Portal Hypertension: The Interventional Radiology View

Clinical Update for the Comprehensive Management of Cirrhosis, Viral Hepatitis, Liver Cancer, and End Stage Liver Disease

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Disclosures

• None
Objectives

- Transjugular intrahepatic porto-systemic shunts (quick review)
- Newer (?) covered stent technology and outcomes
- New techniques for shunt creation (DIPS)
- Alternative procedures to TIPS for portal hypertension/gastric varices

History

- Described by Dr. Rösch in 1969 and shortly thereafter performed in humans by Dr. Gordon
- “imaging-guided procedure in which a channel is constructed within the liver with the intent of reducing portal pressure by diverting blood from the portal to the systemic circulation”
Indications:

- Prevention of variceal bleeding (primarily esophageal)
- Refractory ascites
- Budd-Chiari
- Hepatic hydrothorax
- Portal hypertensive gastropathy
- Hepatorenal syndrome

<table>
<thead>
<tr>
<th>Indication</th>
<th>Best Available Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary prevention of variceal bleeding</td>
<td>1A</td>
</tr>
<tr>
<td>Refractory ascites</td>
<td>1A</td>
</tr>
<tr>
<td>Budd-Chiari syndrome</td>
<td>4</td>
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<tr>
<td>Hepatic hydrothorax</td>
<td>4</td>
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<tr>
<td>Hepatic venoocclusive disease</td>
<td>4</td>
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<tr>
<td>Hepatorenal syndromes (types 1 and 2)</td>
<td>2B</td>
</tr>
<tr>
<td>Hepatopulmonary syndrome</td>
<td>4</td>
</tr>
<tr>
<td>Portal hypertensive gastropathy</td>
<td>2B</td>
</tr>
<tr>
<td>Refractory acute variceal bleeding</td>
<td>1B</td>
</tr>
</tbody>
</table>

- 1A – systemic review of randomized controlled trial
- 1B – individual randomized control trial
- 2B – individual cohort study
- 4 – Case series

*Fidelman et al American Journal of Roentgenology 2012
Re-bleed for variceal hemorrhage

- Two meta-analyses published in 2002 and 2008 evaluating the 13 randomized controlled trials:
  - Three fold decrease in re-bleed rates after TIPS compared with various endoscopic therapies
  - All cause mortality was similar
  - Two fold increase in hepatic encephalopathy

Refractory ascites

- Meta-analysis of the 6 randomized controlled trials (TIPS versus paracentesis)
  - 7 fold reduction in risk of recurrent tense ascites after TIPS
  - Improvement in ascites 38-84% (versus 0-43% with paracentesis only)
  - No survival difference in older trials, but two newest trials demonstrate improved survival with TIPS
  - 2 fold increase in hepatic encephalopathy
Contraindications

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
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<tbody>
<tr>
<td>Congestive heart failure</td>
<td>Hepatocellular carcinoma</td>
</tr>
<tr>
<td>Severe tricuspid regurgitation</td>
<td>Hepatic vein obstruction</td>
</tr>
<tr>
<td>Severe pulmonary hypertension (mean &gt;45mmHg)</td>
<td>Portal vein thrombosis</td>
</tr>
<tr>
<td>Multiple hepatic cysts</td>
<td>Severe coagulopathy (INR &gt;5)</td>
</tr>
<tr>
<td>Uncontrolled infection/sepsis</td>
<td>Thrombocytopenia (&lt; 20 k)</td>
</tr>
<tr>
<td>Unrelieved biliary obstruction</td>
<td>Existing hepatic encephalopathy</td>
</tr>
</tbody>
</table>

Also…

- Other models which predict TIPS morbidity and mortality
  - Childs-Pugh score
  - Mayo Clinic risk score
  - MELD (more sensitive)
    - A MELD above 18 predicts a much higher mortality 3 months after TIPS
- Multi-disciplinary evaluation and care for patient is critical!
Sample case

- 56 M with portal hypertension, ESLD due to etoh abuse, and prior history of esophageal and gastric variceal hemorrhage.
- Patient admitted for possible hemorrhage, no bleed found this admission.
Technique

PV pressure: 23 mmHg
Right atrial: 3 mmHg
Portosystemic gradient: 20 mmHg
Post TIPS:
PV pressure: 17 mmHg
Right atrial: 8 mmHg
Portosystemic gradient: 9 mmHg
To cover or not to cover…

• Bare metal stents:
  – Hemobilia
  – Bil-hemia
  – Hepatic vein stenosis leading to shunt failure
    • Incidence ranging between 18-78%
  – Stent thrombosis (traverse biliary radicals)

• Add Polytetrafluoroethylene (PTFE)

PTFE covered stents

  – Viatorr by W. L. Gore©

• Randomized controlled trial in 2007 by Bureau et al:
  – 80 patients (39 covered: 41 metal)
  – Followed for 2 years
    • TIPS dysfunction 15% vs 44%
    • Primary patency 76% vs 36%
    • Encephalopathy 33% vs 49%
    • Clinical relapse 10% vs 29%

• Covered stents preferred!
What if..

