Pancreatobiliary Imaging in a Patient with Pancreatic Adenocarcinoma

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Presentation

52-year old female with jaundice, epigastric pain, and weakness
Jaundice

- Production
- Metabolism
- Obstruction
Physical and Labs

- Afebrile and hemodynamically stable with BP 150/81, HR 68
- Abdomen soft and non-tender
- WBC 8.6
- LFTs
  - ALT 265, AST 225, Alk phos 897
  - Tbili 15.0, direct bili 11.8
- normal amylase and lipase.
Clinical Reasoning

• The picture created by the labs and the presentation were quite suggestive of an obstructive process.

• Distal obstruction can account for the RUQ pain as well as the jaundice and elevated LFTs.
Anatomy of RUQ

http://www.arizonatransplant.com/images/pancreas_large_1.JPG (www.medivisuals.com)
RUQ Pain

- Cholecystitis
- Cholangitis
- Choledocholithiasis
- Cholelithiasis (80% asymptomatic)
- Viral/drug hepatitides
- Tumor
Cholangitis

- Charcot Triad
  - Fever (often with leukocytosis)
  - Jaundice
  - Right upper quadrant pain
- Reynold Pentad
  - Altered mental status
  - Shock
# Imaging Options

## American College of Radiology

**ACR Appropriateness Criteria®**

### Clinical Condition:

**Jaundice**

**Variant 1:**

Acute abdominal pain; at least one of the following: fever, history of biliary surgery, known cholelithiasis.

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>US abdomen</td>
<td>9</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>CT abdomen without and with contrast</td>
<td>7</td>
<td></td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>MRI abdomen without contrast with MRCP</td>
<td>5</td>
<td>If cholangitis or hepatic abscess is suspected, with contrast is preferred.</td>
<td>0</td>
</tr>
<tr>
<td>ERCP</td>
<td>4</td>
<td>If high suspicion of common bile duct stones, some would advocate doing ERCP initially.</td>
<td>☒ ☒ ☒</td>
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<tr>
<td>Cholescintigraphy</td>
<td>2</td>
<td></td>
<td>☐ ☐</td>
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</tbody>
</table>

**Rating Scale:** 1, 2, 3 Usually not appropriate; 4, 5, 6 May be appropriate; 7, 8, 9 Usually appropriate

*Relative Radiation Level*

RUQ US

Evidence of cholecystitis

Major criteria

• sonographic Murphy’s sign

• cholelithiasis

Minor criteria

• thickened gall bladder wall greater than 3mm

• pericholecystic fluid

• gall bladder dilatation
Our Patient’s Dilated Gallbladder on US

- Distended GB
- Dilated cystic duct

Carl Lokko, HMS III
Gillian Lieberman, MD

PACS, BIDMC
US

• RUQ US
  – No definitive intraluminal stones/sludge
  – No sonographic Murphy’s sign
  – No gallbladder wall thickening
  – No pericholecystic fluid
  – Dilated CBD to 1.1cm
  – Intrahepatic biliary dilatation in the right lobe of the liver, concerning for obstructive lesion or stone
Gallbladder US
Distal Obstruction Ddx

Pancreatic carcinoma
Pancreatitis
Ampullary Carcinoma
Lymphadenopathy
Pseudocyst
Stricture (post surgical)
Ampulla of Vater/Sphincter of Oddi dysfunction
Lymphoma
Benign bile duct tumor
Parasites
EUS and CT

• Endoscopic Ultrasound
  – Stones, Masses, Cysts
  – Staging local tumors and nodes
  – US guided FNA

• CT
  – Diagnosis and staging
  – Distant metastasis
CT abdomen

• CT abd/pelvis
  – irregular 1.4 x 1.5 x 1.2cm mass in pancreatic head uncinate region
  – mild pancreatic duct dilation to 5mm and CBD dilation to 1.3cm with abrupt taper at the region of the mass
  – no definitive findings of metastases in the abdomen/pelvis
Our Patient’s CT

- Axial, C+, Portal venous phase CT

- Tail of pancreas
- Celiac artery
- Inferior Vena Cava
- Portal Vein
- Hypoattenuating mass in head of pancreas (measured)

Malignant somatostatinoma in companion patient 1 presenting as a hypo attenuating mass (arrow)
Sheila Sheth. http://www.ajronline.org/cgi/content/full/179/3/725/FIG2
CT Appearance of Various Pancreatic tumors

- Pancreatic adenocarcinoma
  - Hypoattenuating mass
- Islet cell tumor (hypoechoic on US)
  - Hypervascular
- Mucinous cystic tumor – potentially malignant
  - Most commonly multilocular dilated ducts, thick internal septa
  - Hypovascular
- Serous cystadenoma (microcystic adenoma)
  - Hyperattenuating
  - Honeycomb appearance/Swiss cheese
  - Sunburst central calcification spongy mass (10%)
CT protocols for imaging pancreatic masses

• Parenchymal phase and portal venous phase superior to arterial phase
  – tumor-to-pancreas attenuation difference
  – tumor conspicuity.

