An Atlas of Complications of ERCP

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Teaching Goals

1) Understand how ERCP is performed.
2) Become familiar with the indications for ERCP.
3) Know the common complications of ERCP.
4) Identify the menu of radiologic tests used to diagnose complications of ERCP.
5) Recognize radiologic findings of ERCP complications.
Endoscopic Retrograde Cholangiopancreatography (ERCP)

- ERCP is an endoscopic procedure, in which a specialized side-viewing upper endoscope is guided into the duodenum.

- ERCP provides an opportunity for instrumentation to:
  1. Perform procedures such as brush cytology, biopsy, sphincterotomy, and stone removal
  2. Visualize the biliary tree and pancreatic ducts
Anatomy of ERCP: Diagram

Anatomy of ERCP: Fluoroscopy

Common Hepatic Duct

Gallbladder

Cystic Duct

Common Bile Duct

Ampulla/
Sphincter of Oddi

Endoscopy

Pancreatic Duct

2nd Part of Duodenum


Abdominal Fluoroscopy during ERCP
Indications for ERCP

NIH Consensus Guidelines & American Society for Gastrointestinal Endoscopy Guidelines

- Diagnosis and treatment of choledocholithiasis
- Common bile duct (CBD) stone removal after cholecystectomy
- Pancreatitis or cholangitis secondary to CBD stones
- Biopsies/Brushings/FNA of suspicious pancreatic masses for tissue diagnosis to initiate chemotherapy and/or radiation
- Visualization and biopsy of ampullary malignancies
- Stent placement for bile duct strictures
- ERCP with sphincter of Oddi manometry for recurrent pancreatitis
- Drainage of pancreatic pseudocysts
When ERCP is NOT Appropriate

• Asymptomatic cholelithiasis

• Acute pancreatitis (unless gallstone pancreatitis is suspected)

• Exploration for CBD stones prior to cholecystectomy (when there is a low suspicion for choledocholithiasis)
Changing Role for ERCP

- ERCP has become a modality primarily used for treatment and procedures rather than diagnosis.

- Magnetic Resonance Cholangiopancreatography (MRCP) is a non-invasive technique that does not require contrast material to be injected into the biliary tree or pancreatic duct.

Greenberger NJ, Blumberg RS, Burakoff R: CURRENT Diagnosis & Treatment: Gastroenterology, Hepatology, & Endoscopy: http://www.accessmedicine.com
Abdominal MRI, coronal, heavily-weighted T2
COMPLICATIONS OF ERCP
Classification of site, timing, and severity of complications related to ERCP

<table>
<thead>
<tr>
<th>Site</th>
<th>Occurring at the point of endoscopic contact or cannulation</th>
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<tbody>
<tr>
<td>Specific</td>
<td>Occurring in organs not transversed or treated</td>
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<tr>
<td>Nonspecific</td>
<td></td>
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<table>
<thead>
<tr>
<th>Timing</th>
<th>Occurring during ERCP</th>
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<tbody>
<tr>
<td>Immediate</td>
<td></td>
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<tr>
<td>Early</td>
<td>Evident within the recovery period</td>
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<tr>
<td>Delayed</td>
<td>Specific (occurring within 30 days), Nonspecific (1st symptom within 3 days)</td>
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<tr>
<td>Late</td>
<td>Evident after months or years</td>
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<tr>
<th>Criteria for Severity</th>
<th>Occurring after months or years</th>
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<tr>
<td>Mild</td>
<td>&lt; or equal to 3 night inpatient stay</td>
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<tr>
<td>Moderate</td>
<td>4-10 night inpatient stay</td>
</tr>
<tr>
<td>Severe</td>
<td>&gt; 10 nights, ICU admission, or surgery</td>
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<tr>
<td>Fatal</td>
<td>Death attributable to procedure within 30 days</td>
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</tbody>
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Complication Rates

Specific complications (pancreatitis, bleeding, sepsis, and perforation) occur in approximately 5.3-6.9% of patients with mortality rate of 0.33-0.34%.

Non-specific complications occur in approximately 0.87-1.3% of patients with mortality rate of 0.07%.

Specific Complications
- Pancreatitis (4%)
- Hemorrhage (1%)
- Cholangitis (1%)
- Perforation (0.5%)
- Death (0.1%)

Non-Specific Complications
- Medication reactions
- Oxygen desaturation
- Cardiopulmonary events
Index Patient: Clinical Presentation

• 58 year old female presents from OSH 1 day s/p ERCP for choledocholithiasis.

