GALLSTONE: COMPLICATION AND DIAGNOSIS

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COMPLICATION OF GALLSTONE

- Acute cholecystitis
- CBD stone
- Acute cholangitis
- Acute pancreatitis
ACUTE CHOLECYSTITIS

- Cholecystitis
  - Pathologic term, Associated GB wall inflammation

- Etiology
  - Cystic duct obstruction and resultant mucosal damage
  - Usually from gallstones

- 95% of patients have cholelithiasis

- NOT due to bacterial infection
  - Although, bacteria found in bile in 1/3 of cases

- 75% have had previous biliary ‘colic’
ACUTE CHOLECYSTITIS

- Duration of pain > 6 hours
- Epigastric and RUQ tenderness
  - Involuntary Guarding
  - Murphy’s sign frequently present
  - 30% palpable tender GB

- Nausea and emesis common
- Mild Leukocytosis
- Low grade Fever
- Resolution with 2-3 days of conservative care
COMPLICATION

- **Gangrene** — is the most common complication particularly in older patients, diabetics, or those who delay seeking therapy. But gangrene may not be suspected preoperatively.

- **Perforation** — Perforation of the gallbladder usually occurs after the development of gangrene. It is often localized, resulting in a pericholecystic abscess.
LIVER ABSCESS COMPLICATING ACUTE CHOLECYSTITIS
GALL BLADDER PERFORATION
COMPLICATION

- **Cholecystoenteric fistula** — A cholecystoenteric fistula may result from perforation of the gallbladder directly into the duodenum or jejunum.

- **Gallstone ileus** — Passage of a gallstone through a cholecystoenteric fistula may lead to the development of mechanical bowel obstruction, usually in the terminal ileum.
Bouveret’s syndrome: a rare complication of gallstone disease

Fig. 1. CT scan of the abdomen revealed a 3.2-cm gallstone with characteristic eggshell-like calcification within the duodenum (arrow).
Fig. 3. Endoscopy revealing large gallstone causing distal duodenal obstruction.
Fig. 2. Endoscopy showing an extensive ulceration of the duodenal bulb.
Figure 1. Plain abdominal radiography - dilated bowel loops, air-fluid levels and pneumobilia
Gall stone ileus on CT scan
Figure 2. Gallstone impacted in the small bowel (left) and enteral suture repair (right)
EMPHYSEMATOUS CHOLECYSTITIS
**Mirizzi Syndrome**

- Common hepatic duct is obstructed by a stone impacted at Hartmann’s pouch or cystic duct.

- **Type I** when there is external compression only and

- **Type II** if a fistula is formed between gall bladder and common duct due to inflammation and erosion by the impacted stone.
Mirizzi Syndrome, ERCP
Mirizzi Syndrome
Mirizzi Syndrome
CBD STONE

- Ductal calculi may:
  - Pass into the duodenum
  - Remain silent for extended periods of time
  - Obstruct the ductal lumen leading to dilation

- Potentially leads to complications:
  - Cholangitis (gram negative bacteria)
  - Gallstone Pancreatitis
  - Chronic liver disease

- Common duct stones are therefore removed when discovered
ACUTE CHOLANGITIS

- A clinical syndrome characterized by fever, jaundice, and abdominal pain

- that develops as a result of stasis and infection in the biliary tract
Acute cholangitis

Definitive diagnosis
Clinical signs of infection and finding of purulent bile during these procedures:
  ■ ERCP
  ■ Surgery
  ■ Percutaneous puncture

The Charcot triad:
  ■ Fever
  ■ Abdominal pain
  ■ Jaundice
Two of three criteria of the Charcot triad plus

- **Inflammatory response, for example:**
  - Abnormal white blood cell count
  - Elevated C-reactive protein level
- **Abnormal liver test results, for example:**
  - Alkaline phosphatase
  - γ-Glutamyl transpeptidase
  - Aspartate aminotransferase
  - Alanine aminotransferase
- **Imaging evidence of etiology, for example:**
  - Stone
  - Stricture
  - Stent
Gallstone Pancreatitis

