Endovascular Techniques for Symptomatic Portal Hypertension

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Objectives

• Review indications and contraindications for TIPS
• Define a treatment algorithm for acutely bleeding varicies
• Evaluation of Elective TIPS for ascites
• TIPS followup and management
• Role of Balloon-Occluded Retrograde Transvenous Obliteration (BRTO) of spleno-renal gastric varicies
TIPS

• An intra-hepatic portal-systemic shunt usually created by advancing a needle, via a right jugular venous access, from the right hepatic vein to the right portal vein
• CO₂ gas is used as an intravascular contrast agent—rarely need iodinated contrast
• A covered stent is placed to maintain the track created with the needle and provides long term patency
48 y/o WM with hepatitis B & C, cirrhosis, refractory ascities, and recurrent GI bleed

10F sheath already in place in right jugular vein
AP and Lateral CO2 Wedge Venograms

[Image showing AP and Lateral CO2 Wedge Venograms with labeled structures: RPV, LPV, and PV]
Colopinto Needle Exiting Right Hepatic Vein
Upon Getting Blood Return a Guidewire is Advanced
Stent Deployed and Dilated for Desired Gradient
Completion Venogram
General Indications for TIPS

• Management of symptoms related to portal hypertension
  – Variceal bleeding
  – Ascites
  – Pleural effusion secondary to portal hypertension
  – Hepatorenal syndrome
  – Hepatopulmonary syndrome
  – Ectopic Varicities

• Access for other portal vein interventions
TIPS For Acute Variceal Bleeding
Medical Management of Acute Variceal Bleeding

- Judicious volume replacement
- FFP and VIIa
- Lactulose
- Airway management (if heading to TIPS they will be intubated anyway)
- Vasopressin or somatostatin (terlipressin and octreotide)
Endoscopic Management

• Early EGD to exclude Mallory Weiss, etc. (up to 30% of presumed variceal bleeds are something else)

• Banding > sclerotherapy
  – Hemostasis in 80%
  – 25-30% continue or recur

• Otherwise move on to Sengstaken-Blakemore or Linton-Nachlas which are 90% effective
  – 50% bleed on deflation
  – May consider one more EGD
Surgical Options

• Esophageal transection
  – 79% 30 day mortality
  – 26% rebleeding rate

• Surgical portocaval shunt
  – 50-100% mortality in acute setting with Child A or C respectively

• Liver Transplantation best option, but not usually available in acute setting
Emergent TIPS

• Uncontrolled bleeding or early (<48 hour) rebleeding after two EGD therapies
• Bypass endoscopic therapy in
  – esophageal strictures
  – bleeding gastric (??) and unusual GI varicies
• TIPS is not used as primary treatment
  – encephalopathy risk is high
  – survival no better than successful sclerotherapy/banding
Management We Look For Prior to Emergent TIPS

- EGD to confirm variceal bleeding—some outside studies are OK and some are not
- Pharmacologic therapy tried first?
- Intubate
- Balloon tamponade if actively bleeding
- Try to defer if infected (20% of active bleeders have an in-hospital infection)
Work-up Prior to Emergent TIPS

• MR, CT or U/S (r/o tumors, polycystic disease and PV thrombosis)
• Cardiac history to exclude CHF, pulmonary HTN, and tricuspid valve disease (TTE)
• Correct INR to 1.8 and PLT to 50 per microliter
Emergent TIPS Outcomes

- 90% effective in controlling bleeding
- 40 day mortality is 25% if done within 48 hours of first failed endoscopic treatment
Survival Varies Widely

• If they have ascites, are on catecholamines, and if they have a balloon up, their mortality is 96% at 60 days

• If they don’t have any of these three risk factors then 60 day mortality is only 2%
Acute Bleeding Mortality

- Markers of poor survival with or without TIPS
  - APACHE II > 18
  - On pressors
  - Acute renal failure
  - ALT > 100 or bilirubin > 3
  - Encephalopathy or requiring ventilation

- After TIPS mortality related to
  - Liver failure
  - Sepsis
  - Multi-organ failure

Azoulay D. J Hepatol 2001; 35: 590
Other Tools to Predict Mortality of Acutely Bleeding TIPS

- Predictive index = \( 1.54 \times (1 \text{ or } 0 \text{ for ascites}) + 1.27 \times (1 \text{ or } 0 \text{ for ventilation}) + 1.38 \times \ln(WBC) + 2.48 \times \ln(PTT) + 1.55 \times \ln(Cr) - 1.05 \ln(PLT) \)

- Predictive index > 18.3 has 100% mortality

Patch D. J Hepatol 1988; 114: 981)
Emergent versus Non-Emergent TIPS Survival

• If acutely bleeding at time of TIPS
  – 34% die within 30 days

• If elective TIPS
  – 16% 30 day mortality if not bleeding at time of TIPS

• 2.9 x greater odds of death if bleeding at times of TIPS

Rajan DK, Haska ZJ. Am J Gastroenterol 1995; 108: 1143
Coronary Vein Embolization
Adjunctive Embolization