• Phase timing
  – Arterial 25-40s
  – Parenchymal 40s
  – Venous 50s
  – Portal venous 60-85s
Pancreatic Cancer: Some Facts

• Adenocarcinoma is 90% of all pancreatic tumors.
• More common in men than women.
• More common in African Americans.
• Mean age of 60-80 years.
• Several known risk factors include cigarette smoking, hereditary nonpolyposis colon cancer, Peutz-Jeghers, and BRCA-2.
• Pain and weight loss are the most common presenting symptoms. Jaundice occurs in patients with tumors located in the pancreatic head that cause biliary obstruction.
ERCP

- Endoscopic Retrograde Cholangiopancreatography
  - Lower complication rate than Percutaneous Transhepatic Cholangiography

**Allows for:**
- Endoscopic directed brushing
- Stent placement and drainage
- Stone extraction
Diagram of ERCP Stent Placement

Our Patient’s Obstruction on ERCP

- Abnormal narrowing of distal CBD and pancreatic duct.
- Dilatation of proximal CBP and pancreatic ducts- double duct sign.
ERCP of Companion Patient 2

Surgical clips
Common bile duct
Shutter
Biliary Tree
Guide wire
Shutter

PACS, BIDMC
Possible ERCP Findings in Pancreatic Adenocarcinoma

- Double-duct sign-
  - dilation of both the pancreatic and common bile ducts
- Biductal lesions less than 1 cm apart
- Abrupt stricture with irregular margins
- Complete or high-grade obstruction of the CBD
- Rat-tail or nipplelike occlusion of CBD
Cytology

ERCP brushing reveals malignant cells consistent with pancreatic adenocarcinoma
Pancreatic Adenocarcinoma

- 4th leading cause of death by cancer
- 5 year survival 5%
- Treatment options
  - Surgery is only curative
  - Chemotherapy + radiation
Pancreatic Cancer Surgical Approach

- Determine radiographically if the lesion is resectable
  - CT
  - MRI (MRCP) if CT is contraindicated
- Resectable lesions
  - Staging laparoscopy
  - Open exploration
- Whipple procedure
- Palliative operations
Vascular Neighborhood

http://academic.kellogg.edu/herbrandsonc/bio201_mckinley/f20-13at_pancreas_c.jpg
Resectability Criteria

- Encasement or obstruction of vasculature
  - arterial encasement,
  - > 50% venous encasement

- Evidence of metastasis
  - Liver
  - Nodes
  - Mesentery (peritoneal carcinomatosis)
  - Adjacent organs

- Diameter > 5 cm

Only 10-15% of cancers are resectable at presentation.
Resectability

- **CT determination of nonresectability**
  - Positive predictive value ranges from 89% to 100%
  - Negative predictive value ranges from 74% to 79%
- **EUS** is more accurate for local T and N staging and predicting vascular invasion
- **CT** also detects distant metastasis.
Resectability cont.

- Radiographically resectable cancer with normal tissue plane between mass and the SMA and SMV.

Operation

• Negative staging laparoscopy
• Open staging
  – Hard nodule roughly 5 mm in size in the upper surface of segment 5.
• Pathology
  – frozen section analysis yielded metastatic adenocarcinoma of pancreatic origin.
• Palliative mode.
  – Cholecystectomy
  – gastroenterostomy
  – biliary bypass with Roux-en-Y choledochojejunostomy
Non-surgical Treatment of Pancreatic Adenocarcinoma

- 5-FU and gemcitabine are main chemotherapeutic agents
- Metal or plastic stents may be placed for resolution of jaundice and biliary obstruction
- Celiac plexus blocks may be used for pain treatment.
- Chemoradiotherapy
  - concurrent chemotherapy to EBRT modestly improves outcomes compared to either alone in patients with locally advanced pancreatic cancer.
  - cancer-related pain is diminished and cachexia and obstructive symptoms may also improve.
  - Radiotherapy for patients with locally confined disease may result in downstaging and resectability
Prognosis of Pancreatic Adenocarcinoma

• Median survival from diagnosis is less than 10 months.

• In cases where resection can be performed, the average survival rate is 18 to 20 months.

• Complete resection has 5-year survival rates of 18-24%.
An Algorithm

Approach to a suspected pancreatic tumor (pain, weight loss, jaundice)

CT or ultrasound

Mass lesion

Distant mets

FNA biopsy

Non-surgical treatment

No distant mets

No mass lesion

EUS and/or ERCP

Mass or "malignant" ductal strictures

No evidence of tumor

Clinical follow-up

Reasonable surgical candidate

Helical CT angiography or MDR-CT*

Resectable

Surgical resection

Neoadjuvant therapy

Non-surgical treatment

Borderline resectable

EUS-FNA

EUS-FNA biopsy

Unresectable

Non-surgical treatment

Poor surgical candidate

EUS-biopsy
Summary

• Use of ultrasound, endoscopic US, endoscopic retrograde cholangiopancreatography, CT, and MRI in pancreaticobiliary imaging.
• Appearance of pancreatic malignancies on CT.
• Treatment of pancreatic cancer.
• Algorithm for using imaging in cases of suspected obstructing lesions.
Bibliography


Acknowledgments

• Behroze Vaccha, MD
• Jay Pahade, MD
• Adam Jeffers, MD
• Laura Myers, HMS III
• Gillian Lieberman, MD