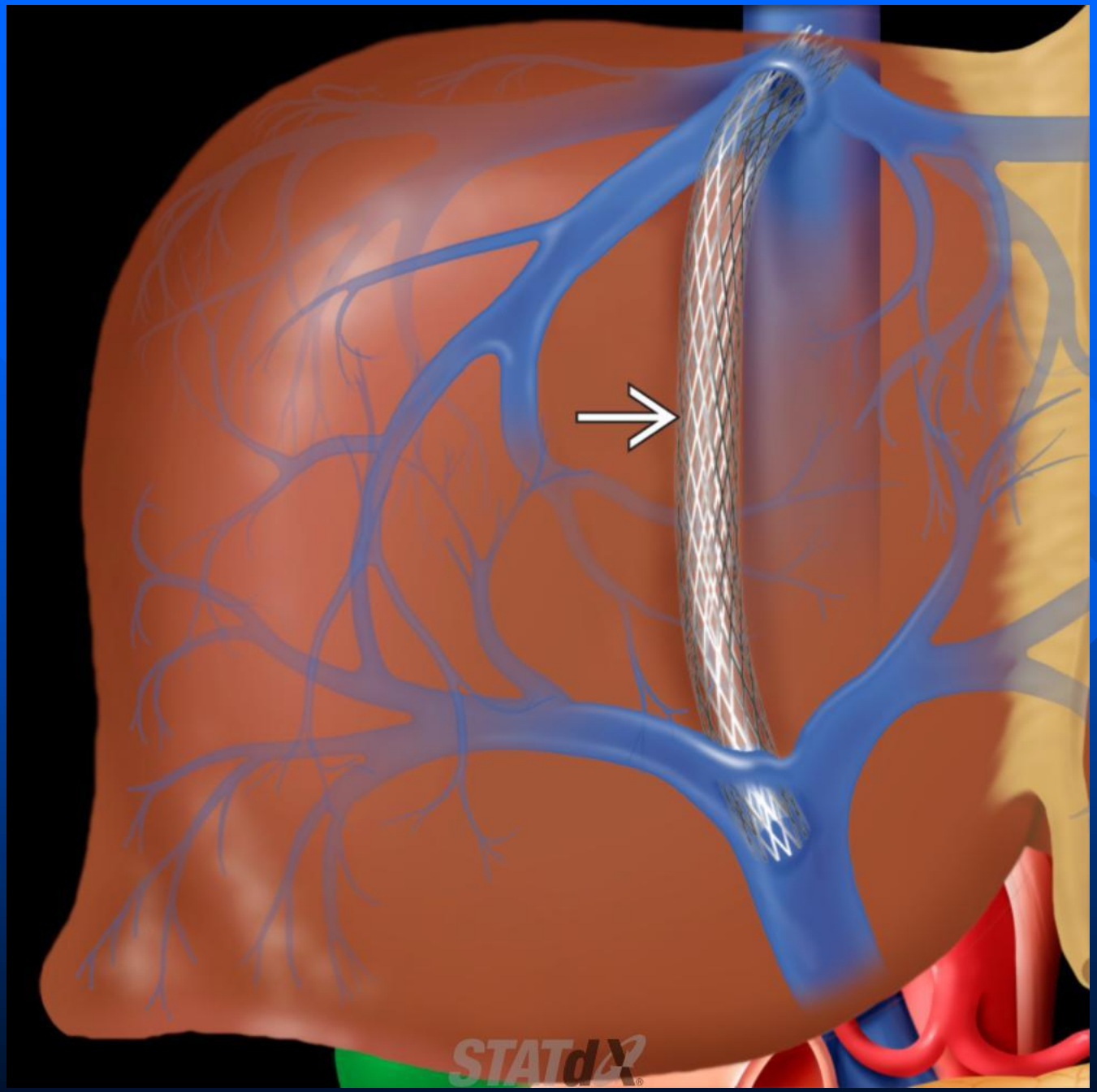
Normal TIPS
Transjugular Intrahepatic Portosystemic Shunt

After puncturing the liver parenchyma, the portal vein is cannulated by a guidewire and the the sheath was inserted into the portal vein showing the entrance point in the right main portal branch

Normal Tips

After balloon dilation a self-expanding stent was inserted and dilated up to 8 mm. Angiogram shows final result.



