Surgical Hepatobiliary Diseases

M. Sinanan MD, PhD

Case 1
- 48 yo WF with RUQ, postprandial pain, fever, nausea, vomiting, and tenderness.
- US and HIDA done
- Issues
  1. Interpretation
  2. Adequate WU?

Normal Studies

Case 1
- 48 yo WF with RUQ, postprandial pain, tenderness, and US and HIDA done
- Issues
  Interpretation?

Gallstone Disease I
- Prevalence: 20% US population (52M in US)
- Female, middle aged, postpartum, + FH
  - NA population increased prevalence
- 90% cholesterol, 10% pigment in character
- 50% symptomatic, 20% over 20 yr rate of becoming symptomatic
- Symptoms tend to be similar to presentation
- Once gallstones are present, they persist
- Once symptomatic, always symptomatic
- Complications of gallstone disease:
  - acute cholecystitis
  - CBD obstruction, gastrectomy, cholecystoduodenal fistula, GB cancer
Gallstone Disease II

- **Diagnosis**
  - **History**
  - **LFT's**
    - Bilirubin < 3, elevated alkaline phosphatase, normal ALT/AST
  - **US**
    - Gallstones
    - GB size, thickness of wall, pericholecystic fluid
    - CBD diameter
  - **HIDA scan**
    - Indicates function of GB, tracer uptake, biliary tract anatomy, drainage
  - **Non-filling GB** - acute cholecystitis
  - **EF <40% with CCK** - chronic cholecystitis

- **Rx**
  - Cholecystectomy (laparoscopic, open)
  - Ursodeoxycholic acid “Actigall” (1-3 gallstones, < 1 cm diameter, noncalcified)
  - Lithotripsy
  - Cholecystostomy (acute cholecystitis in surgically unfit patient)

- **Consequences of cholecystectomy**
  - 50% have looser BM’s initially, will correct for most but 3-5% suffer long term with diarrhea
  - Bile leak, bile duct injury – 0.3%

US Images of Gallstone Disease

- Gallstones with acoustic shadow
- CBD – “railroad tracks”

Laparoscopic Cholangiogram: Normal Anatomy

Images: Lap Chole for Acute Cholecystitis

- **Steps in procedure**

Variations in Biliary Anatomy

Case 1: Outcome

Lap chole for Acute cholecystitis

Acute, necrotizing cholecystitis
**Choledocholithiasis**
- 95% of CBD stones from GB
- Untreated, 80% chance of complications: biliary obstruction, cholangitis, pancreatitis
- Management: always resolve
  1. Endoscopic – ERCP
  2. Laparoscopic/open CBD exploration during cholecystectomy
  3. Transhepatic cholangiography - PTC
- Primary CBD stones – pigment
  - Associated with biliary obstruction, stasis, foreign body
  - Oriental cholangiohepatitis

**Case 2**
- 61 yo BM with 5 kg wt loss, dark urine, clay-colored stools but no pain. Afebrile. Jaundice, mild RUQ tenderness and fullness on clinical exam. No other physical findings.
- Labs
  - LFT's: T. Bili 8, Alk Phos 680, ALT 140, AST 160, amylase 27.
- Next step?

**US – Normal liver**

**Case 2: Studies**
- Hepatitis serology
- US

**Case 2: Studies**
- US
- CT Scan

**Normal ERCP**
Case 2: Studies
- US
- CT
- ERCP

Normal MRI Biliary Tract

Normal bile duct on MRI

Studies
- US
- CT
- ERCP
- MRCP

Studies
- US
- CT
- ERCP
- MRCP
  - vs adjacent vessels

Case 2
- 61 yo WM with wt loss, dark urine, clay-colored stools but no pain
  - LFT Bili 8, Alk Phos 600, ALT 80, AST 45

Issues
- DDx
- Evaluation
- Radiographic studies
- Curative vs noncurative
- Natural history of each treatment option
- Surgical options

Painless jaundice: DDx
- Indirect bili elevation, no ductal dilation
  - Hepatitis – liver failure (usually associated symptoms)
- Direct bili elevation, no ductal dilation
  - Sclerosing cholangitis
  - Early obstruction
- Direct bili elevation, ductal dilation
  - Choledocholithiasis with obstruction
  - Periampullary malignancy
    - Pancreatic adenoca
    - Distal cholangiocarcinoma
    - Ampullary adenoca
    - Duodenal adenoca
  - Klatskin's, CBD, CHD tumor
  - RHD or LHD tumor with significant liver dysfunction
  - Other
Pattern of Extrahepatic Cholangiocarcinoma

