Portal Hypertension

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Lecture contents- PH

- anatomy of splanchnic, extrahepatic circulation
- Basic facts – liver physiology
- PH- definitions
- PH- Pathophysiology
- PH- Etiologies
- PH- Clinical features (History, physical exam, complications , lab tests, Child – Pugh classification)

- **Treatment for ACUTE Variceal hemorrhage**
- **Prevention of recurrent hemorrhage**
The extrahepatic portal venous circulation
Basic facts about liver’s physiology

- dual blood supply: portal venous and hepatic arterial
- Hepatic blood flow averages 1500 mL/minute
- portal vein contributes two thirds of the total hepatic blood flow
- hepatic arterial perfusion accounts for more than half of the liver's oxygen supply
Definitions:

- portal venous pressure > 5 mmHg
- collaterals > 10 mmHg
- bleeding > 12 mmHg
Portal hypertension

casted by:

(1) increased intrahepatic resistance
(2) increased splanchnic blood flow
Etiologies:

- Pre-hepatic
- Hepatic
- Post-hepatic
prehepatic

• portal vein thrombosis
• Congenital atresia or stenosis of portal vein
• splenic vein thrombosis
• left sided portal hypertension (inflammation – tumor)
• Splanchnic arteriovenous fistula
intrahepatic - presinusoidal

Primary biliary cirrhosis (early stage)
• Idiopathic portal hypertension (early stage)
• Myeloproliferative diseases
• Polycystic disease
• Hepatic metastasis
• Schistosomiasis
• Hepatic fibrosis
intrahepatic - sinusoidal / post-sinusoidal

- Hepatic cirrhosis
- Acute alcoholic hepatitis
- Schistosomiasis (advanced stage)
- Primary biliary cirrhosis (advanced stage)
- Idiopathic portal hypertension (advanced stage)
- Acute and fulminant hepatitis
- Congenital hepatic fibrosis
intrahepatic - sinusoidal / post-sinusoidal

• Vitamin A toxicity
• Venoocclusive disease
• Budd-Chiari syndrome
Post- hepatic

- Inferior vena cava (IVC) obstruction
- Right heart failure
- Constrictive pericarditis
- Tricuspid regurgitation
- Budd-Chiari syndrome
- Veno-occlusive disease
- Arterial-portal venous fistula
- Increased portal blood flow
- Increased splenic flow
Cirrhosis

- Alcohol
- Viral: hepatitis B & C
- Cholestatic: primary biliary cirrhosis, Autoimmune cholangitis, primary sclerosing cholangitis
- Autoimmune: AIH
- Metabolic: hemochromatosis, Wilson’s, alpha 1 – antitrypsin deficiency
- Cardiac: cardiac cirrhosis
Cirrhosis

• two major phenomena:
  loss of cell mass  -  hepatocellular failure

  increased hepatic vascular resistance  -  portal hypertension
Clinical Features- History:

- Jaundice
- Pruritus, fatigue, steatorrhea, deficiencies of fat-soluble vitamins
- Past history of chronic alcoholism/hepatitis/ complicated biliary dis./exposure to hepatotoxins
Clinical Features- complications of portal HTN:

- Melena, Hemoptysis, Hematochezia *(variceal GE bleeding)*
- **Ascites**
- fever, pain (SBP)
- **Splenomegaly (hypersplenism)**
Physical examination:

- spider angiomas
- palmar erythema
- Clubbing
- Dupuytren contracture
- Testicular atrophy
- Muscle wasting
- Gynecomastia

- A palpable spleen suggests portal HTN
- Firm and irregular liver edge

- Shifting dullness (=ascites)
- Dilated abdominal veins
- Impaired mental status
- Asterixis
Ascites
Caput medusa
Palmar erythema
Gynecomastia
Dupuytren contracture
Laboratory Tests

- serum alanine and aspartate aminotransferases (ALT and AST)
- alkaline phosphatase, glutamyl transpeptidase (GGT)
- direct and total serum bilirubin
- albumin
- prothrombin time.
- hepatitis serology
- autoimmune markers –
  - primary biliary cirrhosis (antimitochondrial antibody; AMA)
  - sclerosing cholangitis (peripheral antineutrophil cytoplasmic antibody; P-ANCA)
  - autoimmune hepatitis (antinuclear, smooth-muscle, and liver-kidney microsomal antibody)
### Hepatic Functional Reserve