- Only done in conjunction with TIPS
- Embolize any veins still visible after TIPS placed and gradient dropped to 8 mmHg
  - Stops acute bleeding
  - Prevents competition with TIPS for systemic shunting
- Embolization also done if bleeding persists after TIPS
- Usually done with coils. Can use sotradecol, alcohol, glue, and other devices
Elective TIPS
Additional Evaluation Prior to Elective TIPS

- Age greater than 65—higher risk of post procedure encephalopathy
- Indications:
  - bleeding recurring despite aggressive endoscopic treatment
  - ascites refractory to medical management
- Are symptoms likely related to intrahepatic portal or hepatic vein obstruction?
- Does patient have signs or symptoms of encephalopathy
- Cardiac history?
Work Up Prior to Elective TIPS

• Liver function and kidney function not more than 1 week prior to procedure
• Coagulation not more than 48 hours prior to procedure (if previously abnormal)
• MRI
  – If can’t have MRI then do a CTA
  – If can’t have MRI or CTA then do an U/S
• Echo and EKG (may skip if no cardiac history and patient is <50)
MELD

• Model for end stage liver disease
• MELD=9.6 x ln(Cr) + 3.8 x ln(bilirubin) + 11.2 x ln(INR) + 6.4
• >25 has 35% 3 month survival
• >18 has 40% 3 month survival
• <=18 has a 90% 3 month survival
• <10 has 100% 3 month survival

Angermayr B. Gut 2003; 52: 879
MRI in Patient with Bleeding Rectal Varicices
Elective TIPS for Varicities

- Esophageal varicities refractory to endoscopic treatment
- Gastric varicities that cannot be glued
- Varicities in areas usually not amenable to endoscopic or surgical management
  - Stoma
  - Rectal
Hepatic Venogram

Poor Reflux with CO2
Occlusion Balloon

Still No Reflux into Portal Vein
Portal Venogram
Etiology of Ascites

• Portal hypertension
  – PS gradient $> 12$ mmHg

• Sodium retention
  – Decreased intravascular volume

• Lymphatic leakage from liver
Treatment of Ascites

• Diuretics
• 10-20% of ascites is refractory to diuretics
• LVP next line therapy
• Patients requiring frequent LVP (>2 times a month) should be considered for TIPS
• Peritoneal venous shunt—too many occlusions to be widely used
• LTX
Outcome of TIPS for Ascites

• 95% technical success
• 9% complication rate
  – 3% hemorrhage
  – 3% ARF
  – 1.5% sepsis
  – 1.2% hemolysis
  – 11% heart failure
• 33% encephalopathy
  – Not reduced by prophylactic lactulose
  – Biggest predictor is baseline encephalopathy
Mortality in TIPS for Ascites

• Analysis of 16 studies
• Pooled estimate for complete response at 6 months was 45% and for any response (complete and partial) was 63%.
• Pooled 6-month mortality after TIPS was 36%.
• Risk factors for mortality
  – Renal insufficiency (serum creatinine >1.5 mg/dl)
  – Hyperbilirubinemia (total bilirubin >3 mg/dl)
  – Advanced age (>60 yr)
  – Poor response to TIPS
  – Refractory cases associated with 100% mortality
• New or worsening encephalopathy after TIPS was 32%
• Improvement in creatinine clearance and urinary sodium excretion

Am J Gastroenterol. 2003 Nov;98(11):2521-7
Target PSG

- Mean pressure gradient from PV to RA
- Post TIPS gradient:
  - >16 is no help
  - 8-12 recommended
  - <5 lead to high incidence of encephalopathy
Summary of TIPS for Ascites

• Most have improvement
  – Many still require diuretics
• Most demonstrate improving nutrition
• Probably does not change mortality
  – High creatinine and high bilirubin
• Encephalopathy usually well controlled medically
  – If not controlled, TIPS reduction a must
Difficult Cases

- Occluded hepatic veins
  - Wedge catheter and needle in a small branch and proceed as usual
  - Directly enter liver through intra-hepatic portion of IVC (DIPS)

- Portal Vein Thrombosis
  - Recannalize PV and stent open
  - Reverse TIPS

- Very shrunken livers
  - Reverse TIPS
  - Other ways to make a target in the PV
Budd-Chiari Syndrome

- Hepatic vein obstruction raises portal pressure
- Hypertrophied caudate lobe (short hepatic veins)
- TIPS normally uses hepatic vein as starting point
  - Work in small hepatic vein remnant
  - Direct puncture from intrahepatic IVC
No Hepatic Vein Branches
Wire in Hepatic Artery
CO2 Injections Guide Needle Advancement
3 Dimensional Imaging of Portal
Track Dilated
TIPS Stented and Dilated
TIPS Completed

Portal-Atrial Gradient=8 mmHg
Follow-Up of TIPS
Refractory Ascites Despite TIPS
### Ultrasound Surveillance

