta measure suprarenal (typically prox AO)
***Angle correct

IVC

Normal Measurements:

Normal Renal Artery RI's: 0.6-0.92

Intrarenal arterial RI's: Normal >0.5

?Stenosis <0.5 (>0.8)

Renal Art PS velocities: Normal: <125 cm/s

Gray-zone: 125-180cm/s

Stenosis: >180-200 cm/s

RAR (renal-to-Aortic) Ratio: Normal <3.3

Abnormal: >3.3 (indicates stenosis)

AT normal = <.07

****These are guidelines but also look for tardus waveforms/slow systolic upstroke as abnormal or elevated intrarenal acceleration time >70ms**

Always a bilateral exam (unless patient has a single kidney)

Can be ordered solely as a renal Doppler if a renal or abdomen complete US was ordered in the past **24 hours**.

If the kidneys were not imaged recently, needs to be ordered as a Renal/Renal Doppler .

Prep: NICU/PICU may not apply

For all NON-STAT patients:

0-3 years old: NPO 4 hours prior to exam

4-7 years old: NPO 6 hours prior to exam

8+ years old: NPO 8 hours prior to exam

Transducer:

Transducer use depends on age and the size of the patient. A good guideline is:

C3-10: infants

9L: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

If:

Then:

| | |
|---|---|
| Stenosis/narrowing | <ul style="list-style-type: none">Doppler prox to, at, and distal to stenosis |
| If order is for "Renal Vein Entrapment: | <ul style="list-style-type: none">See "Abdomen Limited Doppler—Renal Vein Entrapment" on pg 8 |
| | <ul style="list-style-type: none"> |



Images

- Pre-biopsy images of the kidney
 - Usually in long, Nephrologist may request transverse images as well
 - Assess location of blood vessels
 - Measure distance between skin and kidney cortex in long w/o applying pressure
 - If no prior imaging has been done, confirm presence of 2 kidneys
- Cine images or still images of biopsy passes
- Indicate pass # on image
- Rough rule of thumb:
 - 3 passes for native kidney
 - 2 passes for surveillance transplant kidney
- Post– biopsy images
 - Taken after applying pressure to the biopsy site for 10 minutes
 - Long and transverse images are helpful, especially when hematoma is present to look for active bleeding.

Age: Any

Purpose: For diagnosis of renal disease in transplant or native kidneys. Transplant rejection, annual surveillance.

Prep: Patient is sedated or placed under general anesthesia. Positioned in prone for native biopsy w/ roll under lower abd; supine or LLD for transplant biopsy. Ultrasound technologist will need to provide biopsy kit and supplies (see chart in supply cabinet).

Transducer: 9L or C2-9/C1-6 dependent on yours or the Nephrologist's preference.

Additional Images

| If: | Then: |
|----------------------|--|
| Post-biopsy hematoma | <ul style="list-style-type: none">• Measure long and transverse; color |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Kidney Transplant

Images

**Similar to a renal/renal Doppler exam

Long

- 3 images of transplanted kidney, measure x3
- Color image for perfusion
- Cine

Transverse

- Trans Superior, Mid, Inferior
- Trans Hilum w/Color showing MRA/MRV

Doppler

- Segmental—Superior, Mid, Inferior poles
Measure RI
*Measure acceleration time
- MRA—Hilum, Mid, Anastomosis
- MRV—Hilum, Mid, Anastomosis
- Common Iliac Art/Vein—Pre-anast, At Anast, Post-anast

***Please NOTE: If connected to AO/IVC Doppler these at Pre-anast, At Anast, Post-anast

Bladder

Sag/Trans w/wo volume

Normal Measurements:

Kidney size will vary depending on donor.

Sonographic Appearance:

Can vary depending on degree of failure

Age: Any

Purpose: New transplant, Surveillance, Rejection, Hypertension, Abnormal Urine Output, Post-biopsy

Prep: NPO

full bladder not necessary

HINT: If available, refer to surgical report to ensure where anastomosis was made (AO/IVC or to Iliac A/V)

Transducer: 9L, 2-9C, 1-6C

Additional Images

| If: | Then: |
|--|---|
| Pt has midline incision | <ul style="list-style-type: none">• MRA/MRV likely connected to AO/IVC |
| Pt has more than 1 MRA | <ul style="list-style-type: none">• Doppler each at hilum, mid, and anastomosis |
| Hydro >9mm | <ul style="list-style-type: none">• Trans cine• Reimage post void |
| Native kidneys removed (immediately post-op) | <ul style="list-style-type: none">• Sag/Trans Native fossa to evaluate for hematoma |



Images

*** There is a job aid for this exam ***

- Select C1-6 probe on abdomen preset
- Patient position: left posterior oblique with right arm raised above head.
- Select **Elasto** button on keyboard (Shear Wave)
- If dual screen populates, change to single screen.
- Located optimal window for ROI placement:

No overlying vasculature, 2-3 cm below liver capsule, capsule perpendicular to US beam.

- Have patient suspend breathing take in breath and release half and hold.
- Obtain elastography samples. (This number will vary based on if this is a research study patient)
- Measure
- Reserve study for appropriate radiologist if needed.

12 measurements in right and 12 measurements in left lobe

Print an image of each measurement

Delete report page between lobes

Print report page

****REMEMBER TO KEEP IQR/Median percentage below 30% for each lobe. If it is above 30%, delete highest and lowest measurement and re-do****

Age: Any

Purpose: Measures the stiffness of tissue. Primarily used in liver

Prep: None unless ordered in addition to an abdomen. Research studies with elasto only are to be NPO 2hours

Transducer: ***C1-6 on abdomen setting

Tips:

Available on all **E10** and **S8** (portable) machines.

Make sure **shear wave** setting is selected

Additional Images

If:

Then:

Color box is not filling in

- Use penetration mode
- Increase color gain

Exam is done as part of a study

- Reserve for the Dr working on that study. Otherwise can be read by any rad.

Small Parts

Images

-Always image supine (lateral/coronal approach), also image upright (from posterior approach) if able to move patient

-If lateral approach obscured, can be imaged from anterior or posterior aspect of chest

-Sag/Trv of upper (level of axilla), mid, and lower lung field

Paralyzed diaphragm

Use M-Mode to show movement (dual screen m-mode for comparison can be helpful)

Cine motion

Watch for inspiration (diaphragm moves down) and expiration (diaphragm moves up)

Trv—Cine image midline if young enough to show bilat motion is synchronized.

Appearance:

Normal—Air artifact, no fluid

Effusion—Hypoechoic to anechoic fluid, debris may be present

Empyema —Thick, echogenic fluid/material

Consolidation—Absent air artifact, lung will look similar to liver/spleen, may be flapping in fluid if present

Atelectasis—Patchy, echogenic areas w/in lung, absent air ring down artifact in areas.

Age: Any

Purpose: Eval for:

Effusion/Empyema

Paralyzed diaphragm/Paradoxical motion

Consolidation/Atelectasis

Prep: Normally None

If for Paralyzed Diaphragm, RT or MD must take pt off vent or pause C-Pap/Bi-Pap during imaging (can remain on nasal cannula)

Transducer: Varies with Age

3-10C, 9L, 2-9C, 1-6C

Additional Images

| If: | Then: |
|------------------------|---|
| Mass present | <ul style="list-style-type: none"> Measure, Color/Spectral Doppler, Cine |
| Debris seen w/in fluid | <ul style="list-style-type: none"> Cine |



Images

Scan AOI in breast in the radial and antiradial planes.

Cine Clip of AOI.

Demonstrate if there is mobile internal debris

Color flow on any pathology

If abnormality noted, does AOI compress? Do dual screen w/wo compression

All images should be labeled with:

Right or Left breast

Time

Distance from the nipple

Radial/Antiradial

Body Marker

Can be ordered as unilateral or bilateral

Order should specify area of interest (ex: right breast, upper inner quadrant; right breast 4:00) or patient can indicate area at time of exam.

Transducer:

6-15L small parts

If patient has large breasts/large lesion, may need to use curved probe for measurements

Additional Images

If:

If specific area not specified or if ordered for entire breast

Then:

Scan entire breast and document 12,3,6,9:00 and any pathology



Scrotum (Contents and w/Doppler)

Images

Transverse:

Bilateral scrotum to show comparison of testicles (with and w/o Color). Dual screen

Epididymis

Testicles – upper, mid, lower

Measure mid testicle width in transverse

Cini– inguinal canal through scrotum

Sagittal:

Measure epididymis length and AP

Testicle medial, mid, lateral

Measure length and AP testicle in sagittal

Cini– Lateral to medial over the distal inguinal canal to scrotum.

