Painless Jaundice . . .

Painful Diagnoses:
Radiologic Evaluation of Periampullary Malignancies

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**PATIENT #1: FS**

**ED Presentation; BIDMC w/u**

- 85M
- May 2004, presented to OSH ED s/p fall
  - Scleral icterus noted.
  - CT for workup of fall revealed pancreatic mass.
- Referred to BIDMC
  - No abdominal pain or back pain. Jaundice over past several days = “painless jaundice”
    - No pruritis, weight loss, or other GI symptoms
  - Exam: “palpable, firm mass in the right upper quadrant, compatible with a Courvoisier’s gallbladder”
  - Labs: indicative of obstructive jaundice
    - Bilirubin (total) 18.3 mg/dL (ref. 0-1.5 mg/dL)
    - Alkaline phosphatase 749 IU/L (ref. 39-117 IU/L)
PATIENT #1: FS
CT Image: Pancreatic Mass

2 cm Pancreatic Head Mass
CBD Stent
SMA (shift left 2° to scoliosis)
Renal arteries
IMV
IVC
Periampullary Anatomy

**ANTERIOR VIEW**

- Hepatic Triad
- Ampulla, CBD, PD
- SMA
- SMV

**POSTERIOR VIEW**

- Celiac Axis
- Portal System
- Biliary Tree

Periampullary Mass Lesions

- Differential diagnoses based on imaging
  - Malignant neoplasms
  - Focal pancreatitis
  - Benign neoplasms
  - Pancreas pseudocyst, traumatic cyst, necrosis
  - Abscess
  - Biloma, Hematoma
  - Lymphadenopathy
  - Aneurysm
  - Duodenal cyst, polyp, diverticulum

- Overlap with DDx of obstructive jaundice?

**Painless Jaundice**

- **Sign classically associated with** _malignant_ etiologies of extrahepatic or obstructive jaundice
  - Carcinoma of ampulla of Vater
  - Extrahepatic cholangiocarcinoma (“CCA”)
  - Ductal adenocarcinoma of the pancreatic head (“ACA”)

- **Diagnostic caveat**
  - Painless jaundice in some cases of cholecystitis
  - Advanced malignancies may often present with pain

- Painless jaundice is the most common presentation associated with a _resectable and curable_ malignancy.
  - **Thus, the radiologist can facilitate rapid, lifesaving diagnosis and surgical intervention.**

Menu of Radiologic Exams

- **US**: dilated ducts, r/o cholelithiasis / cholecystitis; not as likely to show tumor
- **CT**: masses, local anatomy, metastases
- **MRI/MRCP**: biliary tree anatomy
- **ERCP**: giving way to MRCP, therapeutic role
- Future Modalities (?)
  - **EUS**: (irregularly hypoechoic mass, pancreatic duct dilatation)
  - **Functional**: (PET protocols to detect metastases)

CT Imaging

- **Helical CT** = primary imaging study in suspected periampullary malignancy
  - Detection: more sensitive than US $\approx 90\%$ vs. $75\%$

- **CT Findings**
  - Focal **mass**, mass effects, distort gland **contour**
  - **Hypoattenuation** with IV contrast (hypovascularity)
    - “Negative oral contrast”: duodenal-pancreatic interfaces
  - Smoothly dilated pancreatic duct, **abrupt cut-off**
    - Double duct sign (CBD involvement)
  - **Enlarged gallbladder**

- No masses, but dilatation? $\rightarrow$ MRI/MRCP

MRI/MRCP Studies

- **MRI**: (T1 fat suppressed)
  - Pancreatic ACA: low signal on Gd contrast scan due to hypovascularity
  - Cholangiocarcinoma: low T2 signal intensity due to desmoplastic character

- **MRCP**: T2 (FSE) show fluid in biliary tree with high signal intensity
  - **Double duct sign**
  - **PD**: smooth or beaded vs. irregular dilatation
  - **CBD**: irregular, ragged strictures in CCA

CBD $\approx$ 10 mm
PD $\approx$ 7 mm

Malignant strictures

Medical Center for Radiology, Philipps University at Marburg, http://online-media.uni-marburg.de/radiologie
PATIENT #2: JS
Cancer of Ampulla of Vater