<table>
<thead>
<tr>
<th></th>
<th>TIPS with PPG &lt;12 mmHg (n = 60)</th>
<th>TIPS Dysfunction (n = 57)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean TIPS Vmax (cm/s)</td>
<td>99.1 ± 47.5</td>
<td>84.6 ± 55.9</td>
<td>NS</td>
</tr>
<tr>
<td>Mean PV Vmax (cm/s)</td>
<td>29.8 ± 12.5</td>
<td>21.8 ± 6.3</td>
<td>&lt;0.0005</td>
</tr>
<tr>
<td>Change in Mean TIPS Vmax (%)</td>
<td>−18 ± 38</td>
<td>−25 ± 46</td>
<td>NS</td>
</tr>
<tr>
<td>Change in mean PV Vmax (%)</td>
<td>19 ± 35</td>
<td>−33 ± 23</td>
<td>NS</td>
</tr>
<tr>
<td>Flow Direction</td>
<td>52/8</td>
<td>31/26</td>
<td>&lt;0.0005</td>
</tr>
</tbody>
</table>

Once TIPS Stent Encorporated We Can Visualize Stent Lumen
TIPS Check

P-S gradient 14 mm Hg
Prepare to Place Second TIPS
Second Wire Was A Target
Track Dilated and Stent Deployed
Second TIPS to Increase Flow

P-S gradient down to 8 mm Hg
Contraindications to TIPS

• Right heart cannot handle extra flow
  – Tricuspid disease
  – CHF
  – Severe (systolic >45 mmHg) pulmonary hypertension

• Technical blockages
  – Bilateral jugular vein or SVC obstruction
  – Hepatic vein obstruction
  – Portal vein obstruction

• Liver tumor in between the hepatic veins and portal veins

• Very poor liver function

• Uncorrectable coagulopathy

• Severe encephalopathy
Other Structures Opacified
Complications of TIPS

• Access site
  – Bleeding
  – Carotid artery or jugular vein injury

• Chest
  – Cardiac injury
  – Pneumothorax

• Liver
  – Bleeding
  – Abscess
  – Bile leak
  – Infarction
  – Portal thrombosis
Systemic Effects of TIPS

- Sepsis
- Encephalopathy
- Tumor spread
Etiology of Encephalopathy

• Nitrogenous compounds allowed to bypass the liver
• Gamma-Aminobutyric acid and benzodiazepines (neurotransmitters)
Management of post TIPS Encephalopathy

• Restrict protein (<.5gm/kg/day)
• Catharsis
• Control GI bleeds
• Review medications
• Return to alcohol?
• Lactulose (15-45 ml q8-12 for 2-3 stools/day)
• Neomycin or metronidazole
• Branched chain amino acid diet
• Flumazenil, bromocriptine to block GABA
Reducing a TIPS

- Hemolysis
- Uncontrollable encephalopathy
- Avoid occluding the TIPS—leads to severe ill effects (hemorrhage, hypotension, acidosis)
- Additional hour-glass shaped stent placed
BRTO
TIPS Check for UGI Bleeding
TIPS Check For Recurrent Massive UGI Bleeding
Spleno-Renal Shunt

Catheter in short gastric vein branch of splenic vein
Aggressive Embolization
Parallel TIPS Created

PSG 6-7 mmHg
“Afferent Gastric Veins”

“Potential Draining Veins”

Gastric Variceal Anatomy
B-RTO

(Balloon Retrograde Transvenous Obliteration)
B-RTO Appearance on Endoscopy

- Gastric Vein
- Stomach
- Drainage Vein
Catheterized Spleno-Renal Shunt
CORONAL PLANE
(DYNA CT)

Gastro-renal Shunt

TIPS

Occlusion Balloon
SAGITTAL PLANE (DYNA CT)

Stomach

Gastric Varix
CT PRE and Post BRTO

PRE B-RTO

72 HRS POST B-RTO

Bleeding Gastric Varices

Thrombosed Gastric Varices
CT PRE and Post BRTO

PRE B-RTO

72 HRS POST B-RTO

SAGITTAL (MDCT)

Patent Gastrorenal Shunt

Thrombosed Gastrorenal Shunt
B-RTO Indications

- **Gastric Varices**
  - Prophylactic Management – High Risk GV
    - Poor TIPS candidates (B-RTO alone)
    - B-RTO as adjunct to TIPS
  - Acute Management – Bleeding GV
    - Adjunct (to TIPS and Endoscopic Glue Therapy)

- **Refractory Hepatic Encephalopathy**
  - B-RTO alone
  - B-RTO with partial splenic artery embolization
B-RTO

- Procedural success (>90%)
- Recurrent bleeding (<10%)

- Worsening esophageal varices (10-30%)
- Non-target embolization (rare)
- Gastric Ulceration (rare - case report)
- Hemoglobinurin (50%)
Conclusions

• TIPS a valuable adjunct in the management of symptomatic portal hypertension

• Procedure provides high technical success with good clinical outcomes in carefully selected patient population