

LIVER TRANSPLANT DOPPLER ULTRASOUND PROTOCOL (ULIVLD)

(ULIVLD is a combined charge of UABDL and UORGDC. Use ULIVCD if a Complete Abdomen was done. This is combined charge of UABDC and UORGDC.)

PATIENT PREP: No Prep

****INCLUDES COLOR AND SPECTRAL DOPPLER OF PORTAL VEINS, HEPATIC ARTERIES, HEPATIC VEINS, AND SPLENIC VEIN. TO BE USED FOR POST LIVER TX EVALUATIONS, INCLUDING SPLIT LIVER TX EVALS.****

*****For repeat exams on INPATIENTS within 72 hours, and it is not the routine POD 1,4,7 or 10 exam, limited evaluation of the liver parenchyma for new findings, vasculature, bile ducts and assessment for new fluid collections is acceptable. State in the report that kidney, spleen, pancreas were “not evaluated.” If it is ordered as a POD 1,4,7, or 10 exam, or if it has been longer than 72 hours (3days) since we looked at everything, do the full exam. Billing code remains ULIVLD.*****

IMAGES TO OBTAIN

ASSESS FOR FLUID COLLECTIONS:

- Document any fluid collections, hematomas and/or masses in two dimensions, with and without color doppler images.

PANCREAS:

- Transverse image of head, body, and tail.
- Sagittal image of head, body, and tail.
- Transverse image of head showing porto-splenic confluence.
- Transverse image of body showing splenic vein
- Document and measure pancreatic duct if visible.
- Take image of “Pancreas Area” if not well seen.

LIVER:

Left lobe - subcostal/epigastric approach

- Transverse images:
 - Left hepatic vein confluence into IVC
 - Left lobe visualizing dome of liver
 - Left lobe with left portal vein
 - Cine clip sweeping through LHL in transverse from superior to inferior
- Sagittal images:
 - Left lobe with left portal vein and ligamentum teres.
 - Left lobe with hepatic vein
 - Cine clip sweeping through LHL in sagittal from medial to lateral

Caudate lobe – subcostal/epigastric approach

- Sagittal image of the caudate lobe.
- Transverse image of the caudate lobe.

Right lobe - subcostal or intercostal approach

- Sagittal images:
 - Right lobe to visualize dome of liver
 - Right liver with middle hepatic vein draining into IVC
 - Main interlobar fissure with gallbladder and CHD and MPV
 - Right lobe and right portal vein.
 - Right hemidiaphragm to assess for pleural effusions and ringdown.
 - Right lobe showing echo texture between liver and right kidney.
 - Right lobe and right kidney documenting approximate liver size. Measurement of length of the liver is not needed unless requested.
 - Cine clip sweeping through RHL in sagittal from medial to lateral
- Transverse images:
 - Right lobe showing right and middle hepatic veins.
 - Right lobe at right portal vein.
 - 2D image through MPV
 - COLOR image of MPV showing patency and direction of flow
 - Right lobe and right kidney.
 - Cine clip sweeping through RHL in transverse from superior to inferior

COLOR DOPPLER IMAGES- (Be sure to optimize your color image.)

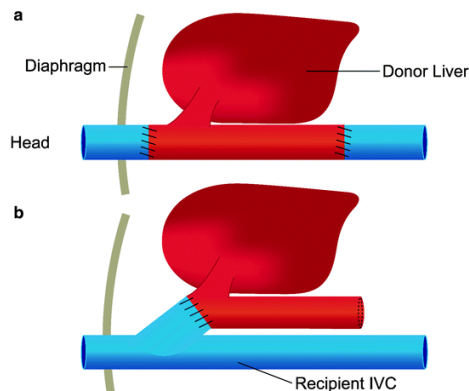
- Color images of MPV with anastomosis.
- Color image of the hepatic confluence.
- For a Split Liver Tx, evaluate the MHV in its entirety. It often runs along the free edge of the liver and has been reconstructed.
- Color image of the IVC anastomosis
- Evaluate any stenotic vessels or abnormal flow patterns with additional images as needed.
- Color image documenting any collaterals or varies if present in periportal area, LUQ, epigastric region, or the presence of a recanalized umbilical vein.