Evaluate inguinal canals

*Measure and apply color to any intra or extratesticular mass or cyst.

*When a varicocele is found, dual screen with Color Doppler with and w/o valsalva.

*When there is an undescended testicle within the canal, apply a small to moderate amount of pressure to see if it can be moved into the scrotum.

*When a testicle is not within the scrotum or the canal you can try to look for it in the abdominal cavity.

Doppler evaluation:

Place Color Doppler on testes to verify blood flow on all exams

Obtain arterial/venous spectral Doppler tracings in the body of the testicle (venous often best seen peripherally near mediastinum)

Age: Any age

Purpose: This exam helps to determine the cause of pain, swelling, redness, and/or any other clinical anomalies related to the male scrotum.

Prep: No prep is necessary.

CONTENTS:

Ambiguous Genitalia

Atrophy/Undescend Testis

Inguinal Hernia

Spermatocele

Swelling/hydrocele

Varicocele

DOPPLER:

Infection/Cellulitis/Erythema

Lesion/Mass/Tumor

Testicular pain/torsion

Injury/Trauma

Transducer: Linear transducer- ML6-15 for most patients. Can use curved probe if testicles too large to fit

Additional Images

If:

Then:

| | |
|---|---|
| If a hernia containing bowel is seen... | <ul style="list-style-type: none">Apply Color Doppler to show perfusion/ r/o incarceration. Have pt valsalva |
| The epididymis is enlarged and heterogenous... Eval entirety of epididymis, epididymitis will start in tail and move upward. | <ul style="list-style-type: none">Apply Power Doppler and look for an avascular ovoid area. This is a sign of a torsed appendix epididymis |
| You suspect a hernia but the patient is too young or is unable to valsalva... | <ul style="list-style-type: none">(with the help of a parent) stand the patient up on the bed and image the canals.Take pacifier away to make patient cryHave pt sit semi upright (encourage pt to do a crunch) |



Head/Neck Soft Tissue

Images

Thyroid— TR Midline, grayscale and color

Parotid gland (Bilaterally)—TR and LG, grayscale and color

Submandibular gland (Bilaterally)—TR and LG, grayscale and color

Bilateral Neck—TR pictures from Parotid gland to Clavicle, TR cine of same

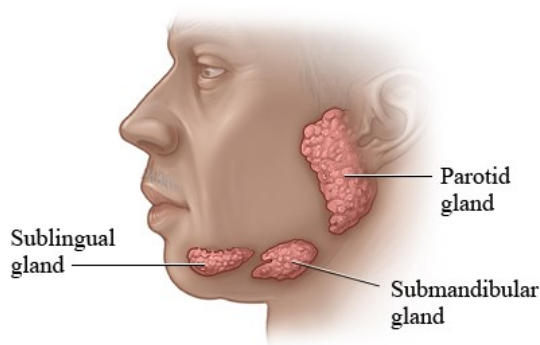
AOI— Label as such, measure in dual screen, grayscale, color, and Doppler if needed

Normal Parotid and Submandibular Ap-

pearance: Hypoechoic, homogeneous.

Similar to muscle echogenicity. Parotid will be more attenuative than submandibular gland due to fat content.

Normal sublingual glands: very small, often only seen if pathology present. Homogeneous, hypoechoic similar to parotid gland. Try L8-19i (hockey stick) probe first, visualize submentally.



© Healthwise, Incorporated

Age: Thymus visualized prior to puberty, Torticollis infants <3months.

Purpose: Classify palpated lump, pain, or swelling (eg: solid, cystic, mixed,) lymphadenopathy, Branchial cleft cyst, Thyroglossal duct cyst, parathyroid gland mass, thymus pathology, parotiditis, parotid or submandibular duct stone, sublingual gland, cystic hygroma, abscess

Tip: Parotid gland may contain lymph nodes. Submandibular gland should never contain other tissue

Transducer: ML6-15, 9L—for deep structures, L8-19i (hockey stick) for small superficial lesions

Prep: Remove pillow or place pillow beneath patient's shoulders to extend the neck. Tuck towel into collar of shirt or gown, or remove shirt/gown if needed

Additional Images

If:

Then:

Cervical lymphadenopathy present

- Measure the single largest lymph node on each side in dual screen
- **Take screening image of thyroid to document presence**

AOI is a fluid collection

- Take a cine to look for mobile debris/motion

Indication is Torticollis or Fibromatosis colli

- Image the sternocleidomastoid muscle (SCM) bilaterally in grayscale, and use color. Look for hematoma within SCM
- Show tapering of muscle superior and inferior



Post Thyroidectomy--NECK MAPPING

Images

Always BILATERAL ultrasound exam of the neck, utilizing the quadrants depicted below.

Systematically interrogate each zone for **abnormal** lymph nodes and label corresponding zone. For example: Right zone 1A or Left zone 5

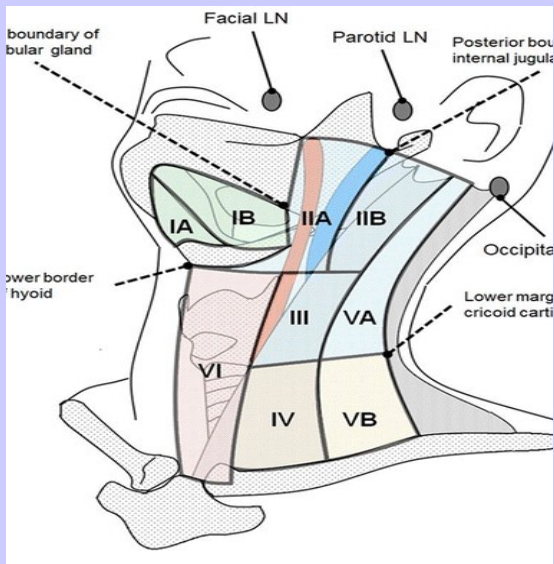
Document greyscale and color of each abnormal node

- dual screen, trans and long with measurement.
- Demonstrate vascularity.

Take a transverse cine clip of each side of neck regardless of normal/abnormal nodes noted on exam. Note this does NOT replace still images.

Tech report documentation:

Document each **abnormal** node and tell what level and how many are seen in that zone. For ex. Zone 5A– two abnormal nodes seen. If normal nodes are seen document-additional normal appearing nodes seen at various levels.



Age:

Purpose: interrogation and documentation of cervical lymph nodes in order to identify suspicious lymph nodes prior to surgical intervention.

Order will specify for neck mapping.

Transducer: ML6-15

Prep: none

Additional Images

If:

Then:

Abnormal appearing nodes noted

- Document long and transverse on dual screen
- Document zone
- Document vascularity

The hyoid bone separates zones 1a ,1b, 2a, 2b from 3 and 6.

The cricoid separates zones 3 and 6 from 4 and 5b



Pre-Thyroidectomy--NECK MAPPING

Images

Always BILATERAL ultrasound exam of the neck, utilizing the quadrants depicted below.

Systematically interrogate each zone for all **normal** and **abnormal** lymph nodes and label corresponding zone. For example: Right zone 1A or Left zone 5

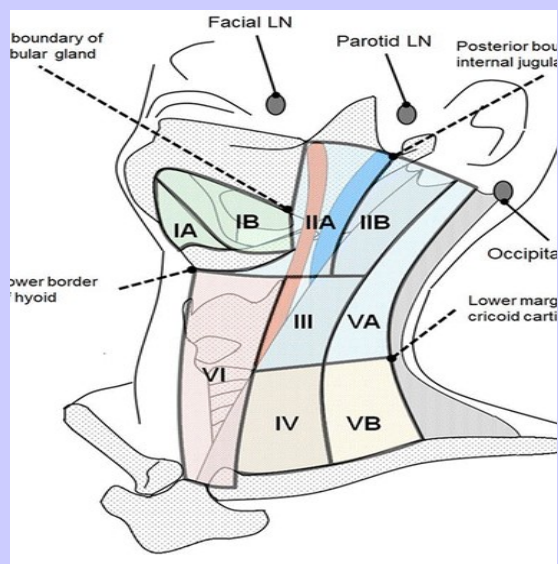
Document greyscale and color of each node

- dual screen, trans and long with measurement.
- Demonstrate vascularity.