- Painless jaundice in 75%
- Intestinal histology
- Associated w/ FAP
- CBD/PD dilated to ampulla
- Patient JS:
  - 73F
  - Elevated LFTs
PATIENT #2: JS
Cancer of Ampulla of Vater (2)

- Tend to present relatively early
- Retroperitoneal means less interference with other structures
- Better prognosis

Ampullary Mass

CBD Stent
Pancreatic Duct Dilatation

BIDMC PACS
Extrahepatic Cholangiocarcinoma

- Location in Biliary Tree
  - Perihilar (Klatskin tumor): 60-70%
  - Distal CBD: 20-30%
  - [Intrahepatic ducts 10%]

- 5 year survival \(\approx 5-15\%\)

- *Semin. Liver Dis.*, July 2004: Clinical picture is “complex”, “not straightforward”, and “continues to defy diagnosis”.
  - Imaging complements clinical observations to reach the diagnosis.
PATIENT #3: JC
Cholangiocarcinoma

- Patient JC
  - 76M
  - Painless jaundice
  - Alk phos 389 IU/L
  - Bili 28.3 mg/dL

- CT Findings
  - Asymmetric CBD wall thickening,
    - With medial enhancement near ampulla (fibrosis)
    - CBD dilated near ampulla
  - Hepatic artery proper
  - SMV, splenic veins

BIDMC PACS
PATIENT #4: MD
Cholangiocarcinoma (2)

- Patient MD: (Hosp. Univ. Pennsylvania)
  - 73F
  - Painless jaundice, two weeks diarrhea
  - Alk phos 64 IU/L
  - Bili 7.7 mg/dL

- MRCP Findings
  - 2.1 cm CBD stricture
  - Beaded left hepatic duct
Pancreatic Cancer

- Epidemiology (USA)
  - 31k new cases, 31k deaths estimated in 2004
  - 4th leading cause of cancer deaths for men and women
  - 5 year survival < 5%

- Pathology
  - > 90% ductal adenocarcinoma
  - 70% in pancreatic head
  - Broad DDx

St. George’s Hospital, Dept. of Histopathology http://www.sghms.ac.uk/depts/histopathology
RECAP PATIENT #1: FS

Dilated Ducts in Pancreatic ACA
Role of Radiology in Treatment

“Imaging studies play a critical role in evaluating patients with biliary obstruction, and because resection is the only effective treatment, such studies should be directed at fully assessing the extent of disease.”

Treatment Options

- Potentially curative for all three malignancies: Whipple Procedure
  - 80% inoperable

- Palliative biliary tree stenting

(1) JHU Gastroenterology & Hepatology, http://hopkins-gi.nts.jhu.edu
(2) BIDMC PACS
CT Evaluation of Resectability

- Post processing methodologies / CT angio
  - Multiplanar 3D reconstruction
  - Curved planar reformation
  - 3D volume rendering
  - Maximum intensity projection (MIP)

- Evaluate by CT:
  - Adjacent invasion of tumor
  - Vascular: hepatic phase acquisition
    - Tumor encasement: vessel narrowing, deformation, obliteration, and collaterals
  - Neurovascular plexus: check fat planes
  - Metastases and nodal involvement

Staging Pancreatic Cancer for Determining Resectability

- Oncologic Staging: TMN
  - Size (< 2cm), extension, metastases, nodes

- CTA Surgical Staging (Raptopoulos, 1997):
  - 0. Normal
  - 1. Smooth displacement of vessel, resectable
  - 2. Flattening or deforming a vessel, ? resectable
  - 3. Narrowed vein, unresectable (unclear margin)
  - 4. Occluded vessel, unresectable
  - (5. Distant Metastases, unresectable)

- Identical concept for cholangiocarcinoma

PATIENT #5: CK
Clear Fat Planes

- Patient CK
  - 83M
  - Painless jaundice, 10 days duration
  - Bili 17.2 mg/dL
  - Alkphos 2024 IU/L

