Navigating the Biliary Tract with CT & MR: An Imaging Approach to Bile Duct Obstruction

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Objectives

• To identify the levels of the biliary tract commonly involved by obstruction

• To formulate a differential diagnosis based on the level of obstruction and the appearance of the duct as determined with imaging
The Five Questions

• Is biliary obstruction present?
• What is the level?
• What is the cause?
• If tumor, is it resectable?
• What are the therapeutic options?
Laboratory Analysis

• Alkaline phosphatase
  - Sensitive in detection of BD obstruction
  - Mildly elevated in hepatitis & cirrhosis
  - Other sources – bone, intestine, kidney, placenta
  - Hepatic source confirmed if GGTP is also elevated
  - May remain elevated 1 week after relief of obstruction & return of serum BR to normal

• Serum bilirubin
  - Jaundice occurs when > 3mg/dl
Imaging Criteria of Biliary Dilatation

**EHBD**

- US, CT, MRCP \( > 4-8 \text{ mm} \)
- ERCP/PTC \( > 10 \text{ mm} \)

**IHBD**

- \( > 2\text{ mm} \)
Biliary Obstruction

**False Positives**

Dilated ducts ≠ Biliary Obstruction

- Aging
- Prior obstruction
- s/p Liver transplantation
- +/- Post-cholecystectomy
Biliary Obstruction
False Negatives

- Early/intermittent obstruction
- Low grade stricture
- PSC
- Cirrhosis
Levels of Bile Duct Obstruction

- Intrahepatic
- Confluence
- Porta Hepatis
- Mid-Extrahepatic
- Intrapancreatic
- Ampullary
- Multiple Levels
Intrahepatic Biliary Obstruction

- Metastases
- HCC
- Peripheral cholangiocarcinoma
- Biliary cystadenoma/CA
Neoplastic Intrahepatic Biliary Obstruction

- Extrinsic ductal obstruction
- Intraductal tumor extension
- Hemobilia
- Combination of the above
Metastases
Hepatocellular Carcinoma
Peripheral Cholangiocarcinoma
Peripheral Cholangiocarcinoma
Biliary Cystadenocarcinoma
Biliary Cystadenocarcinoma
Clues to Narrowing the DDx of Intrahepatic BD Obstruction

• Assess for history of primary malignancy
• Determine presence of cirrhosis
  ➢ HCC, not CCA, usually occurs in cirrhotic liver
  ➢ Exception, CCA complicating PSC
• Capsular retraction, low T2 SI & delayed enhancement typical of CCA, not HCC
Confluence Obstruction

- Hilar cholangiocarcinoma
- Liver metastasis
- HCC
- Biliary inflammatory pseudotumor
Hilar Cholangiocarcinoma
Hilar Cholangiocarcinoma
Biliary Inflammatory Pseudotumor

- Chronic inflammatory process of the hilar region indistinguishable from CCA
- AKA “malignant masquerade”
- Accounts for 5-10% of hilar obstructions in surgical series
- Usually diagnosed only after surgery
Biliary Inflammatory Pseudotumor
Biliary Inflammatory Pseudotumor
Clues to Narrowing the DDx of Hilar Obstruction

• Features suggestive of pseudotumor
  ➢ Young patient
  ➢ Multiple biopsies negative for tumor

• Features suggestive of hilar CCA vs. central met or HCC
  ➢ Delayed enhancement with CCA vs early enhancement with HCC
  ➢ History of primary malignancy
  ➢ Cirrhosis
Porta Hepatis Obstruction

- Enlarged nodes
- Gallbladder carcinoma
Enlarged Periportal Nodes
Gallbladder Carcinoma
Gallbladder CA & BD Obstruction

Causes

- Metastatic nodal enlargement
- Direct tumor growth along cystic duct & hepatoduodenal ligament
- Intraductal tumor extension
Gallbladder Carcinoma
Clues to Narrowing the DDx of Periportal Obstruction

• Features suggestive of gallbladder carcinoma as a cause
  ➢ Mass involving or replacing the GB
  ➢ GB stones and/or porcelain GB – supportive evidence

• Features suggestive of enlarged nodes as a cause
  ➢ History of primary malignancy
Mid-Extrahepatic Bile Duct Obstruction

- Post-op stricture
- Mirizzi Syndrome
Post-cholecystectomy Stricture

- Develops in ~0.5% undergoing CCY

- Causes
  - Ligation of cystic duct at entry into BD
  - Injury of BD epithelium with T-tube

- Timeline
  - Causes symptoms months-years after surgery
Definition:
Cholecystocholedochal fistula due to erosion of cystic duct stone into bile duct
Mirizzi Syndrome
Intrapancreatic Bile Duct Obstruction

**Neoplastic**
- Pancreatic carcinoma
- Distal cholangiocarcinoma
- Peripancreatic nodes
- Pancreatic head metastasis

**Inflammatory**
- Chronic pancreatitis
- Acute pancreatitis
Intrapancreatic BD Obstruction

Neoplasia  Pancreatitis
Pancreatic Carcinoma
Pancreatic Carcinoma
Chronic Pancreatitis
Acute Pancreatitis
Acute Pancreatitis
Clues to Narrowing the DDx of Intrapancreatic BD Obstruction

• Malignant vs Inflammatory
  - Abrupt BD narrowing with rat-tail configuration typical of malignant obstruction
  - Tapered BD narrowing with lesser degree of dilatation typical of inflammation

• Acute Pancreatitis
  - Tapered BD narrowing associated with features of acute pancreatitis
  - Assess for BD & GB stones
Clues to Narrowing the DDx of Intrapancreatic BD Obstruction

- Chronic Pancreatitis
  - PD dilatation, PD stones, pancreatic atrophy & fibrosis

- Caution!!
  - Typical findings of chronic pancreatitis seen in association with a focal pancreatic mass may represent focal pancreatitis OR pancreatic carcinoma superimposed on a background of CP.
Ampullary Obstruction

- Calculus
- Periampullary tumors
- Ampullary stenosis
Periampullary Tumors

• Generic term that includes carcinomas of the
  ➢ Ampulla
  ➢ Pancreas
  ➢ Duodenum
  ➢ Distal bile duct

• Often impossible to distinguish among the tumors with imaging or histologic analysis

• Result in BD obstruction in 75% and PD obstruction in 67%

• Direct visualization with endoscopy may be required to identify the tumors due to their small sizes
Duodenal Carcinoma
Duodenal Carcinoma
Ampullary Stenosis

- Anatomic deformity of the ampulla characterized by narrowing of the distal bile duct resulting in biliary-like pain
- Two mechanisms proposed
  - Dysfunction of the sphincter of Oddi with spasm resulting in increased intraductal pressure & pain
  - Organic stenosis resulting from acute/chronic inflammation
    - passage of gallstones
    - acute or chronic pancreatitis
    - sclerosing cholangitis
Ampullary Stenosis
Ampullary Stenosis - Chronic Pancreatitis
Obstruction at Multiple Levels

- PSC
- Cholangiocarcinoma
- Metastases
- Calculi
- AIDS cholangiopathy
Primary Sclerosing Cholangitis
When confronted with possible biliary tract obstruction, radiologists must answer the following questions:

- Is biliary obstruction present?
- What is the level?
- What is the cause?
- If tumor, is it resectable?
- What are the therapeutic options?

Identifying the level of the obstruction allows for the formulation a differential diagnosis.

The differential diagnosis list can be narrowed by observing imaging features characteristic of the diagnostic possibilities.