Take a transverse cine clip of each side of neck regardless of normal/abnormal nodes noted on exam. Note this does NOT replace still images.

Tech report documentation:

Document each node and tell what level and how many are seen in that zone. For ex. Zone 5A – two abnormal nodes seen. If normal nodes are seen document-additional normal appearing nodes seen at various levels.



Age:

Purpose: interrogation and documentation of cervical lymph nodes in order to identify suspicious lymph nodes prior to surgical intervention.

Order will specify for neck mapping.

Transducer: ML6-15

Prep: none

Additional Images

If:

Then:

Nodes are seen

- Document long and transverse on dual screen
- Document Zone
- Document vascularity
- MEASURE

The hyoid bone separates zones 1a ,1b, 2a, 2b from 3 and 6.

The cricoid separates zones 3 and 6 from 4 and 5b



Images

TR Midline— Grayscale and color of bilat lobes

Isthmus—TR -Grayscale and AP measurement

Bilateral Lobes -

TR—Superior, Mid, Inferior poles.

Measure width at mid pole

LG—Medial, Mid , Lateral

Measure length and height, color at Mid

ALL thyroid nodules need to be measured.
Be sure to number or label nodules to differentiate (A, B, C or 1, 2, 3) . Location of sup/ mid/inf needs to be listed (radiologist will label laterality).

However, if patient has multiple colloid cysts, measure largest 2-3 on each side.

For any measurements— dual screen to demonstrate all measurements on a single image

(put each thyroid nodule in the package under location [i.e. right upper mid nodule])

Refer to US19004845 for example

Normal Measurements:

| In cm: | TR | LG | AP |
|-------------------------|-------|-----|---------|
| Infants/Young children: | 1-1.5 | 2-3 | 0.2-1.2 |
| Young Adults: | 2-4 | 5-8 | 1 - 2.5 |

Reference: <http://www.ohsu.edu/xd/>

Purpose: Evaluate for nodules, goiter, thyroiditis, post thyroidectomy look in thyroid bed for residual tissue.

Prep: Remove pillow or place pillow beneath patient's shoulders to extend the neck. Tuck towel into collar of shirt or gown, or remove shirt/gown if needed

Transducer: ML6-15, 9L—for deep structures

Additional Images

If:

Then:

Multiple Nodules
(measure ALL nodules)

- Label each nodule (eg #1,) measure in dual screen, grayscale, and color
- Cine in long and trans of thyroid lobe

Multiple colloid cysts

- Measurement largest 2-3 on each side
- Cine in long and trans of thyroid lobe

Post thyroidectomy

- Check Bilateral neck for abnormal lymph nodes



Scleroderma /Morphea

Images

Gray scale dual screen affect vs. unaffected

Screen Left ALWAYS= affected.

Affected

Unaffected

Document sup, mid, inf of lesion

Color SINGLE screen only of affected vs unaffected. Switch back and forth between affected vs unaffected sup, mid, inf of lesion.

Ex: affected sup, unaffected sup;
affected mid, unaffected mid

Note: prior to obtaining first color image, turn gain all the way up to where artifact/flash is occurring. Then slowly decrease overall color gain to eliminate flash. Once these settings obtained, DO NOT ADJUST color settings!

AOI must be scanned on the same preset as previous exam (often MSK General)

Normal Measurements:

Purpose: This is a study protocol. This exam allows for the thickness and vascularity of a lesion to be compared to the unaffected contralateral side.

Prep: Lesion MUST be marked by clinic prior to ultrasound exam being performed.

You will need a large quantity of gel for the exam. Do NOT use a standoff pad. Keep transducer pressure LIGHT as the vessels and skin can be compressed skewing results

Images will be obtained in the superior, mid, and inferior aspects of the marked lesion. If lesion is large—image sup, sup/mid, mid/inf, and inf.

Transducer: ML6-15

Must be scanned under MSK Sup setting

Once gain settings set, DO NOT ADJUST

Additional Images

If:

Then:

| | |
|--|---|
| | • |
| | • |
| | • |

GYN



Pelvis (Non-OB Complete and Doppler)

Images

- Transverse
 - Vagina
 - Cervix
 - Uterus (min. 3 images- **fundus, body, LUS**)
 - Measure width
- Long uterus (min. of 3 images- **ML, right, left**)
 - Measure length and height
 - Measure endometrial thickness and document LMP if applies
- Long and trans right ovary (min. 2 gray-scale in each plane)
 - color and Doppler (if ordered)
 - Measure length, height, width (DUAL SCREEN)
- Right adnexa long and transverse
- Long and trans left ovary (min. 2 gray-scale in each plane)
 - color and Doppler (if ordered)
 - Measure length, height, width (DUAL SCREEN)
- Left adnexa long and transverse
- Transverse, show relationship of each ovary to uterus
- Posterior cul-de-sac

** If evaluating for precocious puberty or PCOS look at adrenal glands

Normal Measurements: Measured in mean ovarian volume.

1 day-3 months: 1.06mL 11-12 years: 2-4mL

4-12 months 1.05mL Post-menarche average= 8mL

13-24 months .67mL (can range from 2.5-20mL)

2—5 years: .8-.9mL

6-10 years: 1.2-2.3 mL

Age: any

Purpose: Evaluate uterus and ovaries for any abnormalities, typically to rule out:

WITH DOPPLER:

Torsion/pain, PID

Mass/tumor

Cysts > 3cm

WITHOUT DOPPLER:

Precocious Puberty/PCOS

Amenorrhea/Menorrhagia/
Dysmenorrhagia

Uterine anomaly

Prep: Patient must have full bladder Finish drinking water 1 hour prior to ultrasound. Water intake is dependent on patient age.

0-5 years: 8 ounces water

6-9 years: 16 ounces

10-14 years 24 ounces

15-18 years 32 ounces

Transducer: C3-10 or 9L for infants, C2-9 for small children

C1-6 for teens/young adults, and adults.

Additional Images

If:

Then:

| | |
|---|---|
| Mass or cyst larger than 3 cm visualized; mass in adnexa | <ul style="list-style-type: none">• Measure (DUAL SCREEN) and color Doppler for flow |
| Free fluid identified in the pelvis | <ul style="list-style-type: none">• Label and use color to demonstrate lack of flow |
| If scanning for/find congenital pelvic anomaly, PCOS, or precocious puberty | <ul style="list-style-type: none">• Image adrenal area |
| If there is concern for pregnancy, | <ul style="list-style-type: none">• Beta or urine is required prior to US• Verify IUP, fetal heart tones and ovaries |



If pelvis is ordered to r/o ectopic:

- + UCG OR + beta HCG MUST BE RESULTED prior to ordering the exam
- If NEGATIVE UCG but still concerned for ectopic, must have a POSITIVE beta HCG.

Exam needs to be ordered as a

US Limited OB. This is for the trans-abdominal charge. If necessary/required, a second order can be placed for a **US Transvaginal Pregnant Uterus**

Please note there is a charge with Fetal Health (FH) at end, do NOT use this charge.

Images

Document location

Presence or absence of fetal heart tones (M-mode)

Check for FF

Age: any

Purpose: Evaluate uterus and ovaries for any abnormalities, typically to rule out:

WITH DOPPLER:

Torsion/pain, PID

Mass/tumor

Cysts > 3cm

WITHOUT DOPPLER:

Precocious Puberty/PCOS

Amenorrhea/Menorrhagia/
Dysmenorrhagia

Uterine anomaly

Prep: Patient must have full bladder Finish drinking water 1 hour prior to ultrasound. Water intake is dependent on patient age.

0-5 years: 8 ounces water

6-9 years: 16 ounces

10-14 years 24 ounces

15-18 years 32 ounces

Transducer: C3-10 or 9L for infants, C2-9 for small children

C1-6 for teens/young adults, and adults.

Additional Images

If:

Then:

| | |
|------------------------------------|---|
| If there is concern for pregnancy, | <ul style="list-style-type: none">• Beta or urine is required prior to US• Verify IUP, fetal heart tones |
| Transvaginal exam also needed, | <ul style="list-style-type: none">• Additional order needed for US transvaginal pregnant uterus and consent |
| | <ul style="list-style-type: none">• |



Images

*NOTE this is NOT for the IUD research study.

Perform normal pelvis ultrasound per CMH protocol (see previous pages for protocol)

Normal IUD placement is when the stem is straight and entirely within the endometrial cavity. The arms of the IUD extend laterally at the uterine fundus.

Distance from top of uterine cavity to IUD should be 3mm or less.