- Gallstones, the most common cause
- History of biliary colik
- ALT > 150 with 95% PPV
BILIARY SLUDGE AND MICROLITHIASIS

Sludge appears as a mobile, low-amplitude echo that layers in the most dependent part of the CBD and gallbladder and is not associated with shadowing.
We perform EUS even after one attack if the cause is not clear for,

- Pancreas abnormalities,
- Small tumors at or near the ampulla,
- Microlithiasis in the gallbladder or bile duct, and early chronic pancreatitis.
**GALL STONE PANCREATITIS**

- The total number of complications is fewer after early endoscopic sphincterotomy for predicted severe pancreatitis.

- There is of **no benefit** of early endoscopic sphincterotomy for patients with acute gallstone pancreatitis without cholangitis.
While gallstones are associated with cancers of the gallbladder, the actual nature of their relationship needs to be clarified. This would aid the recommendations on the need for prophylactic cholecystectomy.

The evidence at the current time indicates that gallstones are a cofactor in the causation of gallbladder cancer. Absolute proof of their role as a cause for gallbladder cancer is lacking.
DIAGNOSTIC EVALUATION

- Laboratory Evaluation
- Imaging
  - Abdominal radiographs
  - Trans-abdominal Ultrasound
  - Nuclear Medicine (HIDA scan)
  - Magnetic Resonance Imaging (MRC/MRCP)
  - Endoscopic Ultrasound (EUS)
  - Endoscopic Retrograde Cholangiopancreatography (ERCP)
  - CT scan
**IMPORTANT LABS**

- **Infection**
  - WBC
  - Blood Cultures
- **Hepatocyte inflammation and injury**
  - AST/ALT
- **Biliary Obstruction and Cholangiocyte injury**
  - Total Bilirubin
  - Alkaline Phosphatase
- **Gallstone Pancreatitis**
  - Amylase (salivary, bowel)
  - Lipase (more specific to pancreas)
LABORATORY INTERPRETATION

□ Acute Cholecystitis
  • WBC ≤ 15
  • AST and ALT 2-3 x’s normal
  • Total Bilirubin ≤ 4
  • Alk Phos mildly elevated

□ Cholangitis
  • WBC ≥ 15
  • Significant AST/ALT elevation
  • Total Bilirubin > 4
  • Modest elevation Alk-Phos

□ Choledocholithiasis
  • Normal labs unless stone impaction
  • When obstruction occurs labs reflect either cholangitis, pancreatitis or both

□ Gallstone Pancreatitis
  • Elevated WBC
  • Elevated lipase and amylase
  • Concomitant biliary obstruction

□ Biliary Colic
  • Normal labs
**Abdominal Radiographs**

- Abdominal series:
  - supine, upright, decubitus and upright CXR
- Low sensitivity and specificity for stones
- Aid in the differential diagnosis
- Calcification in pancreatitis
- Ileus
- Perforation
- Intestinal pneumotosis
- Pneumonia
A plain abdominal x-ray showing calcified gallstones in the gallbladder (GB), cystic duct (CD) and common bile duct (CBD).
ULTRASOUND

- Initial diagnostic imaging modality of choice
  - 95% sensitivity for gallbladder stones >2 mm
    > 95% specificity with the post-acoustic shadow
- Quick
- Non-invasive
- Useful in the diagnosis of cholelithiasis, cholecystitis, choledocholithiasis, cholangitis
- Accurate
- Evaluates both hepatic, biliary and GB anatomy
Ultrasound images of a gallbladder adenomatous polyp (left panel arrowhead) compared to a gallstone (right panel arrowhead). Note the shadow cast by the stone (red arrow) compared to the absence of a shadow behind the polyp.
ULTRASOUND OF GALLSTONES
ULTRASOUND

