TIPS:

A Discussion of Portal Hypertension and the Transjugular Intrahepatic Portocaval Shunt

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Objectives

- Patient Presentation
- Discussion of portal hypertension
- Esophageal varices: pathophysiology and treatment options
- TIPS procedure: indications, methods, complications
- Patient outcome
Patient Presentation

- Pt JC is a 54 y/o African-American man who was brought to BIDMC via EMS for vomiting profuse amounts of blood.
- Past medical history includes hypertension, hepatitis C, alcoholism, Child Class A cirrhosis, and known esophageal varices (pt had undergone variceal banding 2 weeks prior).
- Social history was significant for a history of IV drug abuse and alcohol abuse.
Upon arrival at the patient’s home, EMS noted that JC’s blood pressure was 40/palpable.

Upon arrival to BIDMC, JC was resuscitated per ACLS protocol. Nasogastric lavage showed bright red blood that did not clear with 1 L saline; the patient was then intubated. A nasogastric tube and Blakemore tube were placed.

Physical Exam on admission:

- VS: pulse 100, BP 127/61, RR 12, O2 sat 98%
- Physical exam was significant for blood coming from nares and mouth. Rest of physical exam was within normal limits.
Patient Presentation (cont.)

- **Resuscitation included the following:**
  - 8 units PRBC
  - 4 units FFP
  - 5-6 L normal saline

- **Labs:**

  
  9.8
  
  7.7
  
  133
  
  23.3

- **JC was started on IV octreotide and admitted to the MICU for bleeding esophageal varices.**
Portal Hypertension

- Portal HTN is a disorder created when there is an increase in resistance to the outflow from the portal venous system.
- Portal HTN is defined as a porto-systemic pressure gradient greater than 5 mm Hg.
  - Pressures measured include IVC pressure and wedged hepatic vein pressure (which is essentially equal to portal vein pressure)
  - Porto-systemic pressure gradient = wedged hepatic vein pressure - IVC pressure
Etiologies of Portal HTN

- **Prehepatic- proximal to sinusoids**
  - Thrombosis/narrowing of portal vein (e.g. splenic vein thrombosis)
  - Tumor around porta hepatis
  - Schistosomiasis (most common worldwide, rare in US)

- **Intrahepatic- within sinusoids**
  - Alcoholic cirrhosis (most common in US)
  - Cirrhosis from hepatitis
  - Nodular regenerative hyperplasia
  - Primary biliary cirrhosis
  - Primary sclerosing cholangitis

- **Posthepatic- distal to sinusoids**
  - Budd-Chiari Syndrome
  - Right heart failure (e.g. constrictive pericarditis, myopathy)
Manifestations of Portal HTN

The only definitive cure for portal HTN is liver transplantation!

CT with contrast of cirrhosis in different patient

- Ascites
- Cirrhotic liver with irregular border
- Gastric varix
- Splenomegaly
CT with contrast of cirrhosis in different patient
**Child-Pugh Classification**

- **Criteria for assessing hepatic functional reserve**

<table>
<thead>
<tr>
<th>Points</th>
<th>1 point</th>
<th>2 points</th>
<th>3 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum bilirubin (mg per 100 ml)</td>
<td>&lt;2</td>
<td>2-3</td>
<td>&gt;3</td>
</tr>
<tr>
<td>Serum albumin (g per 100 ml)</td>
<td>&gt;3.5</td>
<td>2.8-3.5</td>
<td>&lt;2.8</td>
</tr>
<tr>
<td>Prothrombosis time (increase in seconds)</td>
<td>1-3</td>
<td>4-6</td>
<td>&gt;6</td>
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<tr>
<td>Ascites</td>
<td>None</td>
<td>Slight</td>
<td>Moderate</td>
</tr>
<tr>
<td>Neurologic disorder</td>
<td>None</td>
<td>Minimal</td>
<td>Advanced, &quot;coma&quot;</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Class</th>
<th>30-day mortality after acute esophageal bleed</th>
<th>1-year mortality after esophageal bleed</th>
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<tbody>
<tr>
<td>Child Class A (5-6 points)</td>
<td>10%</td>
<td>24%</td>
</tr>
<tr>
<td>Child Class B (7-9 points)</td>
<td>30%</td>
<td>45%</td>
</tr>
<tr>
<td>Child Class C (10-15 points)</td>
<td>50%</td>
<td>85%</td>
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Collateral Circulation

The increased resistance to blood flow through the portal system results in the formation of collateral circulation between the portal and systemic venous systems that function to bypass the liver bed.

Esophageal Varices

- Created as blood is diverted from the path of greater resistance (liver bed) to lesser resistance (collateral circulation)

- Formed when the portal venous pressure gradient is greater than 12 mm Hg. Thus, the goal of treatment of varices is to decrease the pressure gradient.