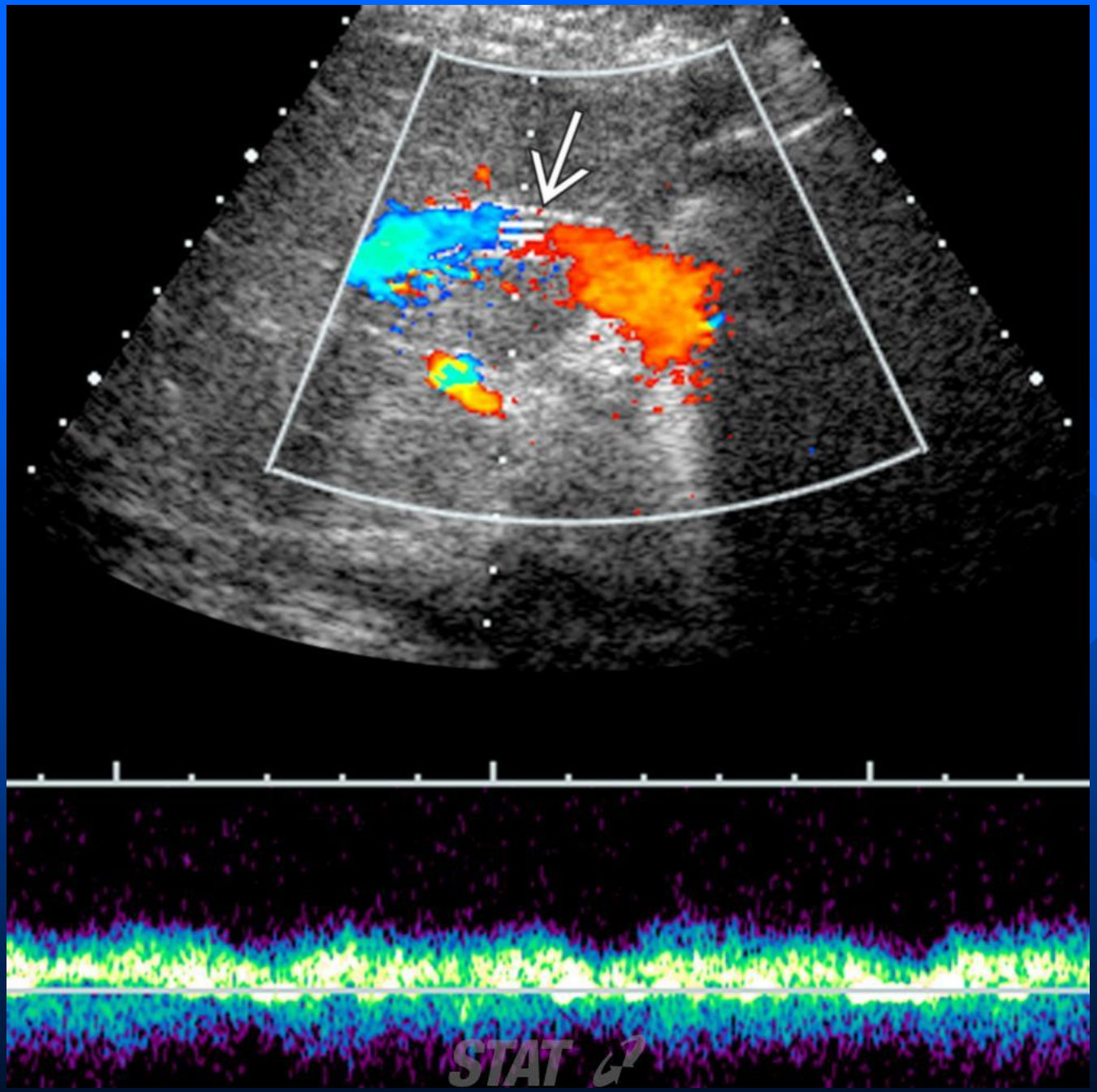
Graphic of TIPS shunt creation shows the hepatic vein punctured within 2 cm of the IVC. The metallic wire TIPS (white solid arrow) extends to the right portal vein, adjacent to its junction with the main portal vein.

