Bile Duct Stone Management: Clinical Pearls

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Disclosures

- None.
Learning Objectives

• Discuss an evidence based strategy to correctly diagnose symptomatic bile duct stones.

• Review the challenge of biliary cannulation in the presence of an impacted CBD stone and a simple method for improving success.

• Discuss management of “simple” stones and when to consider a strategy of decompression and referral.
Challenge #1: Ensuring an Accurate Diagnosis
Challenge #1: Accurate Diagnosis of Choledocholithiasis

“ERCP is most dangerous for people who need it least.” – Peter B. Cotton, M.D.

Overall risk of post-ERCP pancreatitis varies from 5-15% and, in select populations with additive risk factors, may even approach 40%.

I know of no other commonly and community performed GI procedure with this type of risk profile.

Challenge #1: Accurate Diagnosis of Choledocholithiasis

ERCP is dangerous for the endoscopist as well as the patient.

Diagnosing Choledocholithiasis: *Not always Straightforward*

**Medical School Diagnosis of “Biliary Colic”:**

- **Severe, intermittent upper abdominal pain.**
- **Poorly localized to the epigastrium or RUQ.**
- **Onset over 15 minutes and lasts 1-6 hours.**
- **May be associated with elevated Bilirubin, AP, or transaminases (AST/ALT is transient).**

The differential diagnosis for symptoms compatible with “biliary colic” is broad.

The differential diagnosis for “abnormal LFTs” is equivalently broad.

2010 ASGE Guideline: “Role of endoscopy in the evaluation of suspected choledocholithiasis.”

- Published as a “proposed strategy to assign risk of bile duct stones in patients with symptomatic cholelithiasis.”
- Included a list of “predictors” which were assigned weight based upon retrospective surgical registry data.
- Accompanying algorithm to be used based upon features present.

ASGE Standards of Practice Committee. The role of endoscopy in the evaluation of suspected choledocholithiasis. Gastrointest Endosc. 2010 Jan; 71(1):1-9
## Diagnosing Choledocholithiasis: *Not always Straightforward*

### Table 2

A proposed strategy to assign risk of choledocholithiasis in patients with symptomatic cholelithiasis based on clinical predictors

<table>
<thead>
<tr>
<th>Predictors of choledocholithiasis</th>
<th>Likely Risk of Choledocholithiasis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very strong</strong></td>
<td></td>
</tr>
<tr>
<td>CBD stone on transabdominal US</td>
<td>(High)</td>
</tr>
<tr>
<td>Clinical ascending choilangitis</td>
<td>(High)</td>
</tr>
<tr>
<td>Bilirubin &gt;1 mg/dL</td>
<td>(High)</td>
</tr>
<tr>
<td><strong>Strong</strong></td>
<td></td>
</tr>
<tr>
<td>Dilated CBD on US (&gt;6 mm with gallbladder in situ)</td>
<td>(High)</td>
</tr>
<tr>
<td>Bilirubin level 1.8-4 mg/dL</td>
<td>(High)</td>
</tr>
<tr>
<td><strong>Moderate</strong></td>
<td></td>
</tr>
<tr>
<td>Abnormal liver biochemical test other than bilirubin</td>
<td>(Intermediate)</td>
</tr>
<tr>
<td>Age older than 55 years</td>
<td>(Intermediate)</td>
</tr>
<tr>
<td>Clinical gallstone pancreatitis</td>
<td>(Intermediate)</td>
</tr>
</tbody>
</table>

### Assigning a likelihood of choledocholithiasis based on clinical predictors

- Presence of any very strong predictor: **High**
- Presence of both strong predictors: **High**
- No predictors present: **Low**
- All other patients: **Intermediate**

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Table Adapted from: ASGE Standards of Practice Committee. *The role of endoscopy in the evaluation of suspected choledocholithiasis*. Gastrointest Endosc. 2010 Jan; 71(1):1-9
Diagnosing Choledocholithiasis: *Not always Straightforward*

**2010 ASGE Guideline:**

High = Very Strong

High = Both Strong

Low = Nothing

Intermediate = anything else

Problems w/ 2010 Guideline:

- Not externally validated before publication.
- Somewhat over-complex.
- Doesn’t apply to post-chole patients or those with atypical presentation(s).
- Doesn’t really help you figure out what to do with multiple measurements of Tb over time.
- Somewhat disrespects the DDx.