<table>
<thead>
<tr>
<th>% of extrahepatic cholangioca</th>
<th>Prevalence</th>
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<tr>
<td>8-13%</td>
<td>#1</td>
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<td>10-26%</td>
<td>#2</td>
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<td>14-37%</td>
<td>#3</td>
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<tr>
<td>6%</td>
<td>#4</td>
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<tr>
<td>30-50%</td>
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Gallbladder cancer – 2-9X more common than ductal cholangioca

Biliary Anatomy

Gallbladder Cancer

- Present in 1/200 to 1/500 cholecystectomy specimens
- High association with gallstones
- Preop Dx
  - Continuous pain
  - RUQ mass by palpation, mass in GB on US
  - Porcelain gallbladder
- Intraop
  - "Inflammation" out of proportion to history
  - Hepatic invasion
- Postoperative
  - Pathology
- Stage 1-2 potentially cured with cholecystectomy
  - Liver wedge resection and porta lymphadenectomy for Stage 2
  - Port site recurrences
- Stage 3-4
  - Incurable
  - 3-6 mo median survival
  - Chemo and XRT-unresponsive

Staging and Survival

<table>
<thead>
<tr>
<th>Stage</th>
<th>T</th>
<th>N</th>
<th>M</th>
<th>Survival % (5 yr)</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>75</td>
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<tr>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>1-3</td>
<td>T1-2,N1</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>4a</td>
<td>T4</td>
<td>N0-1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>4b</td>
<td>Tany</td>
<td>N2</td>
<td>Any</td>
<td>1</td>
</tr>
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</table>

Most patient present in Stage 3 or 4

Hilar Cholangiocarcinoma

(Klatskin’s Tumor - Case 2)

Extrahepatic Ductal Cholangiocarcinoma

- Dx
  - W/U pruritis, jaundice
  - US, CT, ERCP, EUS and biopsies (brushings)
  - Visible mass by preop studies is poor prognostic finding as it usually indicates local extension into porta structures rendering the lesion unresectable
- Rx
  - Resection - <10% resectable for cure
  - ChemoXRT – Equivocal benefit
  - Luminal XRT (Brachytherapy) – experimental
  - Palliative - Wallstent
Case 3
- 54 yo female
  - H/O Hepatitis C
  - Increased fatigue, RUQ pain and tenderness
  - Intermittent confusion noted by family
  - Exam shows jaundice, ascites.
  - W/U?

W/U?
- ALT – 100, AST – 100, Bili – 2.8, Albumin 2.5, INR – 2.2
- AFP (nonmaternal)
  - 5 (6 mos ago) rising to 2000

US – Normal liver

Case 3: US

CT – Normal Liver

Case 3: CT Scan

Margin of mass

Portal vein invasion
**Case 3**

- **54 yo female**
  - **H/O Hepatitis C**
  - **Increased fatigue, RUQ pain**
- **W/U**
  - “LFT’s”
    - ALT – 100, AST – 100, Bili – 2.8, Albumin 2.5, INR – 2.2
  - **US**
    - Cirrhosis
    - liver masses, bilobar
  - **CT**
    - Hypervascular, multifocal masses with right PV invasion
  - **AFP (nonmaternal)**
    - 5 (6 mos ago) rising to 2000

**Hepatitis C (HCV): Overview**

- Leading cause of chronic liver dz US (prevalence 1.4% US population)
- Transmission: IVDA, transfusions, sexual transmission
- **Most common** indication for liver transplantation
- RNA virus, 4M infections in US, 170M worldwide
- **Natural History**
  - 20-35% progress to cirrhosis
  - 2-5% of cirrhotics develop HCC per year
  - 50% of HCV carriers +cirrhosis develop HCC
- **Timing**
  - 10 yr to clinical liver dz
  - 21.2 yr to cirrhosis
  - 29 yr to HCC
- **Rx:** peginterferon alpha and ribavirin – eliminates virus in 55% patients

**HCV: Cirrhosis**

- **Cirrhosis**
  - **Survival**
    - Compensated dz (CPT 5-9, Child’s A and B)
      - 90% 5 yr, 80% 10 yr
    - Uncompensated dz (CPT >9, Child’s C)
      - 50% 5 yr
      - Transplant group

**Hepatocellular Ca (HCC) - 1**

- **Incidence:** World-wide very common
  - 560,000 new cases/yr
  - SE Asia, Sub-Saharan Africa 52/100,000
  - NA and Europe 2.5/100,000
- **Risk factors** – chronic liver dz – Hep B & C, EtOH
- **Dx** – at risk individual, mass, ↑ AFP, bx
- **Resectable dz**
  - 40-50% 5 yr dz free survival but only 10-20% are candidates for resection
- **Recurrence**
  - satellite nodules or multicentric foci in liver
  - regional LN, lungs, bone, adrenal