Distance of 4mm is more often associated with pain and bleeding, and increased risk of expulsion or displacement.

IUD locations

-WNL

-Embedment

-Possible expulsion

Age: any

Purpose: to assess for location of IUD

Prep: Patient must have full bladder Finish drinking water 1 hour prior to ultrasound. Water intake is dependent on patient age.

0-5 years: 8 ounces water

6-9 years: 16 ounces

10-14 years 24 ounces

15-18 years 32 ounces

Transducer:

C2-9 for small children

C1-6 for teens/young adults, and adults

Additional Images

If:

Then:

If IUD not visualized and expulsion suspected

- Patient needs XR to confirm (up to radiologist to decide) Ordering provider will need to be contacted for order

If IUD not well visualized, confer w/rad for need for TV

- If internal we can place the order
- If external, must call pro-

•



Images

- Long uterus midline
 - Measure length and height
 - Endometrial thickness
- Long uterus cine
- Transverse images
 - Cervix
 - Uterus
 - Measure width
- Right ovary long (color and Doppler)
 - Measure length and height
- Right ovary transverse
 - Measure width
- Right adnexa long and transverse
- Left ovary long (color and Doppler)
 - Measure length and height
- Left ovary transverse
 - Measure width
- Left adnexa long and transverse

** If patient has an IUD document location.

Normal Measurements:

Data on ovarian volume in younger females is limited due to the invasiveness of the examination.

Pre-pubertal (11-12) 2.5-3.7mL

Post-menarche 13+ 2.5-20mL (avg 8mL)

Age: Sexually active females or females who have used tampons or have had a pelvic exam with a speculum.

Purpose: Evaluate uterus and ovaries at a closer view than a transabdominal ultrasound. Can be used to rule out the same things as a transabdominal.

Prep: Patient needs to have an empty bladder prior to the ultrasound. Patient must void right before the ultrasound examination.

Patient or parent/guardian must sign consent form and verbally agree to transvaginal ultrasound as well as fit criteria.

Transducer: IC5-9-D

** pt also needs TA pelvis non-ob limited to r/o adnexal pathology.

Additional Images

| If: | Then: |
|---|--|
| Cyst or mass is visualized | <ul style="list-style-type: none">• Measure in long and transverse with color and Doppler. |
| | <ul style="list-style-type: none">• |
| Gestational sac or fetal pole is seen intrauterine or ectopic | <ul style="list-style-type: none">• Document CRL and monitor heart rate. |



Transvaginal (continued)

Criteria

In order for a transvaginal US to be performed, patient has to meet AT LEAST ONE of the following criteria:

1. has been sexually active
2. tolerated a previous pelvic exam / speculum
3. used a tampon

Consent / Chaperone

PARENT/GUARDIAN must sign consent form if under the age of 18 and pertains to the following:

- Negative HCG
- Negative for STDs
- Negative for hx of rape/abuse

Patient MAY sign consent form if the patient is under the age of 18 and pertains to the following:

- Positive HCG
- Positive for STDs
- Positive for hx of rape/abuse

NOTE: If parent is unavailable and exam ordered through ER, patient can consent as long as criteria is met.

A chaperone has to be present for consent and the exam (ER staff member, child life, rad tech). Chaperone must be a CMH employee. **Chaperone CANNOT be another sonographer/student.

Exam can be ordered with or without doppler. Follow same indication list for doppler as we would transabdominally.

| WITH DOPPLER: | WITHOUT DOPPLER: |
|-------------------|-------------------------|
| Torsion/pain, PID | Precocious Puberty/PCOS |
| Mass/tumor | Amenorrhea/Menorrhagia |
| Cysts > 3cm | Uterine anomaly |

Infection Prevention

Probe cover and sterile gel to be used on transducer
Follow standard work practice to high level disinfect probe, including use of enzymatic sponge and Trophon.

Orders

***A pelvis non-OB LIMITED order has to be ordered/performed in addition to the transvaginal or the transvaginal/transvaginal with doppler exam.

NOTE: If patient had a negative UCG (urine screen), wait for beta (blood) results before proceeding if a to eval for ectopic

Transvaginal Ultrasound Examination Consent

8071-400 MR 05/13



A transvaginal ultrasound has been ordered by Dr. _____ to evaluate (for) _____

This examination will take place at The Children's Mercy Hospital/South/North/East/Broadway (please circle location) radiology/ultrasound department.

A transvaginal ultrasound is an examination that involves the insertion of a probe in the vagina to evaluate the pelvic structures of the uterus, adnexa/ovaries and bladder. The probe will be covered by a condom and gel prior to use. The benefits of this examination include better visualization of anatomic detail of the uterus and adnexa/ovaries when compared to the transabdominal ultrasound approach. Some transabdominal images may also be performed at the time of the examination.

The physician who ordered the transvaginal examination has discussed the examination with you, including the indications, risks and benefits, and has determined that you are a candidate for the examination. The examination has been ordered due to the inability to visualize the pelvic organs adequately by use of the transabdominal approach. The ability of the patient to tolerate the examination has been assessed based on the patient's history, such as the prior ability to tolerate a speculum examination, tampon, or intercourse.

Some discomfort may occur with the examination. Please let us know if you experience any discomfort during this examination so that this can be assessed. Comfort level will also be assessed throughout the examination. A female chaperone will be present during the examination.

I, _____ (legal guardian/patient) consent to have the transvaginal examination performed. The risks, benefits, and alternatives to this examination have been explained. All my questions have been answered regarding this examination.

Signature of Authorized Consenting Party: _____

Printed Name: _____

Relationship to Patient: _____ Date: ____/____/____ Time: _____

Signature of Person Obtaining Consent: _____

Printed Name: _____ Date: ____/____/____ Time: _____

Signature of Witness: _____

Printed Name: _____ Date: ____/____/____ Time: _____

INTERPRETER (if applicable):

Signature of Interpreter: _____

Relationship to Participant: _____ ☐ N/A

Printed Name: _____ Date: ____/____/____ Time: _____

Pediatrics



Hips Static Limited

Images

- Left hip coronal
 - ♦ 3 images each (do no overlap measurements)
 - ♦ 1 without measurements
 - ♦ 1 with alpha angle
 - ♦ 1 with femoral head coverage measurement
- Left hip axial
 - ♦ 3 images each
- Dual screen axial images
 - Stress vs non-stress (1 image)
- Right hip coronal
 - ♦ 3 images each (do not overlap measurements)
 - ♦ 1 without measurement
 - ♦ 1 with alpha angle
 - ♦ 1 with femoral head coverage measurement
- Right hip axial
 - ♦ 3 images each
- Dual screen axial images
 - Stress vs non-stress

Normal Measurements:

Alpha angle > than or equal to 60 degrees

Femoral head coverage greater than 50%

Age: 6 weeks post birth-6 months GESTATIONAL AGE.

Purpose: Evaluate for hip dysplasia or dislocation.

Prep: No prep required for infant static hip ultrasound.

Transducer: 9L

Brace vs Harness

***Brace:** hard plastic that must be removed for exam

***Harness:** Do not removed harness. Pavlik harness; soft fabric that wraps around waist and looks similar to overalls

Additional Images

If:

Then:

| | |
|----------------------------|---|
| If patient is in a harness | <ul style="list-style-type: none">• DO NOT STRESS!!!• No hips are done out of harness unless specified |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Hip for Effusion

Images

With the patient in supine, try to position the legs as flat on the bed as possible with the toes pointed directly upward. Place the transducer along the anterior hip in the region of the femoral head/proximal femur bone.

Images:

Take 2-3 sagittal greyscale images of head/neck of femur and more inferior of proximal femur

Take 1 sagittal Color Doppler image

Take 2-3 transverse images

Repeat for the contralateral hip.

Take at least 1 sagittal dual screen image comparing both hips.

Normal Measurements:

Age: Any

Purpose: This exam helps to identify the source of hip pain and/or difficulty bearing weight. Specifically we are looking for abnormal fluid within the joint space.

