Management of Acute Cholecystitis in the Critically Ill
The problem

• ICU patients with shock and suspected sepsis of unclear etiology, with suspicion for gallbladder pathology as cause
• How can the diagnosis be made?
• How should the patients be managed?
Acalculous Cholecystitis

- Biliary stasis without stones, due to sludge
  - GB dysmotility, surgery or vagotomy
  - TPN, fasting, rapid weight loss
  - Medications
  - Microvascular ischemia
- Common after organ transplantation (heart, kidney)
- Leads to biliary colic, cholecystitis, cholangitis, acute pancreatitis
- Gangrene more common
- High morbidity and mortality (41-47%)

Once you’ve made a diagnosis

• What is the best therapeutic approach?
  – Hemodynamic instability
  – Multiple co-morbid conditions
  – Higher operative mortality in critically ill

• Failure of medical management can lead to delay in treatment
  – Perforation (up to 10%)
  – Gangrene (up to 50%) with mortality of 30%

Winbladh et al. HBP 2009; 11:183-193
Barie and Eachempati. Gastroenterol Clin N Am 2010; 39: 343-357
Two Views on Percutaneous Cholecystostomy

Critical Care
- ICU patients are at high risk for acalculous cholecystitis but nonspecific symptoms
- Ultrasound/CT supports diagnosis
- Perc. cholecystostomy is diagnostic and therapeutic
- Very low complication rates
- Benefit > Risk

Interventional Radiology
- Clinical signs and ultrasound/CT findings lack sensitivity/specificity in ICU patients
- Additional testing to support diagnosis (eg, HIDA) is warranted to prevent unnecessary procedures
- Risk > Benefit
# Tokyo Guidelines: Diagnosis of Acute Cholecystitis

## Local signs of inflammation
- Murphy’s sign
- RUQ mass/pain/tenderness

## Systemic inflammation
- Fever
- ↑ CRP
- ↑ WBC

## Imaging findings
- Ultrasound
- MRI
- CT
- HIDA

Physical and laboratory exam

• Patients often intubated and/or sedated
  – Sedatives and analgesics can mask abdominal pain
  – Encephalopathy/sedation makes Murphy’s sign unreliable

• Fever, leukocytosis, and CRP are nonspecific and frequently occur in ICU patients
Imaging Findings

• Guidelines do not prioritize any imaging modality

• Imaging “confirms the diagnosis when acute cholecystitis is suspected clinically”

• Findings on imaging do not correlate with prognosis

Ultrasound

• Test of first choice due to portability, low cost, few contraindications or complications

• For acalculous cholecystitis:
  – Sensitivity 67-90%
  – Specificity > 90%

• Retrospective review of trauma pts with acalculous cholecystitis
  – Sensitivity 30%/90%*
  – Specificity 93%/26%*

Tokyo Guidelines

Ultrasound findings

- **Sonographic Murphy’s sign**: GB wall > 4mm, if no heart failure or cirrhosis
- **GB**: GB > 8 cm long axis, > 4 cm short axis
- **Incarcerated gallstone**: debris echo, pericholecystic fluid
- **Sonolucent layer in GB wall**: striated intramural lucencies, and Doppler signals

Computed Tomography

- Benefit: can also rule in/out other causes of shock
- Drawbacks: contrast, roadtrip, radiation, time
- For acalculous cholecystitis:
  - Sensitivity 11-100%
  - Specificity 92-99%

Ahvenjarvi et al. Trauma 2011; 70: 183-188
Tokyo Guidelines

CT findings

- Thickened gallbladder wall
- Pericholecystic fluid collection
- Enlarged gallbladder
- Linear high-density areas in the pericholecystic fat tissue

CT scan in ICU patients

• Retrospective case-control study of ICU patients with CT scan within 72 hours of open cholecystectomy
• Each patient compared with two matched controls that had abdominal CT
• Abnormal GB findings in 96% of all pts who had a CT scan

Ahvenjarvi et al. Trauma 2011; 70:183-188
CT scan in ICU patients

- Most specific findings for necrotic GB found during cholecystectomy:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas in GB wall or lumen</td>
<td>11%</td>
<td>99%</td>
</tr>
<tr>
<td>Lack of GB wall enhancement</td>
<td>38%</td>
<td>95%</td>
</tr>
<tr>
<td>Edema around the GB</td>
<td>22%</td>
<td>92%</td>
</tr>
</tbody>
</table>

Ahvenjarvi et al. Trauma 2011; 70:183-188
Hepatobiliary Scintigraphy

• Ideal: fasted 4-6 hours
  – 1 hour: false positives (GB non-viz)
  – 24 hours or TPN: false positives (GB non-viz)

• Meds given:
  – Cholecystokinin: GB contraction
  – Morphine: Sphincter of Oddi contraction

# Tokyo Guidelines

| Non-visualized gallbladder with normal uptake and excretion of radioactivity | Rim sign (augmentation of radioactivity around the gallbladder fossa, usually associated with gangrene) |

GB Non-visualization

- Hepatitis or ascending cholangitis:
  - Decreased uptake in liver and GB

- CBD obstruction or intrahepatic cholestasis
  - Normal hepatic but decreased GB uptake

- Acute alcalculous cholecystitis in critically ill
  - False negative HIDA due to lack of actual obstruction

Comparison of Imaging Modalities

• Review of 56 trauma patients with clinically suspected acalculous cholecystitis:
  – 40 ultrasounds: sensitivity 92%, specificity 96%
  – 15 CT scans: sensitivity 100%, specificity 100%
  – 46 HIDA scans: sensitivity 95%, specificity 38%
    • 1 false negative
    • 13 false positives (most recovered with medical mgmt)