**Resection: Gold standard for lesion eradication**

- **Resection** – 40-50% 5 yr dz free survival
  - Only 30% are resectable for cure
- **Issues:** Resectability, hepatic reserve
  - Resectability – pattern/extent of dz
    - Staging (US, CT, MR, PET)
    - Consider preop treatment (RFA, PV embolization)
    - Segmental vs lobar resection, limiting intraop ischemic injury to liver
  - Hepatic reserve
    - Child-Pugh score
    - 3D reconstruction of liver for assessment of % residual volume (35% normal liver for survival)
    - Clearance studies (ICG or lidocaine)
    - Portal-hepatic venous gradient
CT Criteria for Hepatic Segmentation

Hepatic Vascular Anatomy

Issues in Hepatic Resection: Control of Bleeding

Liver resection

Hepatic Anatomy

Resection: Gold standard for lesion eradication

- Hepatic blood flow
  - 20% of CO to liver
  - 2/3 in PV (1/3 \( \text{O}_2 \)), 1/3 in HA (2/3 \( \text{O}_2 \))
- Procedural steps
  - Mapping lesion and vascular anatomy - IOUS
  - Dissection of porta
  - Vascular control/isolation
    - PV, HA to resected area divided
    - inflow occlusion (Pringle)
    - Hepatic vein occlusion (outflow occlusion)
    - Liver isolation: "Heaney" maneuver
  - Parenchymal dissection along anatomic lines
    - Ligasure
    - Stapler
    - Clips and ties

- Hepatic Anatomy

- Resection – 40-50% 5 yr dz free survival
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- Issues: Resectability, hepatic reserve
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### Child-Pugh-Turcott (CPT) Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Bili (mg/dl)</th>
<th>Albumin (gm/dl)</th>
<th>PT (sec)</th>
<th>Hepatic Encephal</th>
<th>Ascites (grade)</th>
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<tbody>
<tr>
<td>1</td>
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<td>&gt;3.5</td>
<td>1 – 4</td>
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<td>None</td>
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<td>2</td>
<td>2 – 3</td>
<td>2.8 – 3.5</td>
<td>4 – 6</td>
<td>1 – 2</td>
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<tr>
<td>3</td>
<td>&gt;3</td>
<td>&lt; 2.8</td>
<td>&gt;6</td>
<td>3 - 4</td>
<td>Severe</td>
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<table>
<thead>
<tr>
<th>Sum Score</th>
<th>Child’s Class</th>
<th>Survival (%, 1 yr)</th>
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<tbody>
<tr>
<td>5 - 6</td>
<td>A</td>
<td>80</td>
</tr>
<tr>
<td>7 – 9</td>
<td>B</td>
<td>70</td>
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<tr>
<td>&gt; 9</td>
<td>C</td>
<td>50</td>
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### Alternatives to Liver Resection

- **Transplantation** (for HCC, selected pts)
- **Embolization**
  - Lipiodol
  - Chemoembolization
- **Ablation**
  - Radiofrequency energy
  - Ethanol
  - Cryotherapy
  - Acetic Acid
- **Radiation**
  - Confocal radiation
  - Yttrium microspheres (Theraspheres™)

### Transplantation for HCC

**MELD Feb 2002 Implementation**

- **Criteria** (highly selected patients):
  - One HCC nodule up to 5 cm, OR
  - Up to 3 lesions (all < 3 cm)
  - No extrahepatic spread, vascular involvement, not a resection candidate
- **Survival**
  - 83% at 3 yr

### Hepatocellular Carcinoma

**Limited Disease**

- 1 ≤5 cm
- 3 ≤3 cm
- ϕPV thrombosis

**Extensive Disease**

- >5 cm or >3 lesions
- PV thrombosis
- Metastases

**Hepatic Reserve**

- Child’s A
- Child’s B
- Child’s C

- $<10$
- $>10$
- Other factor: Platelet count

### RFA

- **Indications:**
  - No evidence of extrahepatic tumor
  - Less than 5 cm in diameter
  - Not in proximity to portal triad
Hepatocellular Carcinoma

Limited Disease

- Child’s A
  - Hepatic Reserve: <10
  - Performance Status: Good
  - Wedge Pressure Gradient: <10
  - Tumor: near limit - progressive
  - Bridging Rx: Ablation
  - Resection