MHV

RHV

LHV

IVC

Portal vein

LPV

RPV

Tumor
• Portal Vein inadequacy:
  – PV thrombosis

• Portal Vein inadequacy:
  – PV thrombosis
  – Very small PV’s
  – PV calcification
• Inadequate pathway for conventional TIPS:
  – Tumor
  – Existing TIPS (either thrombosed or inadequate)
• Inadequate hepatic veins for conventional TIPS:
  – Budd Chiari

Alternative methods

• Direct portosystemic shunt
  – Many methods described including transabdominal US, CT guidance, direct fluoroscopic guidance, intra-vascular ultrasound
  – In essence, if can not access the branches of the portal vein by conventional TIPS
46 M presented to hepatology clinic with 2-week history of increasing abdominal swelling, weight gain and SOB

- PMH: strokes, DVTs, sagittal sinus thrombosis
- Budd Chiari suspected on outside CT, which showed prominent focal narrowing of the intrahepatic IVC, nutmeg liver, ascites, small R pleural effusion
  - admitted to the hospital for a paracentesis, endoscopy and work up for hypercoagulable state
CT findings

- Thrombosis of portal vein, splenic vein, SMV, IMV and parts of the hepatic veins
- Nutmeg liver
- Ascites
- Stigmata of portal hypertension, i.e. collaterals, recanalized paraumbilical vein
TIPS attempted

• .....and failed.
After 37 hours of pharmacologic thrombolysis, mechanical thrombolysis, aspiration thrombectomy

Follow up

- 2 months out he is asymptomatic.
- On coumadin
- Still getting worked up for hypercoagulable state
- Ultrasound shows visible flow within intra-hepatic portal veins
- CT (outside institution): Status post portal systemic shunt with NO evidence of any portal vein or mesenteric thrombus.
Other indications for access into Portal Vein and treatment of Portal hypertention:

- Variceal embolization
Other indications for access into Portal Vein and treatment of Portal hypertension:

- Variceal embolization
- Portal vein thrombolysis
- Portal vein angioplasty and stenting (usually associated with transplant)

Complications:

- **Minor**
  - Neck hematoma
  - Arrhythmia
  - Stent displacement
  - Hemolysis
  - Bilhemia
  - Hepatic vein obstruction
  - Stent thrombosis

- **Major**
  - Hemoperitoneum
  - Hemobilia
  - Liver ischemia
  - Cardiac failure
  - Sepsis
  - Portal vein thrombosis

Hepatic encephalopathy
What if TIPS is not an option?

- Right heart failure
- Portal vein thrombosis (not amenable to lysis)
- Hepatic encephalopathy
- Severe uncorrectable coagulopathy
- TIPS not approved (many Asian countries)

Balloon-occluded Retrograde Transvenous Obliteration (BRTO)

- Access the portal system from a systemic collateral (commonly the left renal to splenic vein shunt)
BRTO

- Technical aspects:
  - Need to have gastro-renal or systemic-portal collateral (exists up to 85% of the time)
  - Need to prevent non-target embolization.
  - If thrombosed main portal vein, could lead to mesenteric ischemia (blocking only outflow!)
  - Technical success 79-100% with patent gastrorenal shunt

BRTO

- Portal hypertension
- Gastric varices
- Ascites
- Esophageal varices
- Hepatic encephalopathy
BRTO

• Greatest advantages:
  – Preserve or improve hepatic function
  – Stable or improved hepatic encephalopathy

• Disadvantages:
  – Increased portal pressures
  – Worsening of esophageal varices
  – Worsening of ascites if present

Splenic artery embolization

• Originally performed in 1973 by Maddison et al.
  – Lead to abscess, splenic rupture, sepsis, pneumonia and death!

• Then followed by additional improvements in 1979 by Spigos et al:
  – Added antibiotics
  – Post embolization pain control
  – Partial splenic embolization (compared with complete)
Splenic artery partial embolization

- Portal hypertension
- Gastric varices
- Ascites
- Esophageal varices
- Hepatic encephalopathy
Splenic artery partial embolization

• Advantages:
  – Decreased sequestration (improved platelet, wbc, and rbc counts)
  – Improved encephalopathy
  – Decreased esophageal variceal hemorrhage

• Disadvantages:
  – Increased risk for infection
  – Post embolization syndrome
  – Over embolization can lead to abscess, sepsis, and need for surgical splenectomy

Summary

• TIPS:
  – Proven useful for prevention of recurrent variceal bleeding and refractory ascites
  – Not without its complications and difficulties

• DIPS
  – Can be useful for difficult TIPS access
  – Slightly more costly in equipment, but can enter portal system with as few as one needle pass
  – Gaining popularity as primary approach
Summary

• BRTO
  – Useful for gastric varices and improved liver function
  – Can worsen portal hypertension
  – Requires a patent portal-system shunt

• Splenic artery partial embolization
  – Useful for esophageal varices and decreased sequestration of platelets, wbc, and rbc.
  – Can have potentially significant complications of sepsis, abscess, and possible need for splenectomy.

Thank you!