Transducer: 9L for most patients, ML6-15 (may need to reduce the MHz). C1-6

Can scan under baby hips, MSK general, or abdominal setting

Additional Images

| If: | Then: |
|--------------------------------------|---|
| ...fluid is identified. | <ul style="list-style-type: none">...measures the AP thickness in long and transverse.Apply color Doppler to assess for hypervascularity |
|the patient has a large habitus. | <ul style="list-style-type: none">....try using a C2-9 or C1-6 curved probe for extra penetration. |
| If positive | <ul style="list-style-type: none">Capsule will be convex |



Head (Encephalogram)

Images

KEEP DEPTH THE SAME FOR CORONAL AND SAGITTAL IMAGES WHEN USING THE SAME TRANSDUCER

Coronal Plane:

Scan anterior to posterior making sure to include the following landmarks:

- *Level of frontal lobes
- *Level of frontal horns of ventricles
- *Level of thalami
- *Level of body of lateral ventricle
- *Level of Cisterna Magna
- *Level of Choroid Plexus
- *Level of occipital lobe
- *Cine anterior to posterior
- *Color of COW

Sagittal Plane:

- *Midline w/Color on ACA, VoG
- *Lateral Right Caudothalamic groove
- *Lateral Right—entire right ventricle
- *Lateral Right Sylvian Fissure
- *Midline
- *repeat for Lateral Left
- *Cine Right to Left (from Sylvian to Sylvian)

Posterior Fossa: (may not be able to see on older babies)

- *Cerebellum -
- *Color images of Rt/Lt Transverse Sinus

(on small babies both sides may be seen from one side, if not scan both Rt & Lt to get images.)

Coronal and Sagittal Still images to be repeated with 9L

*9L Color on extra axial space (decrease depth to zoom in on this area) . Superior sagittal sinus color images. In long and trans.

Age: Until closure of anterior fontanelle

Purpose:

Evaluate for intracranial bleeding, abnormal/absent anatomy, subdural bleeding, cysts/masses, ventriculomegaly, heparin use., prematurity.

Prep: None.

If patient has current EEG being performed, exam to be deferred IF EEG leads obscure fontanelle. Team may also request EEG leads temporarily removed to allow US

If patient has a scalp IV that obscures fontanelle, exam to be deferred until IV can be removed.

Transducer: Varies

3-10C, RNA5-9, 9L; if needed 1-6C, 6-15L

NOTE: If patient is on ECMO head US performed :

- Pre ECMO
- First 5 days on ECMO
- Then M, W F for duration of ECMO

Additional Images

| If: | Then: |
|-------------------------------|---|
| Prominent axial space | <ul style="list-style-type: none">• Use linear , show vessels in fluid to prove if subdural vs benign extra-axial fluid |
| | |
| "Cyst" appearance to VoG area | <ul style="list-style-type: none">• Color flow and Doppler to determine in VoG aneurysm |



Head/Head Doppler

Images

Gray scale images are the same as a standard head (encephalogram) .

For the head/head Doppler protocol, you MUST include:

ACA with color

ACA with Doppler (NO compression)

VOG with color

VOG with Doppler

MCA's with color (try to obtain from temporal window if possible. Can also obtain in the coronal plane).

MCA's with Doppler

ICA's with color

ICA's with Doppler

Normal Measurements:

RIs: Normal 0.6—0.89

Age: Until closure of anterior fontanelle

Possible Reasons for exam:

Edema

Brain death

Apnea

Prep: None.

If patient has current EEG being performed, exam to be deferred IF EEG leads obscure fontanelle. Team may also request EEG leads temporarily removed to allow US

If patient has a scalp IV that obscures fontanelle, exam to be deferred until IV can be removed.

Transducer: Varies

3-10C, RNA5-9, 9L; if needed 1-6C, 6-15L

Additional Images

| If: | Then: |
|-------------------------------|---|
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |
| "Cyst" appearance to VoG area | <ul style="list-style-type: none">• Color flow and Doppler to determine in VoG aneurysm |



Spinal Canal

Images

Position prone in fetal position (w/knees curled to chest) ; LLD in fetal position for larger infants/ difficult to visualize spinal anatomy to open up disc spaces.

Transverse Images:

Trans images documenting cord tapering and spinous processes closing

Cine of trans cord motion

Longitudinal Images:

Sagittal Rt Kidney

Follow last rib to vertebral bodies; label from T12 to end of conus

Sagittal Lt Kidney

Follow last rib to vertebral bodies; label from T12 to end of conus

Sagittal images, continue labeling inferiorly

Measure filum @ L4-L5 area

Cine of cord root motion

Sagittal L5/S1-Coccyx

Count superior from coccyx, document end of conus again

Obtain Logiq view/Panoramic

If f/u spine for hematoma– Limited spine (apply reduced services)

Demonstrate L1-5 still images, cine in long and transverse, demonstrate extent or resolution of hematoma

Age: Newborn—6mos

Purpose: Sacral dimple/hairy tuft, tethered cord, pre/post lumbar puncture, skin tag/tail, hemangioma, pigmented nevi

Prep: None, remove bandage if one covers AOI

*****Reserve for IR doc if evaluating for presence of hematoma status post LP** and send link on PACS***

Transducer: 6-15L, 9L

Normal Measurements:

Conus ends above L2-3 disc space

Filum <2mm

Additional Images

| If: | Then: |
|--------------|--|
| Dimple | <ul style="list-style-type: none">Show dimple relation to coccyx and document if |
| Filar cyst | <ul style="list-style-type: none">Measure, show in sagittal and trans |
| Hematoma | <ul style="list-style-type: none">Identify if subdural vs intrathecal, Identify how far it extends |
| Eval for CSF | Identify presence of CSF and location |



Images

See job aid for reference

Place child seated, facing away from tech. Parents or coworker may need to help stabilize patient depending on patient age.

Static Images:

1. 2 static images of *affected* side w **internal** rotation
2. 2 static images of *affected* side w **external** rotation
3. 1 cini of *affected* side **internal to external** rotation demonstrating the glenohumeral joint to evaluate for instability
4. 2 static images of *unaffected* side w **internal** rotation
5. 2 static images of *unaffected* side w **external** rotation
6. 1 cini of *unaffected* side **internal to external** rotation demonstrating the glenohumeral joint to evaluate for instability
7. 1 static images in dual screen affected and *unaffected* side with **internal** rotation
8. 1 static images in dual screen affected and *unaffected* side with **external** rotation

Normal Measurements:

Radiologist will obtain measurements

Age: neonate and up

Purpose: to evaluate the shoulder for instability/subluxation s/p suspected brachial plexus birth injury

Prep: no prep

Exam should be ordered as an UE non-vascular LIMITED (affected side)

Transducer: 9L

Additional Im-

If:

Then:

| | |
|--|---|
| | |
| | • |
| | • |

Vascular



Images

Veins imaged:

Common Femoral Vein– must show prox to SFJ

Saphenofemoral Junction

Femoral vein: proximal thigh, mid-thigh, distal thigh

Profunda Vein (deep)

Popliteal vein

IF the area of pain/swelling involves the lower leg then also eval:

Posterior Tibial veins (x2; paired veins)

Peroneal veins (x2; paired veins)

Anterior Tibial veins (x2; paired veins)

- Transverse: Gray scale, dual screen with/without compression from CFV to POPV (label v/a directly adjacent to vessel)
- Longitudinal: Gray scale, color Doppler and pulsed wave Doppler.

Age: Any

Purpose: This exam is used to investigate the cause of lower extremity swelling and/or pain. It is also sometimes used to evaluate patients with suspected or proven pulmonary embolisms (PE) or decreased platelets.

Prep: Elevate head of patient

If need veins to dilate put patient in reverse trendelburg or sit patient up and hang legs over side of bed

Transducers: L8-18i (newborns), ML6-15, 9L (for most patients)

Additional Images

If:

Then:

If clot is found in the Common Femoral vein...

- follow superiorly to show extent. Ordering provider will need to enter addi-

If the exam is positive for DVT...