- Acute Cholecystitis
  - Pericholecystic fluid and/or stranding
  - Thickened gall bladder wall
  - Intramural gas
  - Cholelithiasis and/or GB sludge
  - Sonographic Murphy’s sign - PPV >90%

- Choledocholithiasis
  - Extrahepatic stone localization
  - Sensitivity 50% - Common Bile Duct stones
  - Sensitivity 75% - dilated CBD
  > 6 mm intact gallbladder
**Cholescintigraphy (HIDA)**

- Useful if the Ultrasound is non-diagnostic
- **A positive HIDA-scan for acute cholecystitis:**
  - normal uptake of HIDA by the liver,
  - rapid excretion into the biliary system,
  - visualization of the extrahepatic bile ducts,
  - appearance of HIDA in the intestine,
  - failure to visualize the gallbladder
- Sensitivity - 95%
- Specificity - 90%
Showing the visualized gallbladder, common duct and filling of the duodenum.
Materials and methods: Eighty-six patients who underwent a diagnostic computed tomography (CT) scan for acute pancreatitis were included. The readers assessed the presence of pericholecystic increased attenuation of the liver parenchyma, enhancement of gallbladder (GB) and common bile duct (CBD) wall, pericholecystic fat strands, GB wall thickening, stone in the GB or CBD, and focal or diffuse manifestations of pancreatitis on abdominal CT scans. In addition, the maximal transverse luminal diameters of the GB and CBD were measured.
Diagnostic value of CT features of the gallbladder in the prediction of gallstone pancreatitis

European Journal of Radiology, 2010

Summary of CT measurements (mean values) and significance in differentiating gallstone induced pancreatitis and non-biliary pancreatitis.

<table>
<thead>
<tr>
<th>CT features</th>
<th>Gallstone induced pancreatitis</th>
<th>Non-biliary pancreatitis</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximal transverse luminal diameter of the GB (mm)</td>
<td>39.67 ± 7.26</td>
<td>27.01 ± 6.14</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Maximal transverse luminal diameter of the CBD (mm)</td>
<td>10.2 ± 4.13</td>
<td>3.85 ± 2.51</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note: Exact p values from Student’s t-test for comparisons between gallstone induced pancreatitis group and non-gall stone pancreatitis group.
Maximal transverse luminal diameter of the GB and CBD for differentiation between gallstone induced pancreatitis and non-biliary pancreatitis: summary of receiver operating characteristics analysis.

<table>
<thead>
<tr>
<th>Maximal transverse luminal diameter of the GB (mm)</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30</td>
<td>93.3</td>
<td>78.6</td>
</tr>
<tr>
<td>&gt;35</td>
<td>66.7</td>
<td>91.1</td>
</tr>
<tr>
<td>&gt;40</td>
<td>43.3</td>
<td>100.0</td>
</tr>
<tr>
<td>&gt;45</td>
<td>13.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximal transverse luminal diameter of the CBD (mm)</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;6</td>
<td>86.7</td>
<td>82.1</td>
</tr>
<tr>
<td>&gt;8</td>
<td>76.7</td>
<td>94.6</td>
</tr>
<tr>
<td>&gt;10</td>
<td>40.0</td>
<td>92.0</td>
</tr>
<tr>
<td>&gt;12</td>
<td>23.3</td>
<td>100.0</td>
</tr>
</tbody>
</table>
MRI (MRCP)

- Non-invasive technique to visualize the biliary and pancreatic ductal systems
- Recommended low pretest probability of disease
- Provides anatomic information
  - Liver
  - GB and pancreas
  - Extrahepatic biliary anatomy
  - Stones, Strictures, Ductal dilation
Endoscopic Ultrasound: EUS

- Advantages
  - Comparable accuracy to ERCP
  - less complications
  - less costly (diagnostically)

- Disadvantages
  - no therapeutic capability

- Recommended use:
  - low pretest probability of stones or need for therapeutic intervention
  - prior unsuccessful ERCP
  - contraindications for ERCP
ACCURACY OF EUS

A meta-analysis of 27 studies (with a total of 2673 patients) estimated an overall sensitivity of 94 percent (95% CI 93-96%) and specificity of 95 percent (95% CI 94-96%) of EUS compared with ERCP, intraoperative cholangiography or surgical exploration as the reference standard.