#### Child – Pugh classification

<table>
<thead>
<tr>
<th>points</th>
<th>1</th>
<th>2</th>
<th>3</th>
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</thead>
<tbody>
<tr>
<td>albumin (g/dl)</td>
<td>&gt; 3.5</td>
<td>2.8 – 3.5</td>
<td>&lt; 2.8</td>
</tr>
<tr>
<td>bilirubin (mg/dl)</td>
<td>&lt; 2</td>
<td>2 – 3</td>
<td>&gt; 3</td>
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<tr>
<td>PT (sec prolonged)</td>
<td>1 – 4</td>
<td>4 – 6</td>
<td>&gt; 6</td>
</tr>
<tr>
<td>ascites</td>
<td>none</td>
<td>mild</td>
<td>moderate</td>
</tr>
<tr>
<td>encephalopathy</td>
<td>none</td>
<td>minimal</td>
<td>marked</td>
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</table>
Hepatic Functional Reserve

Pugh score $5 – 6 = \text{Child’s A}$
- good hepatic reserve
- good operative candidate $< 5 \% \text{ mortality}$

Pugh score $7 – 9 = \text{Child’s B}$
- moderate hepatic reserve
- modest operative candidate $10 – 15 \% \text{ mortality}$

Pugh score $10 – 15 = \text{Child’s C}$
- low hepatic reserve
- poor operative candidate $> 25 \% \text{ mortality}$
Variceal hemorrhage

- Bleeding: portal pressure exceeds 12 mm Hg

• **most life-threatening** complication of **portal hypertension**

• responsible for **one third of all deaths** in patients with **cirrhosis**

• **risk for death** from bleeding is mainly related to the **underlying hepatic functional reserve**.
Treatment of the Acute Bleeding Episode

- Resuscitation

- Emergency treatment should be **nonoperative** whenever possible.
  - **Endoscopic** treatment (sclerosis or ligation)
  - Balloon tamponade
  - Pharmacotherapy
  - TIPS
  - Emergency **surgical** intervention
Resuscitation and Diagnosis

- Restoration of circulating blood volume
  - isotonic crystalloid solutions
  - Six units of blood for typing and cross matching

- Volume status assessment: cvp, urinary output,

- Give **FFP** if PT is prolonged more than 3 sec.

- **Platelet transfusions** only when platelet count less than 50,000

- **Prophylactic antibiotics** are initiated
Pharmacologic therapy

- **Splanchnic vasoconstrictors**: Somatostatin efficacious as endoscopic treatment for control of acute variceal bleeding
- Central role when endoscopic treatment is unlikely to be effective
- Combination of octreotide and endoscopic therapy more effective in controlling bleeding than octreotide alone
Balloon-tube tamponade

4- lumen:
- esophageal balloon
- gastric balloon

- Gastric aspiration tube
- Accessory N-G tube (suctioning of secretions above the esophageal balloon)
Balloon Tamponade
Balloon Tamponade

- **lifesaving** when **exanguinating hemorrhage** /when endoscopic treat Failed.
- **advantages**:
  - immediate cessation of bleeding in more than 85% of patients
  - widespread availability of device
- **Disadvantages**:
  - frequent recurrent hemorrhage
  - definitive treatment is planned
  - **lifesaving** when **exanguinating hemorrhage** /when endoscopic treat Failed.

  - lethal **complications**: esophageal perforation, ischemic necrosis of esophagus, aspiration
Endoscopic Treatment

• most commonly used therapy
• Acute setting- sclerotherapy/band ligation equally efficacious
• Both stop bleeding in 80-90% of pts
• Failure of endoscopic treatment is declared when two sessions fail to control hemorrhage.
Endoscopic injection sclerotherapy

EIS

- Injecting above esophagogastric junction
- Subsequent treatment session is planned for 4 to 6 days later
- Minor common complications: retrosternal chest pain, esophageal ulceration, and fever
- Serious complications: esophageal perforation, worsening of variceal hemorrhage, and aspiration pneumonitis
Endoscopic injection sclerotherapy (EIS)
Endoscopic ligation of esophageal varices
TIPS- Transjugular Intrahepatic Portosystemic Shunt

• *portal decompression without an operation*
• *not recommended as initial therapy for acute variceal hemorrhage*  
  • used only after endoscopic therapy and pharmacotherapy have failed  
  • short-term bridge to liver transplantation for patients in whom endoscopic treatment has failed  
  • Tips better than emergency operation for Patients with advanced hepatic functional decompensation when less invasive approaches fail to control bleeding.