- message the Radiologist as soon as it is ready to read.
- If outpatient, do not allow patient to leave until ordering provider has been contacted

If peroneal veins are hard to see

- Scan from lateral/posterior approach



LE Arterial Duplex

Images

Arteries imaged: Dual screen w/ wo color In LONG only

Common Femoral Artery

Femoral Artery: Proximal thigh, mid thigh and distal thigh

Profunda artery

Popliteal Artery –prox and distal

If the area of pain/swelling involves the lower leg then also eval:

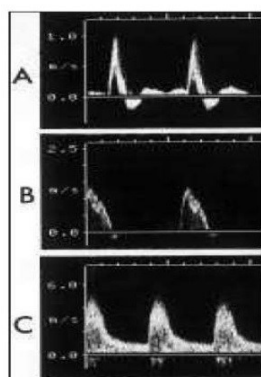
Posterior Tibial artery; distal mid and proximal calf

Peroneal artery

Anterior Tibial Artery (Anterior Calf)

Dorsalis Pedis Artery (Anterior Calf)

- Longitudinal: Gray scale, color



Normal PSV in ADULTS:

CFA: 100 cm/sec

SFA: 80-90 cm/sec

Pop A: 70 cm/sec

- (a) triphasic waveform in normal artery;
- (b) biphasic waveform, with increased velocity, through a mild stenosis;
- (c) monophasic waveform, with greatly increased velocity, through tight stenosis;

Tips:

Steer the color box and angle correct (<60 degrees)

Gray Scale: Check for plaque, thrombus. Try to be perpendicular to vessel and adjust TCGs

Color: Confirm patency while checking for aliasing (which may indicate Stenosis)

Spectral: Sample gate should be small and parallel to vessel walls . Gain low enough to allow spectral window

May be ordered unilateral or bilateral

Purpose: Thrombosis, stenosis, weak pulses, claudication, rest pain, ulceration, post-op, cold extremity, pale extremity

* Verify if patient is having venous or arterial symptoms and clarify with ordering doctor as needed

Transducer:

9L

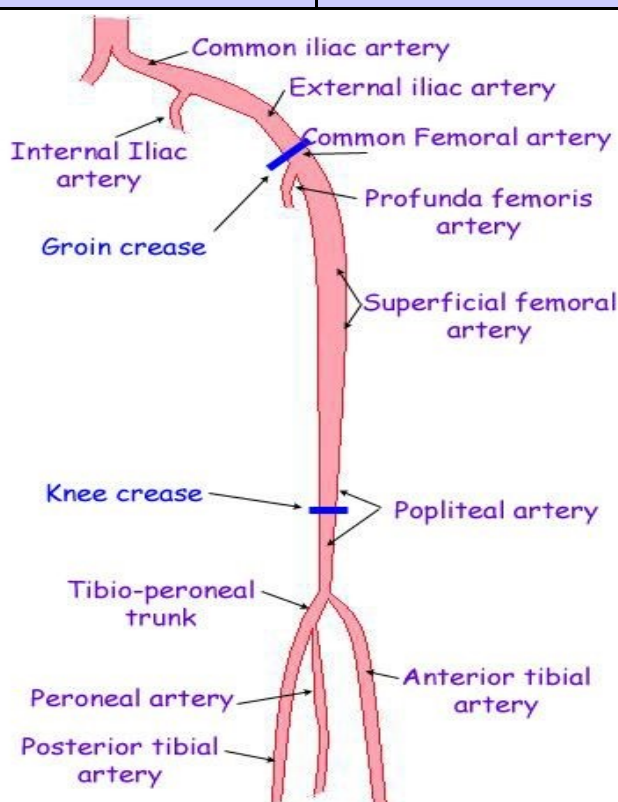
C2-9 or C1-6 if difficult to visualize PTA, Pero A, or ATA

Additional Images

If:

Then:

| | |
|---|---|
| Stenosis is present | <ul style="list-style-type: none">• PSV Prox, in stenosis, and distal |
| Difficult to get color due to slow flow | <ul style="list-style-type: none">• Use Power Doppler |
| | <ul style="list-style-type: none">• |





US UE Venous Duplex

Images

Grayscale, Color and PW Images of the following: dual screen w/wo color

IJV—long and transverse

- Prox
- Mid
- Distal

Subclavian

- Medial
- Mid
- Lateral

Brachiocephalic

SVC -Y view

Not included on routine protocol, but may need to be evaluated based on symptoms:

Axillary

Cephalic (superficial vein)

Brachial (deep; paired vein)

Basilic (superficial vein)

Radial (deep; paired vein)

Ulnar (deep; paired vein)

Age: Any

Purpose: Evaluate veins of the neck and/or arms for thrombus or line placement access.

Prep: None

Transducer: 9L or L8-18 (hockey stick) depending on patient age

C3-10 or S4-10 can be used to get into the medial clavicular notch to image BCs and SVC and in small necks

Additional Images

If:

Then:

Patient is symptomatic in an arm with a line in it.

- Image down to the level of the line

Evaluating vessels in arms

- Document with and without compression.

If patient has a trach

- Have nurse or RT undo trach ties to access neck



Images

Interrogated Vessels:

Common Carotid Artery (CCA) (prox, mid, distal)

Rt Innominate (also can be called B-C but is located ONLY on the right on arterial exams)

Subclavian (lateral, mid, medial)

***NOTE: the Rt Innominate artery is located ONLY on the right in an arterial exam.

The LEFT CCA and Subclavian branch directly off the aortic arch.

Image CCA transverse dual screen(w/ and w/o color) and long grayscale, color, and Doppler prox, mid, distal.)

Rt Innominate long grayscale, color, Doppler.

Subclavian long grayscale, color Doppler and lateral, mid, and medial)

Normal Measurements:

Can be unilateral or bilateral exam

Common reasons for exam: 5P's: 1) Pain, 2) pallor, 3) pulseless (decreased/uneven pulses) , 4) paresthesia, 5)paralysis

Prep:

Transducer:

9L

Additional Images

| If: | Then: |
|-----|-------|
| | • |
| | • |
| | • |



Images

Interrogated Vessels:

Common Carotid Artery (CCA) (prox, mid, distal)

CCA Bulb

Bifurcation (CCA bifurcates into ICA and ECA)

External Carotid Artery ECA near bifurcation

Internal Carotid Artery ICA (prox, mid, distal)

Vertebral Artery

All vessels (except vertebral a) need to be documented in transverse plane at beginning of exam with and without color flow.

All vessels need to be documented in longitudinal plane in grayscale, color, and doppler at each location listed above. ***Be sure to angle correct***

Normal Measurements:

Can be unilateral or bilateral exam

Common reasons for exam: bruit, trauma, hx of stroke

Prep:

None

Transducer:

9L most commonly

L8-18 (hockey stick) or C3-10 can also be used depending on patient age

Additional Images

| If: | Then: |
|----------|--|
| Stenosis | <ul style="list-style-type: none">Take extra doppler samples through area to document the highest velocity |
| Plaque | <ul style="list-style-type: none">Measure percentage of reduction of vessel due to plaque (rare in pediatric patients) |
| | <ul style="list-style-type: none"> |



Aorta IVC Iliac Duplex

Images

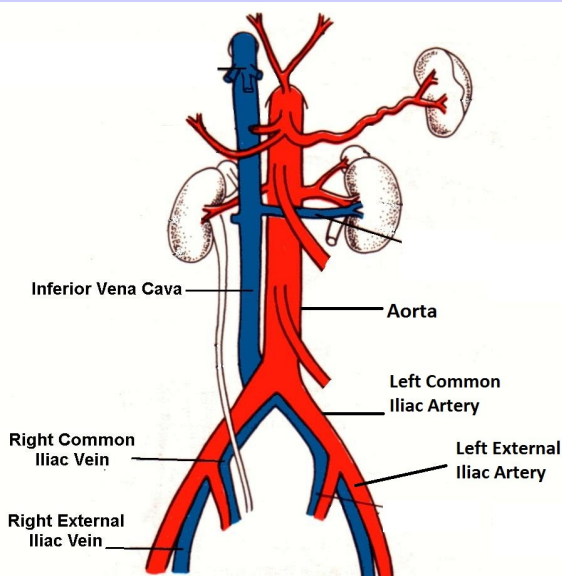
Trans and Long, Gray Scale, Color, and Spectral Doppler of the following:

AO (Prox, Mid, Dstl)* IVC (Prox, Mid, Dstl)
Bilateral Common Iliac Arteries * Bilateral Common Iliac Veins
Bilateral External Iliac Arteries * Bilateral External Iliac Veins

Trans, Gray Scale, Color, and Doppler of the following:

AO Bifurcation IVC Bifurcation

***Measure Peak Systolic Velocities in ALL the arteries and remember to angle correct (<60 degrees)**



Purpose: Purpose: Kidney Transplant Workup (check for patency), thrombosis, proximal known DVT, venous congestion.