TIPS

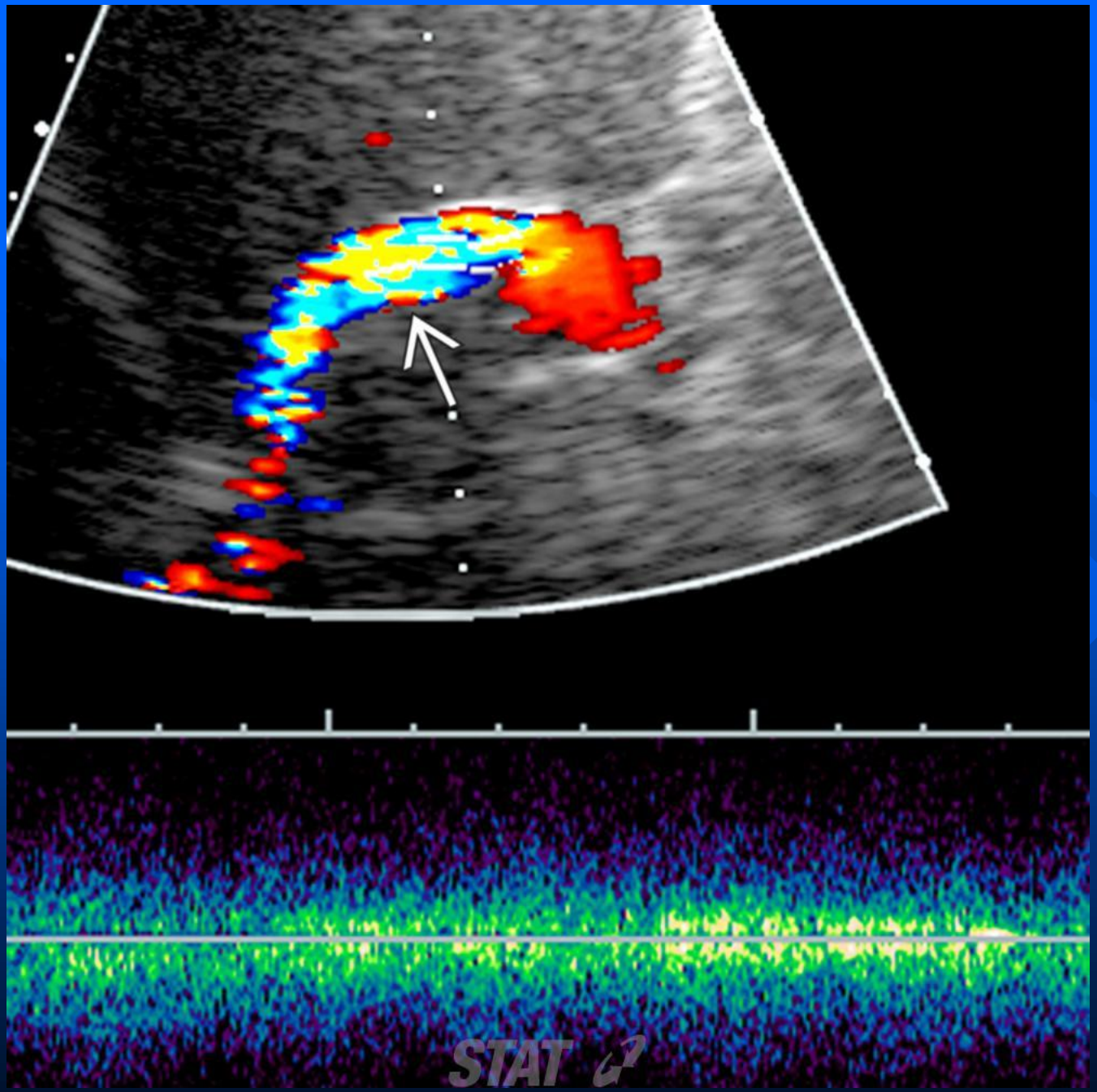
- Stenosis is usually secondary to intimal fibroplasia within hepatic vein or TIPS itself
- Associated abnormalities
  - Hepatic encephalopathy as portal flow bypasses liver