Mirvis et al. Am J Roetgen 1986; 147: 1171-1175
Summary

• No good studies evaluating the efficacy of any imaging modality on acalculous cholecystitis in the critically ill
• Ultrasound and HIDA have equivalent sensitivity and specificity
• Easiest and safest test is ultrasound
Percutaneous cholecystostomy

• Performed at bedside with ultrasound, or
• In IR suite with ultrasound + fluoroscopy
• Transhepatic or transperitoneal approach
• Tube is left in place for weeks until acute illness subsides
  – Cholecystectomy
  – No further treatment

Winbladh et al. HBP 2009; 11:183-193
Percutaneous Cholecystostomy

• No RCTs compare PC to LC or medical mgmt
• Systematic Review: 53 studies, 1918 patients (elderly or critically ill)

• Success rate = 85.6%
  – Includes patients with “sepsis of unclear origin”
• Procedural mortality = 0.36%
• Overall mortality = 15%

Winbladh et al. HBP 2009; 11:183-193
Percutaneous Cholecystostomy

• Review of 30 patients treated with PC
• Workup: physical exam, labs, abnormal ultrasound
• Results:
  – Technical success: 100%
  – Clinical improvement: 100%
  – Major complications or deaths related to procedure: 0
  – Minor complications: 10%

Carafiello et al. Radiol Med 2012
PC: Complications

- 62 patients with sepsis and acute cholecystitis
  - 13 pts acalculous, 49 calculous

- 92% had complete resolution of sx

- Complications = 30.6%
  - Only 1 directly attributable to procedure (bleeding)

- 30-day mortality = 15% (due to persistent sepsis)

Percutaneous Cholecystostomy

- Retrospective study of 106 patients undergoing percutaneous cholecystostomy
  - 71 ED patients (24% got admitted to ICU)
  - 35 inpatients previously admitted (46% ICU)
- Diagnosed by exam, labs, U/S or HIDA

- 68% clinically improved
  - Of 71 ED patients, 84% improved
  - Of 35 inpatients, 34% improved

PC: Complications

• Mortality 35.8%
  – Approx 1/3 of deaths attributed to acute cholecystitis

• Complications in 5 (4.7%)
  – Bile leak with peritonitis (n = 2)
  – Hemobilia (n = 2)
  – Progression of sepsis to septic shock (n = 1)

Empiric percutaneous cholecystostomy

- 82 patients with unexplained or persistent sepsis and abnormal RUQ ultrasound
- Percutaneous cholecystostomy

<table>
<thead>
<tr>
<th>Sign/symptom</th>
<th>% of patients</th>
</tr>
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<tbody>
<tr>
<td>Abnormal LFTs</td>
<td>70%</td>
</tr>
<tr>
<td>Temp &gt; 38.3 C</td>
<td>85%</td>
</tr>
<tr>
<td>Temp 37.2-38.3</td>
<td>15%</td>
</tr>
<tr>
<td>Pressors</td>
<td>45%</td>
</tr>
<tr>
<td>RUQ pain/tenderness</td>
<td>43%</td>
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<table>
<thead>
<tr>
<th>Result</th>
<th>%</th>
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<tbody>
<tr>
<td>Bedside procedure</td>
<td>91%</td>
</tr>
<tr>
<td>Clinical improvement</td>
<td>59%</td>
</tr>
<tr>
<td>Procedure complications</td>
<td>0%</td>
</tr>
<tr>
<td>Clinical improvement despite lack of symptoms</td>
<td>40%</td>
</tr>
</tbody>
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Sonographic findings before percutaneous cholecystostomy in critically ill patients

<table>
<thead>
<tr>
<th>Finding</th>
<th>Positive response group</th>
<th>Nonresponse group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallstones</td>
<td>17</td>
<td>11</td>
<td>26</td>
</tr>
<tr>
<td>Sludge</td>
<td>36</td>
<td>27</td>
<td>63</td>
</tr>
<tr>
<td>Wall thickening</td>
<td>22</td>
<td>12</td>
<td>34</td>
</tr>
<tr>
<td>Pericholecystic fluid</td>
<td>16</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>Murphy’s sign</td>
<td>17</td>
<td>2</td>
<td>19</td>
</tr>
<tr>
<td>Total</td>
<td>48</td>
<td>34</td>
<td>82</td>
</tr>
</tbody>
</table>
Summary: Acute Cholecystitis

• Typical diagnostic algorithms break down in critically ill patients
• Need a rapid way to diagnose and treat unstable patients with suspected biliary pathology
• Additional tests may add cost and risk without benefit
Summary: Imaging

• “Opinion on which test should be done first, second, or at all in acute cholecystitis must not be based entirely on the test’s diagnostic accuracy, but instead should be grounded in comprehensive appreciation of the clinical background and management challenges in AC.”

Summary: Percutaneous Cholecystostomy

• For any patient with unexplained sepsis and signs of acute cholecystitis
• Very safe procedure
• Can be done at bedside with ultrasound
• Diagnostic and therapeutic
  – Even a negative PC is helpful
• Additional testing is unnecessary and potentially harmful
Proposed decision tree

Critically ill, with clinical signs of AC

- Sepsis or shock
- Fever
- Leukocytosis
- RUQ pain or tenderness
- Abnormal LFTs
- No alternative diagnosis

CT scan

Normal GB/other cause

Appropriate management

Abnormal GB

Percutaneous cholecystostomy

Normal GB

CT scan?