Tip: If vessels obscured by gas at midline, come from the right for IVC and left for AO to visualize

***Complete= arteries AND veins**

***Limited= EITHER arteries OR veins**

Prep:

For all NON-STAT patients:

0-3 years old: NPO 4 hours prior to exam

4-7 years old: NPO 6 hours prior to exam

8+ years old: NPO 8 hours prior to exam

Transducer:

9L, C3-10: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

If:

Then:

Stenosis is present

- PSV Prox, at stenosis, and distal

Clot is present

- Measure size and determine if occlusive
- Show renal vessels for patency



Iliac Vasculature Duplex

Images

These are the vessels interrogated:

1. Common Iliac Veins and Arteries (Rt CIV/CIA and Lt CIV/CIA)
2. Internal Iliac Veins and Arteries (Rt IIV/IIA and Lt IIV/IIA)
3. External Iliac Veins and Arteries (Rt EIV/EIA and Lt EIV/EIA)

Transverse Rt/Lt CIV/CIA

Long Rt/Lt CIV/CIA grayscale, color, Doppler

Transverse Rt/Lt IIV/IIA***Internal Iliacs may not be visualized on everyone***

Long Rt/Lt IIV grayscale, color, Doppler if visualized

Transverse Rt/Lt EIV/EIA (usually best seen in groin crease)

Can be ordered as unilateral or bilateral

Tips: ***REMEMBER TO STEER THE COLOR BOX

Arterial studies need to be angle corrected

Prep:

For all NON-STAT patients:

0-3 years old: NPO 4 hours prior to exam

4-7 years old: NPO 6 hours prior to exam

8+ years old: NPO 8 hours prior to exam

Transducer:

9L, C3-10: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

If:

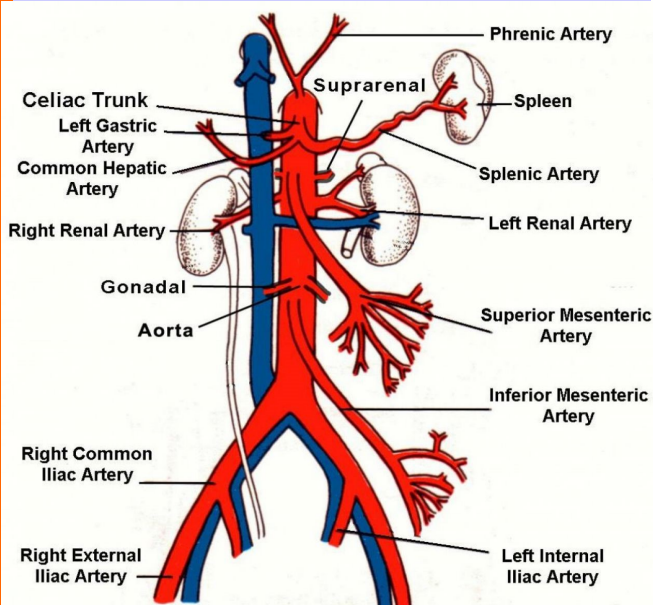
Then:

Clot visualized in CIV

- Image/Doppler distal IVC to show extent of throm-

•

•





Inferior Vena Cava Duplex

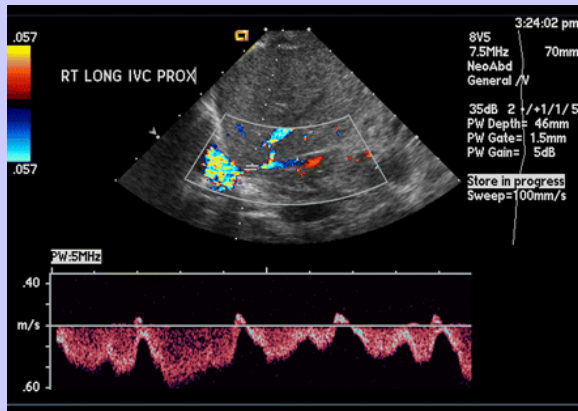
Images

Trans and Long, Gray Scale, Color, and Spectral Doppler of the following:

IVC Prox

IVC Mid

IVC Inf



Normal Measurements:

Proximal IVC waveforms will be pulsatile with reversal of low, more distally the velocity decreases, shows more variance, and is less pulsatile

Purpose: Kidney Transplant Workup (check for patency), thrombosis, proximal known DVT, venous congestion, check for tumor invasion or compression

Tip: If vessels obscured by gas at midline, scan from right coronal .

Prep:

For all NON-STAT patients:

0-3 years old: NPO 4 hours prior to exam

4-7 years old: NPO 6 hours prior to exam

8+ years old: NPO 8 hours prior to exam

Transducer:

9L, C3-10: Infants and small children

C2-9: Small children

C1-6: Larger children & teens/adults

Additional Images

| If: | Then: |
|---------------------|---|
| Thrombus is present | Measure size, image proximal to thrombus Document patency of renal veins |
| | • |
| | • |



Transcranial Doppler

Images

Scanning through temporal window

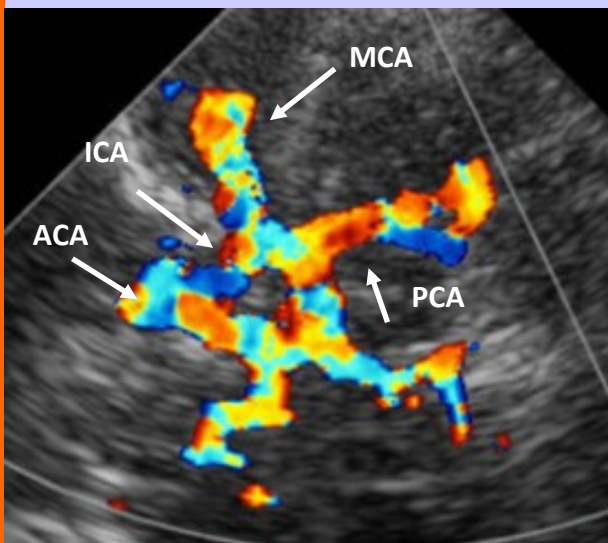
MCA: Distal-Proximal

- Measure MCA as distal as possible (try to start at 3cm). Then measure every .2 cm as you move proximally.
- Depth is listed to the right of the image in the PW screen—SVD (sample volume depth)

PCA: lower velocity than MCA

ACA: flow should be the below baseline; can reverse show above baseline.

ICA



Age: Any

Purpose: To assess for stroke risk, primarily used in Sickle Cell patients.

Prep: None

Pt should be awake, calm, no TV

Transducer: M5Sc, M5S

Measurements (TMAX):

Normal: <171 cm/sec

Conditional: 171-200 cm/sec

Abnormal: >200 cm/sec

Additional Images

If:

Then:

Machine is not tracing waveform accurately.

On PW measure screen:

- Select Modify Auto Calc
- Change Auto Calc option from frozen to off
- Return to prev screen
- Use manual trace option in bottom right corner
- Manually trace the waveform with as much detail as possible



Cardiopulmonary Bypass/ CPB Duplex

Images

US LE Venous Duplex Bilateral:

1. External Iliac Vein
 - Trans— grayscale and color
 - Long— grayscale, color, and doppler
2. Common Femoral Vein
 - Trans— grayscale w/ and w/o compression
 - Long— grayscale, color, and doppler

US LE Arterial Duplex Bilateral:

1. External Iliac Artery
 - Long— grayscale, color, and doppler
2. Common Femoral Artery
 - Long— grayscale, color, and doppler
3. Origin of Superficial Femoral Artery
 - Long— grayscale, color, and doppler

US UE Venous Duplex Bilateral:

1. Internal Jugular Vein
 - Trans— prox, mid, distal in grayscale and color
 - Long— prox, mid, distal in grayscale, color, and doppler

US UE Arterial Duplex Bilateral:

1. Carotid Artery
 - Trans— prox, mid, distal in grayscale and color
 - Long— prox, mid, distal in grayscale, color, and doppler

Age: Any

Purpose: R/o clot prior to patient having heart surgery and being placed on bypass

APPLY REDUCED SERVICES

Prep: None

Questions call 15289

Transducer:

L9 most commonly

L8-18 (hockey stick) or C3-10 can also be used depending on patient age

Additional Images

If:

Then:

- Fully evaluate the length of the vessel, you may not see a prox, mid, distal depending on length of vessel/age of child

- Modify labels to coincide with area being documented (EX: superior; inferior, etc)



US Duplex Hemodialysis Access Flow

Images

- Scan fistula to ensure patency along course
- Scan “native” vessels proximal to fistula to ensure main vessel is also patent
- Clinic may request diameter of vessels as needed

Age: any

Purpose: To assist the dialysis department to access patient’s fistula to connect patient to dialysis.