Imaging

- Goal of US: Detection of stenosis before shunt occludes or symptoms recur
- Best imaging tool
  - US as primary TIPS surveillance tool
  - CTA/MRA indicated if US technically compromised or equivocal
- Doppler US findings of TIPS malfunction
  - PV
    - » Hepatofugal flow ”away from liver”
    - » Peak velocity < 35 cm/sec
  - Within shunt
    - » Peak velocity < 90 cm/sec or > 200 cm/sec at any point
    - » Temporal change in peak velocity > 50 cm/sec



Longitudinal color Doppler ultrasound in the same patient, scanned through the mid-shunt level, demonstrates low-velocity flow (45 cm/s) within the shunt (white solid arrow). A subsequent angiogram revealed a high-grade TIPS stenosis involving the hepatic venous side of the shunt.



Longitudinal spectral Doppler ultrasound in the same patient demonstrates markedly increased velocity of flow and turbulent in the distal shunt (255 cm/s) (white solid arrow), findings consistent with mid-shunt stenosis.

Indications

- Acute variceal bleeding that cannot be successfully controlled with medical treatment, including sclerotherapy
- Recurrent and refractory variceal bleeding
- Others
  - Refractory ascites
  - (Budd-Chiari syndrome)

Absolute contraindications

- Right-sided heart failure with increased central venous pressure
- Polycystic liver disease
- Severe hepatic failure

Relative contraindications

- Active intrahepatic or systemic infection (Bacteria can colonize the stent, causing persistent infection.)
- Severe hepatic encephalopathy poorly controlled with medical therapy
- Hypervascular hepatic tumors
- PV thrombosis (Although PV thrombus may make the procedure more technically demanding, it is not an absolute contraindication to TIPS placement.)

Portal Vein thrombosis

- Performing a TIPS in the presence of thrombus carries the risk of thrombus dislodgment into the portal branches and into the systemic circulation.
- Most of the disrupted thrombi flow towards the lungs with surprisingly almost no consequences.

Technique

- From the right hepatic vein, the needle is usually aimed anteromedially and caudally then advanced 3-4 cm within the liver usually right portal vein.
- An intrahepatic access site with entry into the right PV at least 1 cm from the main PV bifurcation is desired

Successful TIPS

- Successful TIPS placement results in a portosystemic gradient of less than 12 mm Hg and immediate control of variceal-related bleeding
- Main acute complications are bleeding, failed puncture and hepatic rupture.
- Late complications are TIPS thrombosis and hepatic encephalopathy.

Problems of TIPS - Potentially dangerous portal puncture site

The TIPS needle hits the left portal branch very close to the portal bifurcation which is a potential source for extrahepatic bleeding because this section of the portal tree might be located extrahepatically

Problems of TIPS - Potentially dangerous portal puncture site

- One of the problems of TIPS is puncture of the portal vein in an extrahepatic position
- If the procedure is continued, major bleeding into the peritoneal cavity is a potentially life-threatening complication that should be avoided.
- Repuncture – leave guide wire in the event a stent needs to be placed

Problems of TIPS - Potentially dangerous portal puncture site

Budd-Chiari Syndrome Treated with TIPS

- shows no significant opacification of left or middle hepatic vein with only slight opacification of the right hepatic vein 1-2 cm distal to the tip of the catheter.
- A small network of collateral veins is opacified representing the typical "spider web" appearance of hepatic vein occlusion.

