

**Ultrasound – Liver TIPS Doppler Protocol**

**PURPOSE:**

To evaluate a transjugular intrahepatic portosystemic shunt (TIPS) and associated vasculature for patency and flow direction.

**SCOPE:**

Applies to all ultrasound abdominal Doppler studies performed in Imaging Services / Radiology

**ORDERABLE:**

- US Doppler TIPS

**CHARGEABLES:**

- US DOPPLER COMPLETE (CPT 93975)
- Add this as charge to US Liver or US Abdomen Complete, if ordered together
  - **Please see *US Liver 2* or *US Abdomen Complete* protocols for details**

**INDICATIONS:**

- Presence of a TIPS with concern for shunt dysfunction
  - Increasing splenomegaly or ascites
  - Unexplained increasing liver function tests (LFTs)
  - Upper gastrointestinal bleed suspected due to varices
  - Abnormal findings on other imaging studies
- Routine follow-up or baseline TIPS evaluation as indicated by the vascular or interventional specialist

**CONTRAINDICATIONS:**

- No absolute contraindications

**EQUIPMENT:**

- Curvilinear transducer with a frequency range of 1-9 MHz that allows for appropriate penetration and resolution depending on patient's body habitus

**PATIENT PREPARATION:**

- None

**EXAMINATION:**

**GENERAL GUIDELINES:**

- A complete examination includes evaluation of the TIPS shunt, portal veins, hepatic veins, splenic vein, superior mesenteric vein, and inferior vena cava (IVC).

**EXAM INITIATION:**

- Introduce yourself to the patient
- Verify patient identity using patient name and DOB
- Explain test
- Obtain patient history including symptoms. Enter and store data page
- Place patient in supine or left lateral decubitus (LLD) position.

### TECHNICAL CONSIDERATIONS:

- Always review any prior imaging, making note of abnormalities or other findings requiring further evaluation. Make note of prior main portal vein (MPV) and in-stent velocities.
- In LLD position, the liver shifts towards the midline improving accessibility for scanning
- Optimize gain and display setting with respect to depth, dynamic range, and focal zones on grey scale imaging
- Optimize color Doppler setting to show optimal flow
  - Color Doppler box size to include vessel of interest, only
  - Light color in the middle of the vessel lumen, darker toward periphery, to show laminar flow
  - Use Power Doppler if suspect absent flow with color Doppler
- Optimize spectral Doppler gain
  - Spectral scale adequate for interpretation
  - No aliasing for high flow evaluation
  - Gain set to demonstrate spectrum but to minimize noise and other Doppler artifacts
- As much as possible use an angle of  $\leq 60^\circ$  to measure velocities
  - For certain anatomy, may need to try from different approaches
  - Angle correction should always be parallel to the vessel wall / direction of flow
- Normal portal flow with a function TIPS includes hepatopetal flow (towards the liver) in the main portal vein, hepatofugal (reversed) flow within with left portal vein as well as within the right portal vein distal (peripheral) to the TIPS. Hepatopetal flow may be seen in the proximal right portal vein prior to the TIPS. In all segments, flow should be towards the inferior TIPS end. See Appendix.
- TIPS segments should be labeled "Portal End," "Mid", and "Hepatic Vein/IVC End." Proximal TIPS refers to the inferior/caudal end (closer to the portal vein), while distal TIPS refers to the superior/cephalic end (closer to the hepatic vein/IVC). See Appendix.
- Ensure that images of the receiving hepatic vein are included just cephalad to the TIPS. Confirm that hepatic vein flow in this segment is towards the IVC.
- Evaluate hepatic vein phasicity during suspended respiration or shallow breathing
  - Deep inspiration may dampen hepatic venous flow
- Areas of suspected TIPS stenosis or obstruction require spectral Doppler waveform and velocity measurements at and distal to the stenosis
  - Ensure that location of maximum TIPS velocity is interrogated. Look for any color aliasing as a clue for zones of high velocity.