Note: Need clinic to specify which vessels are in the fistula

Transducer: 9L or L8-18 (hockey stick) depending on patient age

Additional Images

| If: | Then: |
|-----|---|
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |

MSK



Images

****Refer to Ankle MSK Job Aid**

Can be ordered as unilateral or bilateral

Ordered as LE non-vascular complete

Interrogate:

Anterior ankle

1. Anterior Joint recess
2. Tibialis Anterior extensor tendon (medial)
3. Extensor Hallusis Longus (mid)
4. Extensor Digitorus Longus (lateral)

Medial ankle

5. Tibialis posterior
6. Flexor Digitorum Longus
7. Flexor Hallucis Longus

Lateral ankle

8. Peroneus Longus
9. Peroneus Brevis

Posterior

10. Achilles Tendon

Age:

Purpose: To evaluate the ankle for joint effusion, arthritis, and/or synovitis.

Note: the machines have a scan assist for this protocol

Transducer: L8-18i

If patient older/large body habitus, may need to use 9L or ML6-15 to assess anterior joint recess

Additional Images

| If: | Then: |
|------------------------------------|--|
| Fluid visualized around a ligament | <ul style="list-style-type: none">• Document in both planes• Cine• Assess for hypervascularity |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Images

****Refer to MSK Knee Job Aid**

Can be ordered as unilateral or bilateral

Ordered as LE non-vascular complete

Interrogate:

Anterior Knee

1. Quadriceps tendon
2. Suprapatellar joint recess
3. Patellar tendon (infrapatellar)

Medial Knee

4. Medial collateral ligament (MCL)

Lateral Knee

5. Iliotibial band (IT band)
6. Lateral collateral ligament (LCL)

Posterior Knee

7. Evaluate popliteal fossa to r/o cysts; show popliteal vessels

Age:

Purpose: To evaluate the ankle for joint effusion, arthritis, and/or synovitis.

Note: the machines have a scan assist for this protocol

Transducer: ML 6-15

Additional Images

| If: | Then: |
|---------------------|---|
| Ordered from the ED | <ul style="list-style-type: none">• Charge as a Limited |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Images

****Refer to Wrist MSK Job Aid**

Can be ordered as unilateral or bilateral

Ordered as UE non-vascular complete

Anterior Wrist

1. Flexor Carpi Ulnaris (adj to ulnar artery)
2. Flexor digitorum tendons/flexor pollicis longus (mid wrist)
3. Flexor Carpi Radialis (adj to radial artery)

Posterior Wrist

4. **Compartment 1:** Extensor Pollicis Brevis; Abductor Pollicis Longus
5. **Compartment 2:** Extensor Carpi Radialis (Longus and Brevis)
6. **Compartment 3:** Extensor Pollicis Longus
7. **Compartment 4:** Extensor digitorum
8. **Compartment 5:** Extensor Digiti Minimi (ulnar side of wrist)
9. **Compartment 6:** Extensor Carpi Ulnaris.

Age:

Purpose: To evaluate for joint effusion, arthritis, and/or synovitis.

Note: the machines have a scan assist for this protocol

Transducer: L8-18i

Additional Images

| If: | Then: |
|---------------------|---|
| Ordered from the ED | <ul style="list-style-type: none">• Charge as a Limited |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Images

****Refer to Elbow MSK Job Aid**

Can be ordered as unilateral or bilateral

Ordered as UE non-vascular complete

- Posterior Elbow– long posterior– posterior fat pad
Eval for effusion
- Posterior Elbow– CINE long posterior– posterior fat pad
- Anterior Elbow– long ML anterior– anterior fat pad
Eval for effusion-
- Anterior Elbow– long anterior medial– anterior fat pad just medial to prior image

Age:

Purpose: To evaluate for joint effusion, arthritis, and/or synovitis.

Note: the machines have a scan assist for this protocol

Transducer: ML 6-15

Additional Images

| If: | Then: |
|---------------------|---|
| Ordered from the ED | <ul style="list-style-type: none">• Charge as a Limited |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Images

****Refer to Shoulder MSK Job Aid**

Can be ordered as unilateral or bilateral

Ordered as UE non-vascular complete

Interrgate:

- Biceps Tendon
- Subscapularis
- Coraco-acromial Ligament
- Supraspinatus Tendon
- Acromio-Clavicular Joint
- Infraspinatus Tendon

Age:

Purpose: To evaluate for joint effusion, arthritis, and/or synovitis.

Note: the machines have a scan assist for this protocol

Transducer: ML 6-15

Additional Images

| If: | Then: |
|-----------------|---|
| Ordered from ED | <ul style="list-style-type: none">• Charge as a Limited |
| | <ul style="list-style-type: none">• |
| | <ul style="list-style-type: none">• |



Popliteal Artery Entrapment Syndrome (PAES)

Images

Artery will be documented with ankle in 4 different patient positions

****Start with unaffected side if unilateral. If bilateral, begin on RIGHT leg****

Use a skin marker to mark the posterior fossa at all 3 levels that you will be evaluating the popliteal artery for consistency

POSITION 1: Neutral Ankle

Positioning: PRONE, mid shin at the end of the bed with ankle/foot hanging off the bed, ankle relaxed/resting position (no pointing or muscle strain)

IMAGES:

Transverse:

- (1) Dual screen Grayscale/Color PROX popliteal artery (ABOVE knee crease)
- (2) Dual screen Grayscale/Color POP FOSSA/DISTAL POP A (AT knee crease)
- (3) Dual screen Grayscale/Color Tibial Peroneal Trunk Bifurcation (BELOW knee crease)

Sagittal:

- (4) Popliteal artery with spectral doppler BELOW the knee crease—ankle at rest

Popliteal artery entrapment syndrome: Uncommon cause of lower limb claudication, generally affecting young athletes. Can lead to popliteal artery damage, embolization or limb ischemia. Patients present with unilateral or bilateral calf pain after physical exertion, caused by the compression/ occlusion of the popliteal artery by the gastrocnemius muscle(s).1

Ultrasound features consistent with PAES: normal caliber/patency of the popliteal artery when the patient is at rest without gastrocnemius muscle activation (image series 1) and later occlusion/severe compression of the popliteal artery(s) upon plantarflexion (image series 2 or 3) or with gastrocnemius muscle activation post exercise image series (4).

Transducer: 9L probe and LE arterial setting.



Images

POSITION 2: PLANTARFLEX ANKLE

Positioning: PRONE, mid shin should be at the end of the bed so that the ankle/foot is hanging off the bed, **ankle in plantar-flexion** (ankle straightened/toes pointed at wall behind them)

IMAGES:

Transverse:

- (1) Dual screen Grayscale/Color PROX popliteal artery (ABOVE knee crease)
- (2) Dual screen Grayscale/Color POP FOSSA/DISTAL POP A (AT knee crease)
- (3) Dual screen Grayscale/Color Tibial Peroneal Trunk Bifurcation (BELOW knee crease)
- (4) Repeat Protocol on opposite/affected leg



POSITION 3: PLANTARFLEX ANKLE WITH RESISTANCE

Positioning: PRONE, mid shin should be at the end of the bed so that the ankle/foot is hanging off the bed, **ankle in plantar-flexion with resistance applied** (ankle straightened/toes pointed at wall behind them)

IMAGES:

Transverse:

- (1) Dual screen Grayscale/Color PROX popliteal artery (ABOVE knee crease)
- (2) Dual screen Grayscale/Color POP FOSSA/DISTAL POP A (AT knee crease)
- (3) Dual screen Grayscale/Color Tibial Peroneal Trunk Bifurcation (BELOW knee crease)
- (4) Repeat Protocol on opposite/affected leg



Images

POSITION 4: PLANTARFLEX ANKLE

Replicate patient's pain on physical exertion by having patient do calf raises until they feel calf pain or for several minutes if pain does not occur. Then position patient for final images

Positioning: must be **STANDING** on tip toes (heels raised) to activate gastrocnemius muscle. Image affected/painful side first.

IMAGES:

Transverse:

- (1) Dual screen Grayscale/Color PROX popliteal artery (ABOVE knee crease)
- (2) Dual screen Grayscale/Color POP FOSSA/DISTAL POP A (AT knee crease)
- (3) Dual screen Grayscale/Color Tibial Peroneal Trunk Bifurcation (BELOW knee crease)
- (4) Attempt Sagittal popliteal artery with spectral doppler below knee crease— while patient standing on tip toes (heels raised)
- (5) Repeat Protocol on opposite/affected leg

References:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4592677/pdf/jmrs0062-0226.pdf>