SPECTRAL DOPPLER IMAGES: (Be sure to optimize your spectral doppler images.)

- Middle, Right and Left Hepatic Veins – Velocity is not needed except for in cases where color flow is seen aliasing or presence of hepatic vein stent.
 - Phasicity of hepatic veins should be assessed during suspended/mid respiration or shallow breathing, deep inspiration may dampen hepatic flow.
 - If monophasic is seen, use LLD positioning to reassess.
 - Main, Right and Left Portal Veins - angle corrected velocity measurement.
 - Normal RPV and LPV velocity is >10cm/s
 - Normal MPV velocity is 10-150cm/s
 - If increased velocity or color aliasing is seen within the MPV, evaluate vessel further for velocity at these areas-
 - At anastomosis (or area of color aliasing)
 - Pre anastomosis (or area of color aliasing)
 - Post anastomosis (or area of color aliasing)
- A velocity gradient of >3 and turbulent flow suggests stenosis.*

- Proper, Right and Left Hepatic Arteries – Measurement of RI with angle correction and showing a linear segment of the artery to verify direction of flow.
 - Normal range is 0.5 -0.8
 - If tardus parvus waveforms are seen, evaluate the PHA anastomosis carefully looking for color aliasing and increased velocity on spectral doppler. This indicates a stenosis may be present.
 - Immediately post op, a transient increase in RI is not unusual. This should resolve after 48-72 hours.

- IVC- For End-to-End anastomosis (a) – most common before 2003
 - Document velocity at the Superior IVC and Inferior IVC anastomoses with angle correction.
- IVC- Piggyback anastomosis (b) – most common after 2003
 - Document velocity at anastomoses with a zero-degree angle.



- Splenic vein is not needed except for in cases of abnormal portal flow.

BILE DUCTS:

- Sagittal image of CBD and CHD with and without measurements in 2D and color doppler at the level of the porta hepatis. If dilated, follow CBD as distal as possible to look for stones/mass and measure as distal as possible as well.
- Document and measure any intrahepatic bile duct dilatation with 2D and color imaging.

RIGHT KIDNEY:

- Sagittal image of right kidney in medial, middle and lateral views.
- Sagittal measurement of right kidney. Take cine only if abnormality is present.
- Transverse images of superior/mid/inferior right kidney.
- Color Doppler image of any mass or pelviectasis.

SPLEEN:

- Sagittal and transverse images through spleen
- Sagittal length measurement of spleen
- Sagittal image through left hemidiaphragm and spleen to assess for pleural effusions and ringdown.
- Sagittal image through spleen and left kidney.
- Color Doppler image of any abnormality.

LOWER QUADRANTS:

- Document RLQ and LLQ to check for ascites.

ADDITIONAL NOTES-

1. If a patient is coming in for pain, please document within the indication section or the “other” section what the current status of pain is. For instance, how long the patient has had pain, if it’s getting worse or better, and where exactly the pain is. Always take an image where the patient is hurting the most (label as “area of pain”). If this area is located where bowel is, take an image of the area with a linear transducer. When describing the pain, write “per patient, ...” in the indication. Example: Per the patient, his pain is now in the RLQ and getting worse.
2. Cine clip of any abnormality.
3. Say “Not well seen” if structure is not well seen and include the reason why.
4. Any masses, cysts, stones or abnormalities should be measured in three dimensions and have a 2D picture and a color image documented.