- Clear Fat Planes
  - No interference with vascular structures
PATIENT #5: CK
Clear Fat Planes (2)

- **CT Recon Image**
  - Surgical clips s/p cholecystectomy
  - Ductal dilatation
  - Thin fat planes between mass and
    - SMV
    - SMA

- **Predict Resectable**
  - No interference with vascular structures
  - Category 1
**PATIENT #6: BK**

**SMV Involvement ?**

- **Patient BK**
  - 65F
  - Jaundice, dark urine, wt loss, pruritis 14d
  - Bili 13.1 mg/dL
  - Alk phos 471 IU/L

- **CT:** “contiguous with SMV for 180°”, but
  - Predicted resectable
  - Category 2

- **Surgery:**
  - “densely adherent . . . not invaded . . . separated” from tumor

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*Image: CT scan showing a 2.2 cm pancreatic head mass with labels for SMV and SMA.*

*BIDMC PACS 05/10/02*
**Patient #7: CJ**

**Portal Vein Involvement**

- **Patient CJ**
  - 53F
  - Jaundice, dark urine, pruritis
  - Elevated LFTs
- **Unresectable**
  - “Tear drop” sign and thrombus in portal vein
  - Category 3-4
PATIENT #7: CJ
Portal Vein Involvement (2)

Diffuse Pancreatic Head Mass

Portal Vein, Thrombus, Tear Drop Sign

CBD Stent

Common Hepatic a.

Splenic a.

Fat Stranding ? Pancreatitis

06/10/04

BIDMC PACS
PATIENT #7: CJ
Venous Collateralization

- SMV and splenic vein tributaries to portal system blocked
- Note extensive collateral venous network
  - Peripancreatic
  - Lesser curvature
  - Greater curvature
**PATIENT #8: PH**

**Metastases**

- **Patient PH**
  - 72M
  - Jaundice, LLQ pain (?)
  - Bili 6.0, Alk phos 899

*Thrombosed SMV*

*7x6 cm Mass*

*Compressed IVC*

*Ascites: perisplenic, perihepatic.*

*? of peritoneal carcinomatosis*

*BIDMC PACS*
Patients’ Results

- Patient #1, FS: CT resectable, liver metastases at Whipple
- Patient #2, JS: CT resectable, s/p successful Whipple
- Patient #3, JC: CT resectable, awaiting Whipple, stent placed by ERCP
- Patient #4, MD: MRI/MRCP resectable, s/p successful Whipple
- Patient #5, CK: CT resectable, awaiting Whipple
- Patient #6, BK: CT resectable, s/p Whipple, but XRT/chemo for positive nodes diagnosed post surgery
- Patient #7, CJ: CT non-resectable, chemotherapy/XRT
- Patient #8, PH: CT non-resectable, chemotherapy/stent
Limitations: CT Resectability

- NPV of CT non-resectability approximately 100%
- In contrast, PPV of CT resectability lacking
  - 53% - 79% CT, 85+% with MDCT, CT angio
- Causes of Lower PPV (false positives)
  - small (< 10mm) liver metastases (Patient #1, FS)
  - small peritoneal metastases
  - unknown nodal metastases (Patient #6, BK)
  - unappreciated portal vein or SMV involvement
  - unappreciated hepatic artery encasement
  - tumor spread: porta hepatis or root of mesentery
  - lack of CT angiography study

Summary

- Painless jaundice associated with curable periampullary malignancy

- Role of radiology in diagnosis
  - CT, MRI/MRCP methods distinguish malignancies from other possible etiologies

- Role of radiology in surgical planning
  - Involvement of adjacent vessels, tissues
  - Future improvements in CT detection and staging of metastases, nodes
References

**PANCREATIC CANCER**

- Cay O, Raptopoulos V. Spiral CT for the Diagnosis and staging of pancreatic adenocarcinoma, in *Spiral CT of the Abdomen* (Terre F, Grossholz M, Becker CD, eds., 2002).
References (cont.)

**PANCREATIC CANCER**


**CHOLANGIOCARCINOMA**

References (cont.)

GENERAL

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