**IMAGE DOCUMENTATION:**

<b>Anatomy</b>	<b>Grey Scale</b>	<b>Color Doppler</b>	<b>Waveform</b>	<b>*PV</b>
Splenic vein/portal confluence	x	x		
Proper Hepatic Artery	x	x	x	x
Portal vein: main	x	x	x	x
Portal vein: left	x	x	x	
Portal vein: right, proximal to stent	x	x	x	
Portal vein: right, distal to stent	x	x	x	
TIPS: portal vein end	x	x	x	x
TIPS: middle	x	x	x	x
TIPS: hepatic vein/IVC end	x	x	x	x
Hepatic vein, with stent	x	x	x	
IVC	x	x	x	
Data page with measurements				
PV = peak velocity				

**PROCESSING:**

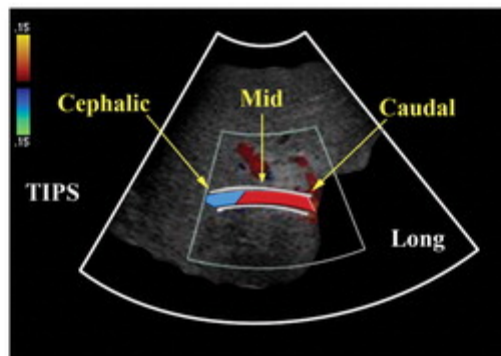
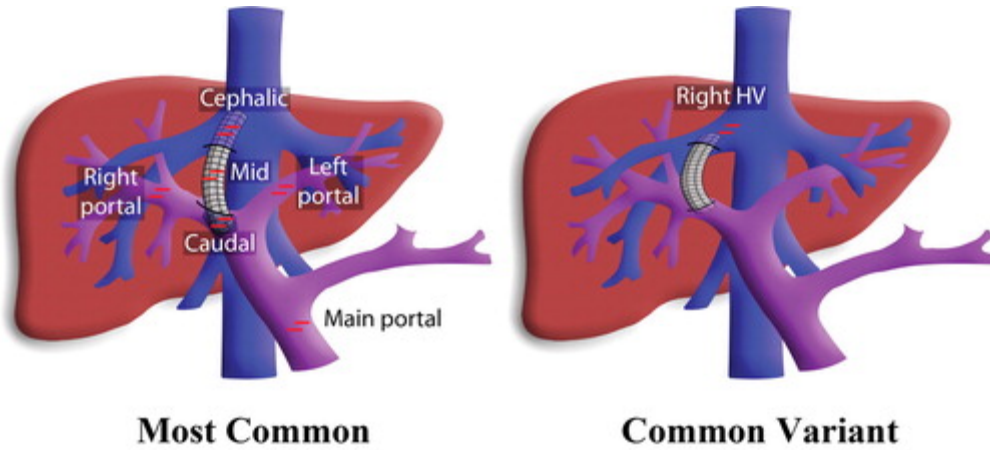
- Review examination data
- Export all images to PACS
- Confirm data Imorgon (where appropriate)
- Note any study limitations (in Tech Study Note or paper communication, per local workflow)

**REFERENCES:**

- ACR-AIUM-SPR-SRU Practice Guideline (Revised 2017)
- IAC Guidelines (Updated 2018)
- Radiology (2011) 260(3): 884-891
- Radiographics (2011) 31(1): 161-189