Budd-Chiari Syndrome Treated with TIPS

- Right hepatic vein to the right portal vein. Injection of this stent shows extensive filling defects within the stent.
- Filling defects within the splenic vein near its confluence with the superior mesenteric vein and in the portal vein consistent with thrombosis.

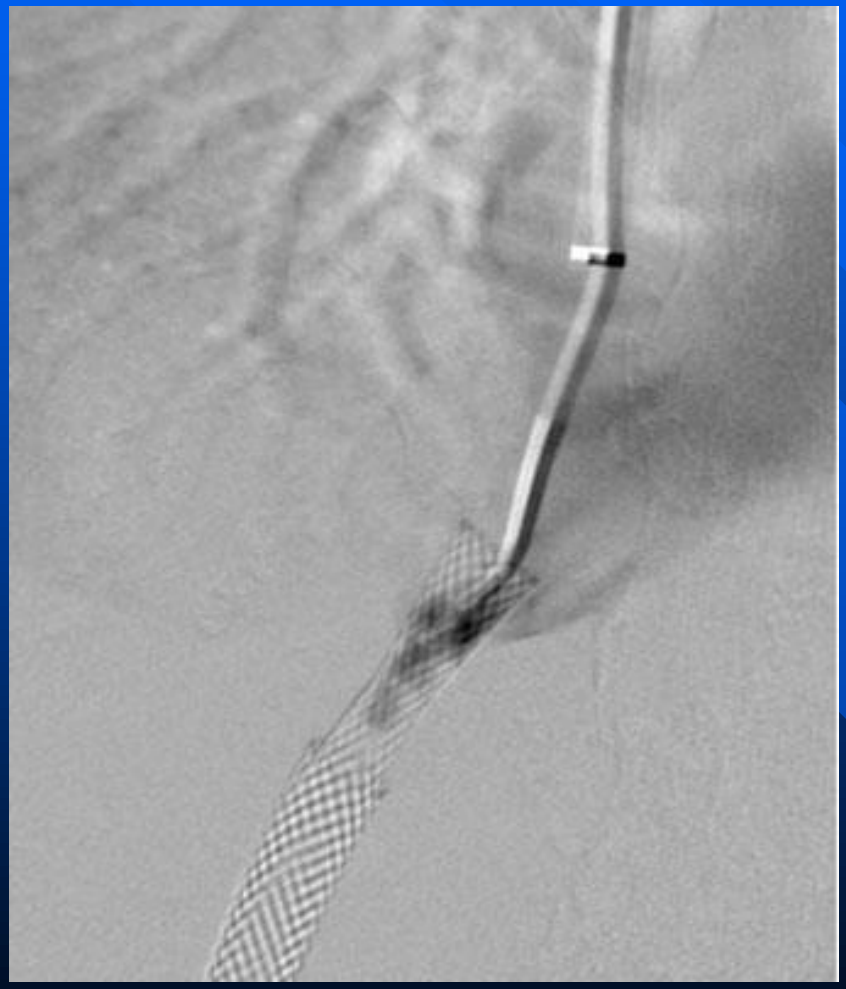
Budd-Chiari Syndrome Treated with TIPS

- Injection of the patient's TIPS after treatment with Urokinase and mechanical thrombectomy