• Stones were extracted from the common bile duct and a biliary stent was placed.

• A few hours after ERCP, the patient presented with facial swelling, thought to be an allergic reaction.

• Later, the patient was noted to have subcutaneous emphysema and transferred to BIDMC for further management.
Index Patient: Initial CXR

- Subcutaneous air in cervical area
- Pneumomediastinum
- “Gingko Sign” Air between muscle fibers of pectoralis major indicating subcutaneous emphysema

BIDMC, PACS
Chest X-ray, Portable
Companion Patient: “Gingko Sign”

37-year-old man 2 weeks after knife wound to chest.

“Gingko Sign” seen as air between the muscle fibers of pectoralis major (arrows and stars) indicating subcutaneous emphysema.
Index Patient: Plain Abdominal Film

Streaky air surrounding T10, T11, T12, and L1 indicating free air in the abdomen

Subcutaneous emphysema

Rigler’s Sign (Box) - bowel wall etched in white with adjacent lucent line indicating free air in the abdomen (pneumoperitoneum)
Index Patient: Chest CT - Pneumomediastinum and “Ginko Sign”

Aberrant air in mediastinum indicating pneumomediastinum

“Ginko Sign”
Air separating muscle fibers of pectoralis major
Index Patient: Chest CT - Pneumothorax

Small pneumothorax

Pneumomediastinum

“Ginko Sign” showing air separating muscle fibers of pectoralis major

BIDMC, PACS
Chest CT with contrast, axial, lung windows
Index Patient: Abdominal CT - Pneumoretroperitoneum and Pneumomperitoneum
Index Patient: Abdominal CT - Duodenal Diverticulum
Index Patient: Abdominal CT - Perforation

Extraluminal contrast suggestive of perforation
Perforation: Overview

• Incidence – Approx. 1.3% of cases

• Clinical Manifestations
  – Abdominal pain
  – Elevated serum amylase

• Risk Factors
  – Sphincterotomy
  – Sphincter of Oddi dysfunction
  – Dilated CBD
  – Long procedure
  – Biliary stricture dilatation
  – Duodenal diverticula
  – Aberrant biliary anatomy
  – Post-surgical anatomy (Roux-en-Y gastric bypass)
Perforation: Radiologic Findings

• Menu of Radiologic Tests
  – Plain Abdominal Film
    • Free air seen as “Rigler’s Sign” (bowel wall outlined by air) or the “Football Sign” (central lucency with visualization of falciform and medial umbilical ligaments).
      – Free air is best seen on upright films or left lateral decubitus (if unable to stand) or cross-table lateral view.
  – Computed Tomography
    • Ability to see tiny foci of free air not seen on plain films.
    • Recommended if patient has increase WBC count or pain and fever.
    • Bile infection and bile leakage through a perforation seen on CT correlates with increased mortality.
Perforation: Companion Patient

- 49 year old female
- ERCP performed for evaluation of RUQ found to have acute cholecystitis
- The patient had pain immediately after the procedure and a significant amount of free air.
  - Subcutaneous free air
  - Pneumoperitoneum
  - Pneumoretroperitoneum
  - Pneumomediastinum

Abdominal CT without contrast, axial, abdominal windows
Pancreatitis: Overview

• Incidence – Approx. 5% of diagnostic cases and 10% of therapeutic cases

• Clinical Manifestations
  – Abdominal pain for >24hrs s/p ERCP
    • Often epigastric or back pain with nausea
  – Elevated serum amylase and lipase (3x normal)

• Risk Factors
  – Operator-Related: inadequate training, lack of experience, low case volume
  – Patient-Related: younger age, females, recurrent pancreatitis, history of post-ERCP pancreatitis, Sphincter of Oddi dysfunction
  – Procedure-Related factors: difficulty with cannulation, pancreatic duct infection, precut/pancreatic/minor papilla sphincterotomy, or biliary balloon sphincteroplasty.
Pancreatitis: Radiologic Findings

• Menu of Radiologic Tests
  – Computed Tomography
    • Heterogeneous enhancement and gland enlargement.
    • Peripancreatic fat has increased attenuation due to extravasation of pancreatic secretions.
    • Glandular necrosis appears as hypoattenuation.
    • Infected necrosis appears as bubbles of gas in devitalized parenchyma.
Pancreatitis: Companion Patient

- 50-year-old man s/p ERCP for a mass in the pancreatic tail
- The patient was readmitted 3 days after ERCP with abdominal pain and low-grade fever.