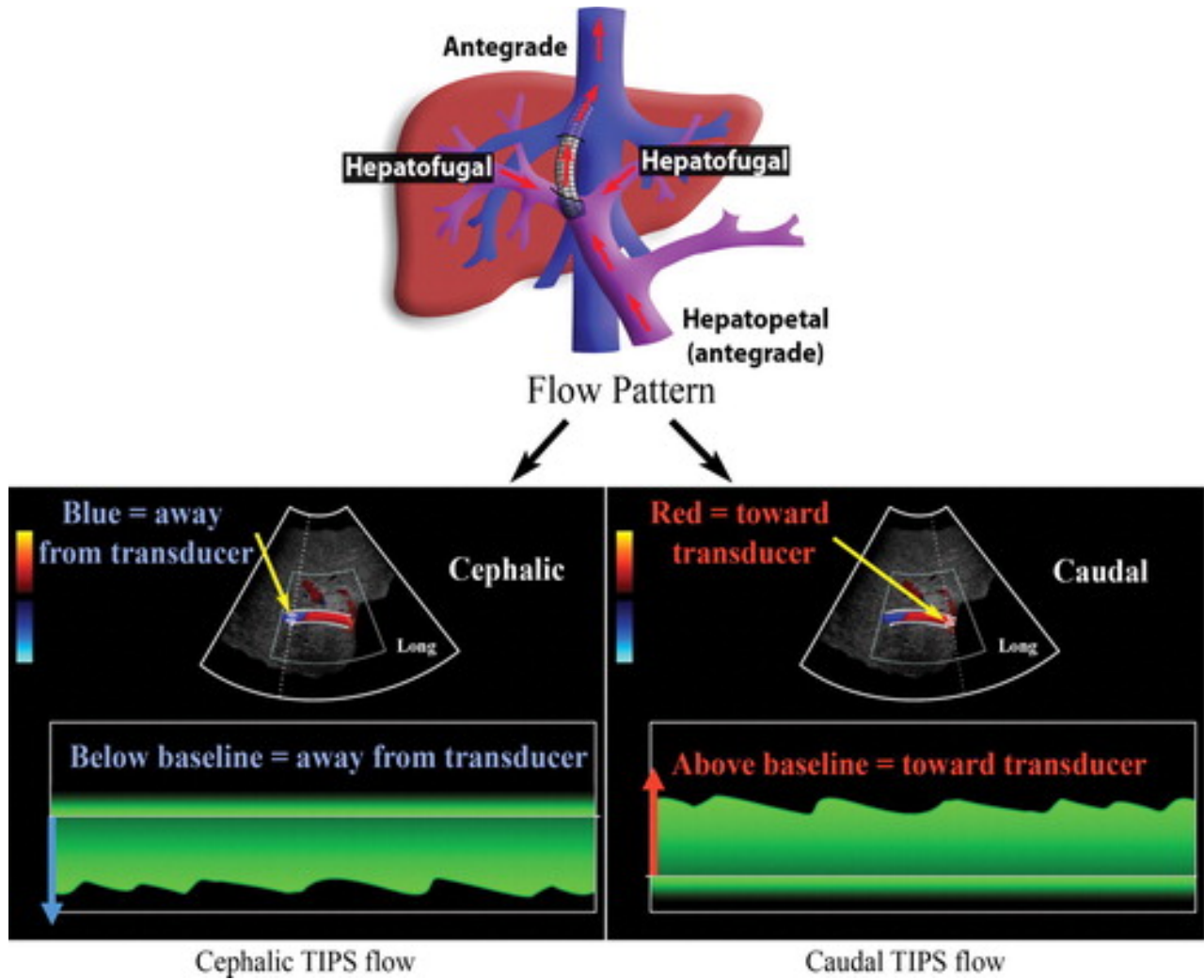
**APPENDIX:**

- Normal TIPS velocity is 90-190 cm/sec
  - Suspect stenosis if
    - Portal vein velocity change from baseline    ↓ >40 cm/sec    ↑ >60 cm/sec
    - TIPS velocity (if no baseline)                    <90 cm/sec       >190 cm/sec
    - Portal vein velocity (if no baseline)           <30 cm/sec
- Portal hypertension
  - Reversal of flow (hepatofugal)
  - Barcelona Criteria
    - Main portal vein diameter >13 mm
    - Monophasic waveform velocity <16 cm/sec
    - Phasic waveform mean velocity <13 cm/sec



**Color US Anatomy**

Note: TIPS segments should be labeled “Portal End,” “Mid”, and “Hepatic Vein/IVC End.” Proximal TIPS refers to the inferior/caudal end (closer to the portal vein), while distal TIPS refers the superior/cephalic end (closer to the hepatic vein/IVC).



Note: Portal flow should be towards the inferior/caudal TIPS (red arrows).

## UT Southwestern Department of Radiology

<b>SUBMITTED BY:</b>	David T. Fetzer, MD	<b>Title</b>	Medical Director
<b>APPROVED BY:</b>	David T. Fetzer, MD	<b>Title</b>	Medical Director
<b>APPROVAL DATE:</b>	11-25-2015		
<b>REVIEW DATE(S):</b>	10-03-2018	<b>Brief Summary</b>	Protocol reviewed. Julie Champine, MD
<b>REVISION DATE(S):</b>			
	06-19-2016	<b>Brief Summary</b>	Protocol reviewed. Changes to list of relevant orders to reflect consolidation of EPIC orderables
	10-22-2018	<b>Brief Summary</b>	Abbreviated protocol to focus on just TIPS
	12-11-2019	<b>Brief Summary</b>	Routine formatting updates