Budd-Chiari Syndrome Treated with TIPS

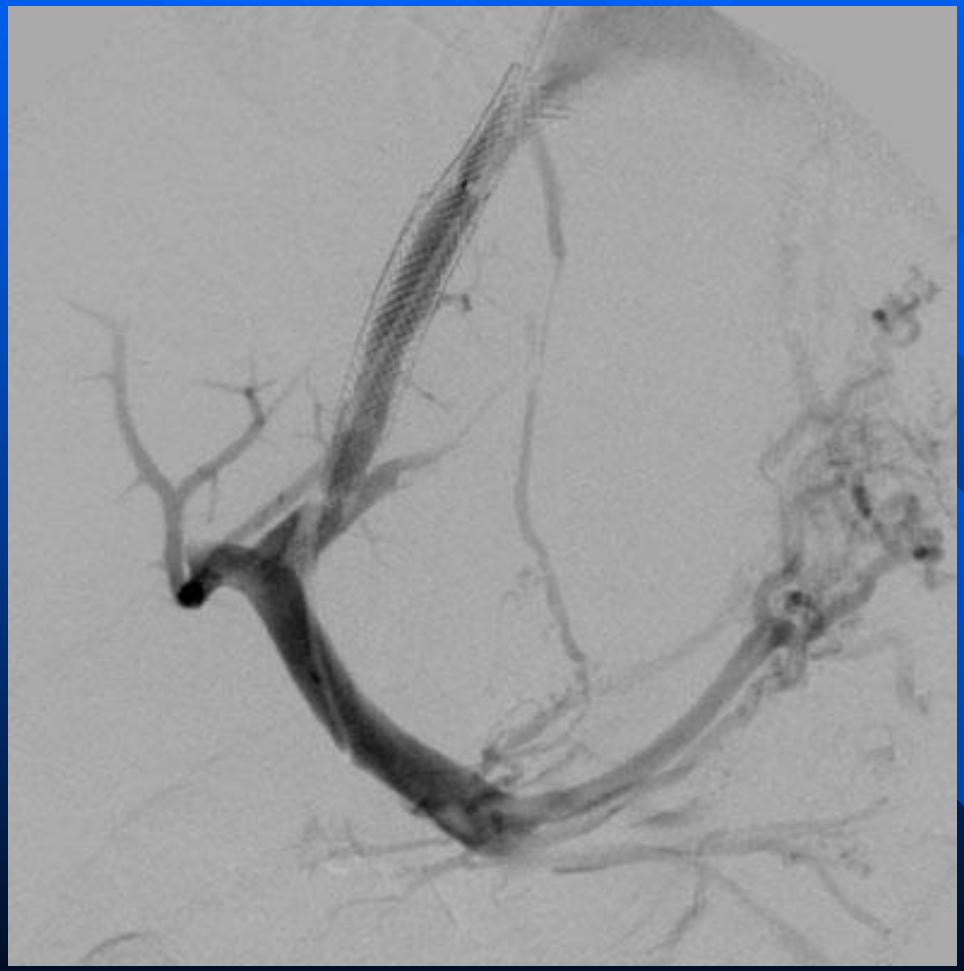
- Primary type
  - membranous obstruction of hepatic veins occurs
- Secondary
  - Obstruction from hematologic disorders such as sickle cell anemia, myeloproliferative disorders, thrombocytosis, polycythemia vera.
  - Also, hypercoagulable state such as pregnancy, protein C and S deficiency, antithrombin III deficiency, and collagen vascular disorders

Percutaneous revision of acute TIPS thrombosis



Selective angiography at the caval end of the TIPS tract shows complete thrombosis

Percutaneous revision of acute TIPS thrombosis



PTA alone partially reopens the tract but remaining thrombus is present. Entrance into the TIPS shunt is still deteriorated by the insufficient stent position

Percutaneous revision of acute TIPS thrombosis

Stent-in-stent placement immediately reopened the tract allowing an improved inflow that leads to hypoperfusion of the intrahepatic portal branches

Percutaneous revision of acute TIPS thrombosis

- As alternatives, thrombolysis or mechanical thrombectomy would have been options.
- Additional stenting was requested in order to improve the inflow into the TIPS tract.
- Portal stenting is problematic but no other option was given in order to avoid early recurrence of TIPS failure
- maximum peak flow velocity with the TIPS of 0.5 m/sec is used as the threshold level to indicate shunt stenosis

TIPS dysfunction with shunt communication to the biliary system