- Heterogeneous attenuation of the pancreas.
- Low-attenuation areas (*) suggest necrosis.
- Thickening of the wall of the antrum of the stomach (arrow) secondary to local inflammation.
- Strandling of the peripancreatic fat.


Abdominal CT with contrast, axial, abdominal windows
Fat stranding around the pancreas

Pannu HK, Fishman EK. Complications of endoscopic retrograde cholangiopancreatography: spectrum of abnormalities demonstrated with CT. Radiographics 2001;21(6):1441-53

Abdominal CT with contrast, axial, abdominal windows
Pancreatitis: Index Patient

Infected pancreatic necrosis with gas

Abdominal CT with contrast, axial, abdominal windows
Hemorrhage: Overview

• Incidence – Approx. 1.3% (with about 29% of bleeds requiring >5 units of transfusions or intervention)

• Clinical Manifestations
  – Drop in hemoglobin/hematocrit
  – Melena or hematemesis

• Risk Factors
  – Sphincterotomy
  – Evidence of bleeding at time of sphincterotomy
  – Prior sphincterotomy
  – Prolonged PTT (at least 2x above normal)
  – Periampullary diverticulum
  – Cholangitis
Hemorrhage: Radiologic Findings

- Menu of Radiologic Tests and Findings
  - Computed Tomography (CT)
    - Typically not performed to diagnose hemorrhage; but bleeding may be detected if CT is performed.
    - Acute hemorrhage is hyperattenuating on noncontrast CT, which can become iso/hypoattenuating in later stages.
    - Non-contrast CT is used to assess for hematoma, while contrast-enhanced CT angiography is used to assess for site of active extravasation.
Hemorrhage: Companion Patient #1

- 67-year-old woman s/p ERCP with unsuccessful cannulation of the common bile duct
- The patient experienced pain after the procedure.
- High attenuation area between the duodenum and pancreas (arrow) representing bleeding

Pannu HK, Fishman EK. Complications of endoscopic retrograde cholangiopancreatography: spectrum of abnormalities demonstrated with CT. Radiographics 2001;21(6):1441-53
Abdominal CT with contrast, axial, abdominal windows
• High-attenuation mass (arrow) that appears to be abutting the lumen of the duodenum, a finding compatible with intramural bleeding.

Pannu HK, Fishman EK. Complications of endoscopic retrograde cholangiopancreatography: spectrum of abnormalities demonstrated with CT. Radiographics 2001;21(6):1441-53
Abdominal CT with contrast, axial, abdominal windows
Infection/Cholangitis: Overview

- Infection can include many complications
- Ascending cholangitis is the most frequent infectious complication of ERCP

- Incidence – Approx 1.4% (with range of 0.4-10% depending on the study)

- Clinical Manifestations
  - Typically occur 24-72 hours after ERCP
  - Fever
  - Jaundice
  - Abdominal pain (RUQ)
  - May develop confusion and hypotension
  - Elevated WBC count

- Risk Factors
  - Biliary stents
  - Combined percutaneous and endoscopic procedures
  - Unsuccessful drainage of the biliary system (retained stones)
Infection/Cholangitis: Radiologic Findings

• Menu of Radiologic Tests
  – Computed Tomography (CT)
    • Bile ducts may appear dilated and bile itself may appear hyperattenuated due to increased debris.
    • Thickening of wall of ducts and pneumobilia.
    • Peri-biliary hyperattenuation.
    • Abscesses may also appear with enhancing capsules.
Infection/Cholangitis: Companion Patient

- 67 year old man with common bile duct stones
- In this case, has not undergone ERCP but demonstrates findings of biliary obstruction
- Diffuse, mottled enhancement of the liver parenchyma
- Dilatation of the intrahepatic bile ducts (arrows)

Summary

• ERCP is an endoscopic procedure primarily used for therapeutic intervention.
• ERCP is appropriately used to remove stones from the CBD, assist in diagnosis of pancreatic/ampullary masses, and stent placement for biliary obstruction.
• The main complications of ERCP include perforation, pancreatitis, hemorrhage, and infection.
• Computed tomography is a good first choice for investigating for complications of ERCP when patients become acutely ill within 24-48 hours after ERCP.
References

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