LIVER TRANSPLANT ULTRASOUND IMAGE LIST

IMAGE	MODE	IMAGE	MODE
Panc Trans H/B/T	2D	IVC velocity at piggyback anastomosis	Spectral cm/s
Panc Sag H/B/T	2D	<i>IVC end-to-end anastomosis:</i>	
Splenic Vein at panc	Color	<i>Superior IVC velocity at anastomosis</i>	<i>Spectral cm/s</i>
<i>Panc Duct if dilated</i>	<i>2D +</i>	<i>Inferior IVC velocity at anastomosis</i>	<i>Spectral cm/s</i>
Left Liver Sag (medial portion)	2D	GB Sag	
Left Liver Sag (lateral portion)	2D	GB Wall w/measurement	2D+
Left Liver Sag M-L	Cine	GB Sag w/ color	Color
Caudate Liver Sag	2D	GB Trans	2D
Caudate Liver Trans	2D	GB Sag LLD	2D
Left Liver Trans (at hepatic vein)	2D	GB Trans LLD	2D
Left Liver Trans (at portal vein)	2D	<i>GB length if r/o chole</i>	<i>2D+</i>
Left Liver Trans S-I	Cine	<i>Cystic duct if r/o chole</i>	<i>Spectral</i>
LPV <i>without color</i>	2D		
LPV <i>w/ color</i>	Color	CHD w/measurement and color	Color+
LPV <i>velocity w angle correction</i>	Spectral cm/s	CBD w/measurement and color	Color+
LHA <i>RI w angle correction</i>	Spectral RI		
LHV <i>waveform only unless stent</i>	Spectral	Right Kidney Sag Mid	2D
		Right Kidney Sag Mid w/ measurement	2D +
Right Liver Trans (at hepatic vein)	2D	Right Kidney Sag Med	2D
Right Liver Trans (at portal vein)	2D	Right Kidney Sag Lat	2D
Right Liver Trans (at hepatic vein)	2D	Right Kidney Trans Sup	2D
Right Liver Trans S-I	Cine	Right Kidney Trans Mid	2D
Right Liver Sag/Rt Chest	2D	Right Kidney Trans Inf	2D
Right Liver Sag	2D		
Right Liver Sag / RK	2D	Spleen Sag x2	2D x2
Right Liver Sag L-M	Cine	Spleen Sag w/ measurement	2D +
		Spleen Trans	2D
MPV <i>without color</i>	2D	Splenic Vein	Spectral cm/s
MPV <i>w/ color</i>	Color		
MPV <i>velocity w angle correction</i>	Spectral cm/s	RLQ/LLQ	2D
<i>MPV velocity if increased or narrowed- pre, at, & post anastomosis or narrowing</i>	<i>Spectral cm/s</i>		
PHA <i>RI w angle correction</i>	Spectral RI	<i>For cirrhosis/HCC screening: Capsule</i>	<i>Linear</i>
RPV <i>without color</i>	2D		
RPV <i>w/ color</i>	Color	<i>SOS/VOD: Elastography x 5, <30% EQI</i>	<i>Elasto</i>
RPV <i>velocity w angle correction</i>	Spectral cm/s		
RHA <i>RI w angle correction</i>	Spectral RI	<i>MFI for lesions</i>	<i>MFI</i>
MHV <i>waveform only unless stent</i>	Spectral		
RHV <i>waveform only unless stent</i>	Spectral		

LIVER TRANSPLANT ULTRASOUND PROTOCOL HISTORY

	Date	Changes made	By whom
Updated	08/14/20		Becky Marion
Updated	03/03/22	-Added Split liver requirements -Added IVC Piggyback vs End-to-end -Added respiration note on HVs -Added if aliasing comments in MPV -Added tardus parvus comments for HA	03/03/22 Protocol Meeting Attendees (Dighe, Lee, Kolokythas) (Document updated by Renee Betit Fitz)
Approved	03/14/22		Manjiri Dighe
Updated	10/13/22	Changed For repeat exams within 24 hours, limited doppler evaluation of all the vessels, bile duct and assessment for fluid collections is acceptable. New: For repeat exams on INPATIENTS within 72 hours, and it is not the routine POD 1,4,7 or 10 exam, limited evaluation of the liver vasculature and bile ducts and assessment for new fluid collections is acceptable. State in the report that Kidney, Spleen, Pancreas were "Not evaluated". If it is ordered as a POD 1,4,7, or 10 exam, or if it has been longer than 72 hours (3days) since we looked at everything, do the full exam.	Manjiri Dighe Lena Sibulesky
Added	10/27/22	Cine clips of RHL & LHL in TRV & Sag	Renee Betit Fitzgerald
Added	4/15/2024	Image lists	Renee Betit Fitzgerald