Portal Hypertension

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Anatomy of Portal System

The portal vein supplies 70% of the blood flow to the liver, but only 40% of the liver oxygen supply. The remainder of the blood comes from the hepatic artery, and blood from both of these vessels mixes in the sinusoids.
Definition

- Portal hypertension is defined as a pressure > 12 mmHg.
- The normal pressure of portal vein is:

5-10 mmHg (13~24 cmH$_2$O)
Pathophysiology

- The increased pressure in the portal system results from a functional obstruction to blood flow from any point in the portal system's origin (in the splanchnic bed) through the hepatic veins (exit into the systemic circulation) or from an increase in blood flow in the system.
Four sites of communicans between portal and systemic circulations

- esophageal and gastric veins
- inferior rectal-anal veins
- anterior abdominal wall veins
- retroperitoneal venous plexus
Portal hypertension should be divided into three types according to the site of blood flow obstruction.

Etiology & Types
Types

- Pre-hepatic
- Intra-hepatic
  - pre-sinusoidal
  - Sinusoidal
  - post-sinusoidal
- Post-hepatic
Pre-hepatic type

- The portal vein trunk itself obstruction.
  - Congenital deformity: obliteration, stenosis
  - Thrombosis: portal vein thrombosis, splenic vein thrombosis, ect
  - Infection: Tropical splenomegaly, ect
  - Trauma: arterio-venous fistula, ect
Intra-hepatic type

- About 95% patients belong to this type of portal hypertension
- A classification by pathology:
  - pre-sinusoidal obstructions
  - sinusoidal obstructions
  - post-sinusoidal obstructions
Pre-sinusoidal obstruction

- **Schistosomiasis cirrhosis.**
  Schistosomiasis eggs deposit in small branches of portal vein, resulting in obstruction of blood flow and increase of portal vein pressure.
- **Primary biliary cirrhosis**
- **Chronic active hepatitis**
Schistosomiasis Cirrhosis

Schistosomiasis eggs
Sinusoidal obstruction

- **Cirrhosis**
  - Post hepatic cirrhosis,
  - Alcohol cirrhosis,
  - Cryptogenic cirrhosis,
  - Metabolic liver disease (e.g. Wilson's Disease)

- **Non-cirrhotic**
  - Cytotoxic drugs,
  - Vitamin A intoxication.
liver cirrhosis
Pseudolobules formation in liver cirrhosis
The regeneration nodules distort the vascular tree, impeding the flow of blood.
Post-sinusoidal obstruction

- **Budd-Chiari syndrome**
  - Obstruction of hepatic veins or inferior vena at hepatic level due to congenital deformity or thrombosis, called Budd-Chiari syndrome.

- **Veno-occlusive disease**
Post-hepatic type

- Posthepatic obstruction occurs at any level between liver and right heart, including
  - Hepatic vein thrombosis,
  - IVC thrombosis,
  - IVC congenital malformation,
  - Constrictive pericarditis.
Pathophysiology

- Congestive splenomegaly
- Porta systemic communicans dilatation
- Ascites
Symptoms and Signs (1)

• Congestive splenomegaly and hypersplenism
  – Splenomegaly is defined as the spleen size >12cm in length.
  – Hypersplenism is a type of disorder which causes the spleen to rapidly and prematurely destroy blood cells.
Splenomegaly
Splenomegaly
Symptoms and Signs (2)

- Porta systemic communicans dilatation:
  - Esophageal and gastric veins: varices rupture and gastrointestinal hemorrhage
  - Inferior rectal-anal veins: hemorrhoid & bleeding
  - Anterior abdominal wall veins: paraumbilical varices (caput medusae)
  - Retroperitoneal veins plexus: dilatation & congestion
Caput Medusae
Esophageal varices
Symptoms and Signs (3)

- **Ascites**
  - Disordered albumin synthesis and decreased plasma colloid osmotic pressure caused by hepatocellular function damage
  - Increased capillary filter pressure due to increased portal hypertension
  - Lymph liquid leakage into abdominal cavity from surface of the liver because of lymph back-flow obstruction
  - Salt and water retention by aldosterone and antidiuretic hormones deactivation disturbance
Ascites
Symptoms and Signs (4)

• Non-specific systemic symptoms:
  – Fatigue
  – Lethargy
  – Loss of appetite
Diagnosis and Differential Diagnosis
Diagnosis

- **Medical history:** Hepatitis, schistosomiasis, alcohol, or drugs?
- **Clinical presentation:** Splenomegaly and hypersplenism, hematemesis and melena, ascites
- **Lab exams and images**
Laboratory Exams & Images

- Blood: WBC↓, Plt↓
- Liver Function: albumin↓, A/G ratio reversing, prothrombin time↑
- Markers of hepatitis B or C
- Ultrasound
- CT/MRI
- Esophageal endoscopy
- Esophageal barium swallow
- Angiography
Images