- Diagnosed by endoscopy

- High mortality
  - Most common cause of death in cirrhotics
  - Mortality is 25-30% (50% in Child Class C patients)
Esophageal Varices

Treatment of Bleeding Varices

- Resuscitation
  - Assess hemodynamic status, give fluid and blood products
- Pharmacotherapy
  - Vasopressin, nitroglycerine, beta blockers, octreotide
- Endoscopic diagnosis and treatment
  - Mainstay of treatment of bleeding varices - stops bleeding in 80-90% of patients
  - Sclerotherapy and banding
- TIPS
- Surgical shunts
  - 50% mortality during bleeding episode because patients who are acutely bleeding have low hepatic reserve
Surgical Shunts

Transjugular Intrahepatic Portocaval Shunt (TIPS) Procedure

- Radiologic procedure in which a shunt is created between hepatic and portal veins and held open by a metallic stent

- Accepted indications
  - Variceal bleeding refractory to endoscopic therapy
  - Recurrent variceal bleeding
  - Refractory Ascites

- Possible indications
  - Hepatorenal syndrome
  - Budd-Chiari Syndrome
TIPS

Advantages
- General anesthesia not necessary
- Can be performed semi-emergently
- Treats underlying portal hypertension
- Recurrent bleeding less likely
- Liver transplantation is still an option

Disadvantages
- High rate of stent stenosis leads to recurrent portal HTN within 2 years
- Hepatic encephalopathy twice as common
- No change in mortality
TIPS: Steps of the Procedure

All images are from our patient’s procedure
TIPS- Steps

1. Right internal jugular vein accessed using U/S
2. Guidewire and TIPS sheath advanced to R atrium and pressures are recorded
3. Curved catheter advanced in IVC into hepatic vein (usually right hepatic vein)
Catheterizing Hepatic Vein

- Catheter in IVC
- Catheter in middle hepatic vein
- Blakemore tamponade balloon
- Nasogastric tube
Steps (cont.)

4. Hepatic venogram performed using contrast or CO$_2$ (CO$_2$ often opacifies portal system as well)

5. IVC, hepatic vein, and hepatic wedge pressures recorded
Contrast injected into hepatic vein opacifying hepatic venous system, including portal vein (DSI)
6. Transjugular puncture needle advanced into hepatic vein and directed toward portal vein
7. Needle advanced through liver parenchyma to portal vein (syringe is aspirated to observe for blood return)
8. When blood is aspirated, the catheter is advanced through the tract and contrast is injected to identify the vessel entered
   • If extrahepatic portal vein is entered, have possibility for hemorrhage and exsanguination
Needle insertion from hepatic vein to portal vein

Catheter tip

Needle tract through liver parenchyma from hepatic to portal vein

Needle tip

Blakemore tamponade balloon in esophagus
Tract Formation with contrast injection (DSI)

- Catheter in hepatic vein
- Right portal vein
- Portal vein
TIPS

9. Tract is dilated using angioplasty balloon
10. Stent is placed through entirety of tract from hepatic vein to portal vein
11. Portal pressures are recorded to ensure porto-systemic pressure gradient is < 12 mm Hg
12. Portal venogram performed
Stent placement (DSI)

- Hepatic vein with catheter
- Metallic stent through liver parenchyma
- Portal vein
- Splenic vein
- Superior mesenteric vein
Results of TIPS

- 95% of TIPS are successfully placed
- 15% of patients rebleed in 6 months
- 25-37% of stents stenose within 6 months
- Most patients have resolution of ascites within 1 month
Complications

- **Technical**
  - Complications accessing hepatic vein
  - Traversal of liver capsule
  - Tract creation to hepatic artery, bile ducts, or extrahepatic portal vein

- **Portosystemic shunt complications**
  - Hepatic encephalopathy
    - most common complication
    - occurs in 30% of patients post-TIPS
    - Treated by reversing precipitating factors (dehydration, azotemia, etc.), lactulose, and neomycin
Complications (cont.)

- **TIPS-related**
  - **Stent thrombosis**
    - Causes recurrent portal HTN within few weeks of procedure and is usually diagnosed by recurrent variceal bleeding
    - Treated by local anticoagulation
    - Studies do not recommend prophylactic anticoagulation before procedure
  - **TIPS stenosis**
    - Most common cause of recurrent portal HTN
    - Caused by proliferation of tissue surrounding stent
    - Very common- 75% of pts have stenosis within 6-12 months, almost 100% within 2 years
    - Monitored by Doppler U/S and angiography
    - Treated by angioplasty
  - **Hemolytic anemia**
    - In 10% of patients
    - Spontaneously resolves within 12 months
Followup after TIPS

- Doppler ultrasonography is the primary modality used to evaluate patency of shunt
  - Performed at 1 day, 1 month, every 3 months for first year, then every 6 months.

- Portal venogram is the “gold standard” test to evaluate shunt dysfunction
  - Intervention, including angioplasty of stenoses, can be performed in angiography suite
Our Patient’s Results

- IVC Pressure - 21 mm Hg
- Before TIPS:
  - Portal vein pressure - 55 mm Hg
  - Portosystemic Gradient - 34 mm Hg
- After TIPS:
  - Portal vein pressure - 32 mm Hg
  - Portosystemic Gradient - 11 mm Hg

*(Critical value for bleeding is 12 mm Hg)*
Patient Outcome

During JC’s hospital course, he received a total of 23 units PRBC, 12 units FFP, and 3 units of cryoprecipitate.

- After TIPS, the patient did not have any further variceal bleeding, and Doppler U/S showed good blood flow through the TIPS stent.
- The patient was extubated on post-TIPS day 6 and did not develop any signs of hepatic encephalopathy. He was discharged home on day 10 with a Hb 12.6 g/dL and Hct 38.2%.
Conclusions

- TIPS is a minimally invasive procedure for the treatment of bleeding esophageal varices and other sequelae of portal hypertension, but is only to be used after endoscopic therapy has failed.
- TIPS addresses portal hypertension itself, not just esophageal varices.
- TIPS is a good short-term solution, but the shunt rarely remains patent for more than 2 years.
- There is a decrease in recurrent variceal bleeds, but there is no decrease in mortality from portal hypertension with TIPS.
References

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