Diagnosing Choledocholithiasis: *Not always Straightforward*

Validation of ASGE Criteria by He et al.:

- Retrospective look at performance characteristics from guideline after 7 years.
- “High Risk Group” performed as follows:
  - Sensitivity for stone at ERCP: 64%
  - Specificity for stone at ERCP: 85%

Validation of ASGE Criteria by He et al.:

- If you change Criterion to be one of the following:
  1. Visualized stone on imaging.
  2. Presence of Cholangitis.
  3. \( Tb > 4 \) and dilated common bile duct

(none of the other stuff counts anymore)

Validation of ASGE Criteria by He et al.:

- **New Criteria perform better:**
  - Sensitivity for stone at ERCP: 55%
  - Specificity for stone at ERCP: 94%

He H et al. *Accuracy of ASGE high-risk criteria in evaluation of patients with suspected common bile duct stones*. Gastrointest Endosc. 2017 Sep;86(3): 525-532.
PEARL #1:
Use the 2019 ASGE Guideline High-Risk Criteria
Diagnosing Choledocholithiasis: *Not always Straightforward*

You may go promptly and directly to ERCP *if*:

- A stone is visualized in the duct on RUQ-US
- Acute cholangitis is present.
- Total Bilirubin > 4 and CBD is dilated.

Diagnosing Choledocholithiasis: Not always Straightforward

You may go promptly and directly to ERCP if:

- A stone is visualized in the duct on RUQ-US
- Acute cholangitis is present.
- Total Bilirubin > 4 and CBD is dilated.

Anything else....

.....perform a risk stratifying test (MRI/EUS)

CHALLENGE #2: Gaining Access to the Bile Duct
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Examination of the Major Papilla & Orientation

- Infundibulum
- Hood
- Papillary orifice
- Frenulum
Challenge #2: Gaining Access to the Bile Duct

Distal CBD stones foul successful access in several ways:

- Block the ampullary common channel
- Block the biliary orifice
- Cause significant edema or stricture (chronic stones).
- Distort the axis of the bile duct relative to the pancreas.
There are several options for biliary access:

- **Conventional “Selective Cannulation”**
- **Techniques w/o pancreatic manipulation:**
  - Freehand Needle Knife Papillotomy
  - Needle Knife Fistulotomy
  - EUS Directed biliary access techniques
- **Techniques with obligate pancreatic manipulation:**
  - Precut pancreatic septotomy.
  - Cannulation alongside PD stent.
  - Double Guidewire technique.
PEARL #2: Double Guidewire Technique
Pearl #2: Double-Guidewire Technique

Wang AY, Strand DS, Shami VS. Clin Gastroenterol Hepatol 2016;14
Pearl #2: Double-Guidewire Technique
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Huang C et al. Use of double wire guided technique and transpancreatic papillary septotomy in difficult ERCP: 4-year experience. EIO 2016; 04:1107-1110.
Pearl #2: Double-Guidewire Technique

Advantages of DGW
- Effective at assisting biliary access.
- Innate familiarity w/ equipment.
- Often occurs “en passant.”

Disadvantages of DGW
- Requires pancreatic manipulation.
- May have a higher rate of post-ERCP pancreatitis.
- Pancreatic stent placement?
**Pearl #2: Double-Guidewire Technique**

<table>
<thead>
<tr>
<th></th>
<th>SCT group (n = 87), no. (%)</th>
<th>DGT group (n = 76), no. (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute pancreatitis</td>
<td>7 (8)</td>
<td>13 (17)</td>
<td>.079</td>
</tr>
<tr>
<td>Mild</td>
<td>4 (5)</td>
<td>9 (12)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>2 (2)</td>
<td>2 (2.5)</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>1 (1)</td>
<td>2 (2.5)</td>
<td></td>
</tr>
<tr>
<td>Bleeding</td>
<td>5 (6)</td>
<td>0</td>
<td>.095</td>
</tr>
<tr>
<td>Acute cholangitis</td>
<td>0</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Acute cholecystitis</td>
<td>1 (1)</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Perforation</td>
<td>1 (1)</td>
<td>1 (1)</td>
<td>1.00</td>
</tr>
<tr>
<td>Death related to ERCP</td>
<td>1 (1)</td>
<td>0</td>
<td>1.00</td>
</tr>
</tbody>
</table>

SCTM, Standard cannulation technique; DGT, double-guidewire technique.

**Herreros de Tejada et al. Double-Guidewire technique for difficult bile duct cannulation. Gastrointest Endosc 2009; 70: (4) 701-709**
Pearl #2: Double-Guidewire Technique

<table>
<thead>
<tr>
<th>Outcome or subgroup title</th>
<th>No. of studies</th>
<th>No. of participants</th>
<th>Statistical method</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Post-ERCP pancreatitis</td>
<td>7</td>
<td>577</td>
<td>Risk Ratio (M-H, Random, 95% CI)</td>
<td>1.98 [1.14, 3.42]</td>
</tr>
<tr>
<td>1.1 Studies that permitted the use of rescue techniques</td>
<td>4</td>
<td>389</td>
<td>Risk Ratio (M-H, Random, 95% CI)</td>
<td>1.76 [0.72, 4.26]</td>
</tr>
<tr>
<td>1.2 Studies that did not permit the use of rescue techniques</td>
<td>3</td>
<td>188</td>
<td>Risk Ratio (M-H, Random, 95% CI)</td>
<td>2.31 [0.99, 5.40]</td>
</tr>
<tr>
<td>2 Overall CBD cannulation success</td>
<td>7</td>
<td>577</td>
<td>Risk Ratio (M-H, Random, 95% CI)</td>
<td>1.04 [0.91, 1.18]</td>
</tr>
<tr>
<td>2.1 Studies that permitted the use of rescue techniques</td>
<td>4</td>
<td>389</td>
<td>Risk Ratio (M-H, Random, 95% CI)</td>
<td>0.97 [0.81, 1.16]</td>
</tr>
</tbody>
</table>