- Ultrasound and Doppler: cirrhosis, splenomegaly, ascites, thrombosis and occlusion of the portal, superior mesenteric and splenic vein, enlargement of portal vein > 13mm and of splenic vein > 10mm
Images

• CT scan
Images

- Esophageal endoscopy:
  white, pink, red, cherry red varices
Images

- Esophageal endoscopy
Images

- Esophageal barium swallow

Multiple irregular filling defects as “string of beads” or “earthworm”
Images

- Angiography

Normal

Portal hypertension
Differential Diagnosis

- ♠ Peptic ulcer
- ♦ Gastritis
- ♦ Gastric cancer
- ♣ Biliary tract involvement
Treatment

- Non-surgical treatment during Massive Variceal Bleeding
- Management of Ascites
- Surgical treatment
Evaluation of liver function reserve
## Child-Pugh Classification

<table>
<thead>
<tr>
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<th>Points</th>
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<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Bilirubin (mg/dL)</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>&gt; 3.5</td>
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<tr>
<td>Prothrombin time (seconds ↑)</td>
<td>1 – 3</td>
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<tr>
<td>Ascites</td>
<td>None</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>None</td>
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</tbody>
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Grade A, 5-6 points; Grade B, 7-9 points; Grade C, 10-15 points
Child-Pugh classification of liver function

Class A (low operative risk): 5 or 6 points
Class B (moderate risk): 7 to 9 points
Class C (high risk): 10 to 15 points
Non-surgical treatment for Massive Variceal Bleeding

- Anti-shock
- Pharmacotherapy and control of bleeding
  - vasopressin
  - sandostatin
  - Beta blockers (propranolol)
Non-surgical treatment for Massive Variceal Bleeding

- Local treatment
  - Endoscopic variceal sclerotherapy or banding
  - Balloon tamponade
- TIPS (Transjugular interhepatic portasystemic shunts)
Endoscopic Banding
Endoscopic Variceal Sclerosis or Ligation
Endoscopic Sclerotherapy

Intravariceal

Paravariceal
Balloon tamponade

(Life-saving procedure)
Balloon tamponade

Sengstaken-Blakemore tube (1950)

- Esophageal balloon (100-150ml)
- Gastric balloon (150-200ml)
- One lumen to gastric balloon
- One lumen for gastric aspiration
- One lumen to esophageal balloon
TIPSS

Transjugular intrahepatic portasystemic stent-shunt

- TIPSS is a small, tubular metal device commonly called a stent that is placed in veins in the middle of the liver to permit blood flow to bypass the liver.
- In a TIPSS procedure, interventional radiologists use image guidance to make a tunnel through the liver to connect the portal vein to one of the hepatic veins. A stent is then placed in this tunnel to keep the pathway open.
TIPSS

Transjugular Intrahepatic Portasystemic Stent-Shunt
TIPSS
TIPSS

Transjugular intrahepatic portasystemic shunt

A TIPSS is used to treat the complications of portal hypertension, including:

- Variceal bleeding, bleeding from any of the veins that normally drain the stomach, esophagus, or intestines into the liver.
- Portal gastropathy, an engorgement of the veins in the wall of the stomach, which can cause severe bleeding.
- Severe ascites (the accumulation of fluid in the abdomen) and/or hydrothorax (in the chest).
- Budd-Chiari syndrome, a blockage in one or more veins that carry blood from the liver back to the heart.
Management of Ascites

- Salt restriction
- Diuretic therapy
- Paracentesis
- Peritoneal venous shunt
Surgical treatment

- Splenectomy
- Portosystemic shunt or bypass
- Extensive devascularization around the cardia
- Liver transplantation
Splenicectomy

- Reduction of portal blood flow
  Because of “Higher volume, Higher pressure”
Portosystemic shunt or bypass

- Anastomose the portal vein or its main branches (splenic vein and superior mesenteric vein) to vena cava or its main branches (renal vein) by use of operative procedures, and put the hypertensive portal blood flow into the low-pressured inferior vena cava.
- To reduce the portal vein pressure and thus decrease the blood flow through collateral venous beds
portacaval end-to-side shunt

portacaval side-to-side shunt
mesocaval shunt

splenorenal shunt
Limited Side-to-Side Portacaval Shunt
Selective distal splenorenal shunt (Warren’s operation)

During the surgery, the splenic vein is detached from the portal vein and reattached to the left renal vein.
Devascularization operations

- Disconnection of the venous circulation of the distal esophagus and cardiac from the hypertensive portal circulation by division of all the feeding vessels.
  - Ligation of lower esophageal and gastric variceal veins
  - Disconnection of cardiac portal systemic venous shunt
  - Resection of lower esophagus and gastric fundus
  - Esophagogastrostomy
Devascularization operations
Liver transplantation

✓ Liver transplantation is potentially applicable to any acute or chronic condition with irreversible liver dysfunction.

✓ Most liver transplants are performed for chronic liver diseases that lead to irreversible scarring of the liver, or cirrhosis of the liver.
Liver transplantation
Thanks for your attention!