- Child’s B
  - Hepatic Reserve: >10
  - Performance Status: Poor
  - Wedge Pressure Gradient: >10
  - Transplant candidate: yes
  - Tumor: near limit - progressive
  - Transplantation
  - Ablation
  - Chemo
  - TACE
  - Supportive Care

- Child’s C
  - Hepatic Reserve: NA
  - Performance Status: NA

Extensive Disease

- >5 cm or >3 lesions
- Child’s A
  - Hepatic Reserve: <10
  - Resection

- Child’s B
  - Hepatic Reserve: >10
  - Ablation
  - Chemo
  - XRT
  - TACE
  - Supportive Care

Metastatic Disease to the Liver

- Treatable lesions (for cure, or for palliation of hormonal secretory function)
  - Colorectal metastases
  - Carcinoid
  - Islet tumors
  - Breast cancer?

- Characteristics
  - Isolated to liver
  - Adequate residual parenchyma and liver function

CRC: Metastatic Liver Tumors

- 15-25% of patients with colorectal cancer (CRC) have liver metastases at time of dx
- 20% of CRC patients develop metachronous liver lesions
- 25% of CRC patients have isolated liver metastases
  - 10-25% are resectable for cure
  - Survival: 25-35% at 5 years

Benign Hepatic Tumors

- Hepatic cysts
- Biliary cystadenomas
- Hemangiomas
- Focal nodular hyperplasia
- Hepatic adenoma

Focal Nodular Hyperplasia
Hepatic Adenoma

Case 4
- 58 yo WM, former alcoholic
  - Symptoms of forgetfulness, fatigue, abdominal distension
  - Exam shows palmar erythemia, gynecomastia, spider angiomata, distended abd with ascites, jaundice, muscle wasting
  - Evaluation?

Case 4
- Labs
  - Hepatitis screen
  - LFT’s, albumin, INR, platelet count
  - AFP
- Films
  - US – portal vein, liver
  - CT – liver, spleen, ascites
- Assessment: Hepatic reserve
  - Cumulative hepatic volume
  - CPT score

CT Scan
- Findings
  - Shrunken liver
  - Irregular contour
  - Perigastric prominent vasculature
  - Splenomegaly
- Dx: Advanced cirrhosis and portal hypertension

Clinical Manifestations of Portal Hypertension

Physiology: Critical Functions
- Synthesis
  - Albumin
  - Clotting factors
  - Plasma proteins
  - Cholesterol/bile salts for digestion
- Regulation
  - Aminoacid metabolism
- Energy metabolism
  - Glycogen - gluconeogenesis
- Detoxification
  - Ammonia to urea for excretion
  - Drugs, metabolites (i.e. octopamine)
- Excretion
  - Bile
- Immunological
  - Bacterial filter, regulation immune response to infection
Clinical Consequences of Portal Hypertension (PH)

- **Definition**
  - portal vein pressure >10-13 mm Hg (57% sensitivity, 100% specificity)

- **Natural History**
  - Most (90%) cirrhotics develop PH eventually
  - Only 20-30% bleed
  - Most (80%) of bleeding episodes stop spontaneously
  - Most (50-70%) rebleeding (1-2 yr)
  - 1 in 3 dies from complications of first bleeding episode
  - 50% - 5 yr survival with cirrhosis + PV

Portal Hypertension: Medical Rx

- Supportive measures (stop EtOH)
- Medical Rx: Beta blocker
- Banding/sclerosis for bleeding esophageal varices

Portal Hypertension: Rx

- Supportive measures (stop EtOH)
- Medical Rx: Beta blocker
- Banding/sclerosis for bleeding esophageal varices
- Portacaval shunt
  - TIPSS (transjugular intrahepatic porto-systemic shunt)
  - Portacaval shunt (nonselective)
- Liver transplantation for decompensation and/or complications

Portal Venous anatomy

Survival after Liver Transplant for Cirrhosis and End Stage Liver Failure

<table>
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<th>UNOS 2001 Annual Report</th>
<th># Pts</th>
<th>1 Year %</th>
<th>5 Year %</th>
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<td>Graft Survival</td>
<td>6577</td>
<td>80</td>
<td>63</td>
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<tr>
<td>Patient Survival</td>
<td>6577</td>
<td>88</td>
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Summary

- Surgical Hepatobiliary Disorders
  - Biliary
    - Gallstone disease
    - Biliary tumors
    - (Cystic diseases of biliary tree)
  - Liver
    - Liver tumors
      - Primary malignancy
      - Role of Hep C
    - Secondary malignancy
    - Benign tumors
    - Liver failure
      - Portal hypertension and complications
      - Liver failure – assessment and definitive Rx – Transplantation