Ref: EUS: a meta-analysis of test performance in suspected choledocholithiasis
EUS-guided ERCP

1. A systematic review of randomized controlled trials compared EUS-guided ERCP to ERCP alone for the detection of common bile duct stones

2. Patients randomized to undergo EUS were able to avoid ERCP in 67 percent of cases and had lower rates of complications and pancreatitis compared to those in the ERCP alone group (OR 0.35 and 0.21, respectively)

3. In that series, EUS failed to detect common bile duct stones in only 2 of 213 patients (0.9 percent)
EUS versus ERCP for patients with intermediate probability of bile duct stones:

GASTROINTESTINAL ENDOSCOPY VOLUME 69, No. 2: 2009

Patients: One hundred twenty patients with intermediate risk for common bile duct (CBD) stones were randomized to either an EUS-first, endoscopic retrograde cholangiography (ERC)-second (n = 60) versus an ERC-only (n = 60) procedure.

Results: The sensitivity and specificity of ERC were 75% (95% CI, 42%-93%) and 100% (95% CI, 95%-100%), respectively. The sensitivity and specificity of EUS were 91% (95% CI, 59%-99%) and 100% (95% CI, 95%-100%), respectively. EUS is more sensitive than ERCP in detecting stones smaller than 4 mm (90% vs 23%, P<.01).
MrCP versus EUS
**CBD stone Diagnostic approach**

"Very strong" predictors
- CBD stone on transabdominal ultrasound
- Clinical ascending cholangitis
- A serum bilirubin greater than 4 mg/dL

"Strong" predictors
- A dilated CBD > 6 mm on ultrasound
- A serum bilirubin of 1.8 to 4 mg/dL

"Moderate" predictors
- Abnormal liver biochemical test other than bilirubin
- Age older than 55 years
- Clinical gallstone pancreatitis
CBD STONE DIAGNOSTIC APPROACH

**High-risk**
- At least one very strong predictor AND/OR
- Both strong predictors

**Intermediate-risk**
- One strong predictor AND/OR
- At least one moderate predictor

**Low-risk**
- No predictors
## Predicting CBD Stones-1

<table>
<thead>
<tr>
<th>Risk</th>
<th>Clinical</th>
<th>LFT</th>
<th>CBD Diameter</th>
<th>Risk CBD stones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>well</td>
<td>N</td>
<td>≤ 7mm</td>
<td>2-3%</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Cholangitis/pancreatitis</td>
<td>□  &lt;2x</td>
<td>8-10mm</td>
<td>20-50%</td>
</tr>
<tr>
<td>High</td>
<td>Cholangitis; jaundice</td>
<td>□  &gt;2x</td>
<td>&gt;10mm</td>
<td>50-80%</td>
</tr>
</tbody>
</table>

Cotton 1991;1993

*Prevalence falls with time delay to imaging*
Symptoms (Biliary colic)

Transabdominal ultrasound

Lab (RBC, WBC, ALT, γ-GT, alkaline phosphatase, bilirubin, lipase)

- High probability of bile duct stones
- Intermediate probability of bile duct stones
- Low probability of bile duct stones

Endoscopic ultrasound/MRC

Bile duct stone

Preoperative BS *
+ stone extraction #

Laparoscopic cholecystectomy **
CASE REPORT

1- A 58 years old male

2- Recurrent severe RUQ pain & fever

3- AST=24, ALT=65, Alk.Ph=731

4- MRI=mild dilation of CBD
CASE REPORT

1. A 50 year old female
2. Recent mild pancreatitis
3. Elevated alkaline phosphatase
4. Sonography = normal
Thanks For Your Attention
Which policy: Observation or cholecystectomy

- Early laparoscopic cholecystectomy is safe and can be completed successfully in most patients with mild acute pancreatitis, delaying laparoscopic cholecystectomy seems unnecessary and can expose the patient to further gallstone-related complications.