• Disadvantage: shunt occlusion( develops in half of patients within 1 year of TIPS insertion)

• **Absolute contraindications**: right-sided heart failure and polycystic liver disease

• **Relative contraindications**: portal vein thrombosis, hypervascular liver tumors, encephalopathy
Transjugular intrahepatic portosystemic shunt

- **Access**: puncture through a hepatic vein
- **Creation of parenchymal tract** between hepatic and portal veins with balloon catheter
- **Creation of shunt**: inserting a 10-mm **expandable metal stent**
Transjugular Intrahepatic Portosystemic Shunt
Emergency Surgery

- used
  - only after endoscopic therapy and pharmacotherapy/ TIPS have failed
  - in hemorrhage from gastric varices
  - failure of long-term endoscopic therapy
    - selection of emergency operation guided by experience of the surgeon.
    - options: transesophageal ligation, emergency portal-systemic shunt, mesocaval/ splenorenal shunt, Esophageal transection
    - **nonselective portocaval shunt** have most immediate and durable effect in acute setting
    - In potential liver transplant candidates- mesocaval shunt or central splenorenal shunt recommended.

- major disadvantage of emergency surgery - operative mortality rates exceed 25% in most reported series.
- Early postoperative mortality related to status of hepatic functional reserve
Emergency Surgery: Esophageal transection

- Consists of: esophageal transection, paraesophagogastroduodenal devascularization, splenectomy and either selective vagotomy with pyloroplasty/ highly selective without pyloroplasty
- High Initial/late mortality rates, high rebleeding rates
Prevention of Recurrent Hemorrhage

- **Goal**: long-term prevention of rebleeding, maintenance of hepatic function

- **Options**: pharmacotherapy, chronic endoscopic treatment, TIPS, shunt operations (nonselective, selective, and partial), hepatic transplantation

- **Repeated endoscopic** therapy sclerotherapy or banding eradicate varices and prevent rebleeding in up to 80% of patients in first year

- **Combining endoscopy** (sclerotherapy/banding) with pharmacotherapy most effective
prevention of recurrent bleeding: Pharmacotherapy

- **Objective:** reducing HVWP **below 12 mm Hg**
- Use of beta-adrenergic blockade or octreotide significantly reduce rebleeding rates in combination with endoscopic therapy
- combining variceal ligation and pharmacotherapy with β-blockade - more effective than variceal ligation alone
prevention of recurrent bleeding: Chronic Endoscopic Therapy (1)

- **Most common** treatment for prevention of recurrent variceal hemorrhage.
- **Objective:** eradicating esophageal varices
- is a rational initial treatment for patients bleeding from esophageal varices
- **But:** subsequent treatment with TIPS/ operation/ hepatic transplantation is anticipated for many

- variceal eradication successful in about two thirds of patients
- After achieving eradication- diagnostic endoscopy performed at 6-month to 1-year intervals
- Increased frequency of bleeding from gastric varices and PHG after eradication of esophageal varices
- uncontrolled hemorrhage/multiple major episodes of rebleeding/ hemorrhage from gastric varices - all require using other treatment modality
Transjugular Intrahepatic Portosystemic Shunt

• nonselective shunt

When should we use it?
• ideal therapy when only short-term portal decompression is required:
  1. liver transplantation candidates who fail endoscopic or pharmacotherapy
  2. patients with advanced hepatic functional decompensation who are unlikely to survive long enough for TIPS to malfunction

✓ Advantages:
• Fewer patients rebled after TIPS than after endoscopic treatment (RCTs)

✓ Disadvantage:
• major limitation: high incidence of shunt stenosis/thrombosis within first year
• encephalopathy significantly more common in TIPS patients (RCTs)
Portosystemic Shunts-

- **most effective** means of preventing **recurrent bleeding** in PH
- Decompress portal venous system by shunting portal flow into the low-pressure systemic venous system.