- Cholecystectomy appears safe as soon as the general condition of the patient improves and the pancreatic necrosis becomes sterile if infected (or remains sterile if not infected)
**FINALLY**

- we also consider performing *early ERCP* if the patient’s clinical course becomes *unstable* or *deviates* from the expected clinical course.
Some patients may not have radiologic evidence for choledocholithiasis, but this possibility still should be considered if laboratory evidence of biliary stasis is found or pain recurs.

However, in a few patients, choledocholithiasis will not be detected despite multiple imaging studies. Therefore, serial serum liver-associated enzyme and pancreatic enzyme tests are performed, initially at a 12- to 24-hour interval.
In the case of gallstones, despite the lack of evidence to support a recommendation, large stones (>3 cm) or a gallbladder packed with stones (high stone/GB volume ratio) could serve as potential indications for prophylactic cholecystectomy.
The distinction between symptomatic and asymptomatic gallstones can be difficult, as symptoms can be mild and varied. The different symptoms attributable to gallstones include upper abdominal pain, biliary colic, and dyspepsia. About 92% of patients with biliary colic, 72% of patients with upper abdominal pain, and 56% of patients with dyspepsia have relief of symptoms after cholecystectomy.
Diagnosis of acute cholangitis has traditionally been made by the Charcot triad criteria; that is, clinical findings of fever, biliary tract pain and jaundice.

Approximately 80% of patients with acute cholangitis respond to broad-spectrum antibiotics alone while the remainder require early biliary drainage in addition to antibiotic therapy.

Endoscopic retrograde cholangiopancreatography (ERCP) and stent placement are considerably safer than surgical biliary decompression.

Elective cholecystectomy should be performed after resolution of acute cholangitis in patients with an intact gallbladder.
RECOMMENDATIONS

- If the clinical presentation is consistent with acute cholangitis, urgent ERCP should be performed (within 24h).

- Early ERCP (within 24–48 h) is performed in patients who have evidence of choledocholithiasis.
If there is persistent or episodic pain, or the laboratories do not resolve as expected, then EUS or ERCP should be considered because choledocholithiasis cannot be ruled out.

Endoscopic ultrasound may be performed first if the patient has risk factors for an adverse outcome after ERCP such as advanced age, comorbidities, or anticoagulation, or is believed to be at low to moderate risk for choledocholithiasis.
ERCP of Common Duct Stone
ERCP is recommended to be urgently performed “when acute cholangitis has complicated acute biliary pancreatitis (about 10% of patients)” and when “clinical or radiographic features suggest a persistent common bile duct stone.”

Early ERCP, as defined as execution within 48 to 72 hours of the onset of illness, should be considered “when biliary pancreatitis is severe or is predicted to be severe (based on APACHE II, Ranson’s criteria, or modified Glasgow criteria).”

Cholecystectomy is indicated “as soon as possible,” but no later than 4 weeks after discharge.
HIGH PROBABILITY OF CHOLEDCHOLITHIASIS

Patients were considered to have a high probability of choledocholithiasis if they had:

1- CBD stone on US or CT or

2- At least three of the following:
   Dilated CBD on US (>7 mm)
   Fever
   Bilirubin >2 mg/dL
   Elevated alkaline phosphatase
   Serum ALT >twice normal.
**Endoscopic Retrograde Cholangiopancreatography: ERCP**

- Gold standard
- Choledocholithiasis, unresolving cholangitis or gallstone pancreatitis
- Both diagnostic and therapeutic potential
- Sensitivity - 95%
- Specificity - 95%
- Similar data for PTC