- **adverse consequences** - portosystemic **encephalopathy**, accelerated hepatic failure

- Who should use it?
  - patients with relatively **well-preserved liver function** (Child class A,B) **not candidates for liver transplantation**

**classification: nonselective, selective, partial**

- goal of selective and partial portosystemic **portal perfusion**

<table>
<thead>
<tr>
<th>Table 30-6 Surgical Shunts to Reduce Portal Venous Pressure</th>
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<tbody>
<tr>
<td><strong>Nonselective</strong></td>
</tr>
<tr>
<td>End-to-side portacaval shunt</td>
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<tr>
<td>Side-to-side portacaval shunt</td>
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<tr>
<td>Large diameter interposition shunts (e.g., mesocaval)</td>
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<tr>
<td>Central splenoportal shunt</td>
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<tr>
<td><strong>Selective</strong></td>
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<tr>
<td>Distal splenoportal (Warren)</td>
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<tr>
<td>Small-diameter portacaval H graft shunt</td>
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Nonselective Shunts

- **completely divert** portal flow
- **Hence, effectively decompress varices. But** - frequent complications - postoperative **encephalopathy** and accelerated hepatic failure
- nonselective shunt is constructed **only when a TIPS cannot be done or fails**
- Presently, **only rarely indicated**
- effectively **relieve ascites** and **prevent variceal hemorrhage**
- **Include**: end-to-side portacaval shunt (Eck fistula), the side-to-side portacaval shunt, large-diameter interposition shunts, and the **conventional splenorenal shunt**
Nonselective shunts
Nonselective shunts

- **Synthetic grafts**
  - major disadvantage- **high graft thrombosis** rate (35%)
- **autogenous vein** (internal jugular vein)
- Advantages- relatively **easy to construct**, hepatic hilum is avoided
survival data from controlled investigations of the therapeutic portacaval shunt

• **most common cause of death** in shunted patients: accelerated hepatic failure

• **important findings:**
  - reliable control of bleeding in shunted patients
  - variceal rebleeding in more than 70% of medically treated patients
  - spontaneous, often severe, **encephalopathy** in 20% to 40% of shunted patients.
selective variceal decompression

- 1967 Warren (+colleagues) - distal splenorenal shunt
- 1968 - Inokuchi and associates - left gastric–vena caval shunt
left gastric–vena caval shunt

- interposition of vein graft between **left gastric vein** and **inferior vena cava**
- **directly** and **selectively** decompresses esophagogastric varices
- Only **minority** of patients with **portal hypertension** have appropriate anatomy for this operation
Distal splenorenal shunt (1)

- Anastomosis of distal end of splenic vein to the left renal vein
- Interruption of left gastric, gastroepiploic veins
- Separation of portal venous circulation into decompressed gastrosplenic venous circuit, and high-pressure superior mesenteric venous system

- **Contraindications:**
  - Patients with medically intractable ascites
  - Prior splenectomy
  - (Relative) splenic vein diameter less than 7 mm

- **Key questions:** How effective is it in preserving hepatic portal perfusion? Is it superior to nonselective shunts (survival)? Is it more effective than TIPS for long-term control of variceal bleeding?
Distal splenorenal shunt(2)

- Preservation of portal flow in more than 85% of patients during early postoperative interval
- high-pressure mesenteric venous system gradually collateralizes to low-pressure shunt
- result: loss of portal flow in about half of patients by 1 year
- degree of portal flow preservation depend on both the cause of portal hypertension and technical details of the operation
distal splenorenal shunt
Partial Shunts

- **Objectives** – same as for selective
- interposition of small-diameter portacaval shunt
- hepatic portal perfusion preserved in most patients
- prospective randomized trial: **partial** vs. **nonselective** portacaval shunts
  - less encephalopathy after partial shunt
  - similar survival for both types of shunts
Partial Shunts
Nonshunt Operations

- Objectives:
  - ablation of varices
  - extensive interruption of collateral vessels

1. most effective- Sugiura: extensive esophagogastric devascularization and esophageal transection and splenectomy
  - High rebleeding rates
  - Used for:
    - unshuntable patients with diffuse splanchnic venous thrombosis
    - patients with distal splenorenal shunt thrombosis
Sugiura procedure
Hepatic Transplantation

• not a treatment for variceal bleeding per se
• Who to consider?
  patients with end-stage hepatic failure-
  nonalcoholic cirrhotic patients, abstinent alcoholic
  cirrhotic patients with limited hepatic functional
  reserve (Child's class B and C)
• not available to all patients (economic factors, limited
  supply of donor organs)
• Contraindications:
  • schistosomiasis (normal liver function)
  • active alcoholism (noncompliance)
Thank you