Tse et al. Pancreatic duct guidewire placement for biliary cannulation for the prevention of PEP pancreatitis. Systematic Review. Cochrane Database.
**Pearl #2: Double-Guidewire Technique**


<table>
<thead>
<tr>
<th></th>
<th>Stent group</th>
<th>No-stent group</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITT</td>
<td>1 (2.9%)</td>
<td>8 (23%)</td>
<td>0.13</td>
<td>0.016, 0.95</td>
</tr>
<tr>
<td>PP</td>
<td>0</td>
<td>9 (24%)</td>
<td>( P = 0.0096 )</td>
<td>–</td>
</tr>
</tbody>
</table>

**Table 3** Frequency of post-ERCP pancreatitis

*ITT* intent-to-treat analysis, *PP* per-protocol analysis, *RR* relative risk, *CI* confidence interval
Pearl #2: Double-Guidewire Technique

Fig. 1  Evidence-based algorithm for biliary cannulation in endoscopic retrograde cholangiopancreatography (ERCP). CBD, common bile duct.

Testoni PA et al. Endoscopy 2016;48
CHALLENGE #3:
Stone Extraction
Challenge #3: Stone Extraction

- Per the ASGE Guideline (2019), outcome metrics of interest when endoscopically managing stones include:
  - Complete stone clearance.
  - Clearance in 1 session, if possible.
  - Minimize adverse events and procedure time.
  - Minimize mechanical lithotripsy.

Challenge #3: Stone Extraction

Options to facilitate stone removal:

- Making additional space:
  - Endoscopic Sphincterotomy (ES)
  - Papillary Balloon Dilation (EPBD)

- Destroying the calculus:
  - Mechanical Lithotripsy
  - Laser or Electrohydraulic Lithotripsy
  - ESWL
Challenge #3: Stone Extraction

Basic Stone Extraction:

- Complete Endoscopic Sphincterotomy
- Followed by Balloon extraction
- Sufficient for straightforward stones
**Question:** What is a difficult bile duct stone?

- **Stones with problematic conformation.**
  - **Large Size (>1 to 1.5 cm), Irregular Shape.**

- **Stones in a difficult location.**
  - **Common bile duct stricture, angled CBD, cystic or hepatic duct stones**

- **Stones present in patients with altered anatomy.**
  - **RYGB, Billroth II, Hepatojejunostomy**

ESGE Algorithm for Common Bile Duct Stones

PEARL #3: Papillary Dilation
Performing Large Papillary Balloon Dilation

- Perform after limited ES (1/3 to ½ distance to horizontal fold).
- w/ 12-20 mm dilating balloon (smaller?).
- Size balloon to be at or less than diameter of distal duct!

Why Large Papillary Balloon Dilation?

Advantages of EPBD:

- Improves stone clearance rate (OR 2.8)
- Reduces the need for mechanical lithotripsy by 30-50%.
- Appears comparable or safer than complete ES for overall AE (OR 0.8).

Technically Easy, Lower Cost than mechanical lithotripsy.

Can place stent afterward for safety.

PEARL #4: Discretion
Pearl #4: Know when to fold ‘em.

Although the goal of ERCP for biliary stones is complete ductal clearance....

..........It is completely reasonable to provide drainage and then refer patients to a center with the necessary equipment and expertise.

Pearl #4: Know when to fold ‘em.

Advantages of stenting:
- Immediate provision of safety for the patient.
- Stent may actually reduce volume & number of stones.

If you’re going to do this – placement of two plastic stents (7 or 8.5 Fr) has better 3-month patency (p=0.008).

Pearl #4: Know when to fold ‘em.

Stents are not a destination:

- **Cholangitis is significant if not changed in 3 month intervals** (35.9% vs 7.7%, p<0.03).

- **And in the elderly (80+) treated with “definitive stenting,” the downstream complication rate is significant** ... 34-63% of cases, driven by **bacterial cholangitis**.

What can I do with difficult stones?

A Referral Center (e.g. UVA) has a lot of value:

- Additional options for biliary access:
  - Conventional, PD wire, and NK access techniques.
  - EUS directed biliary access.
  - Access in Surgically altered UGI anatomy (EDGE)
- Additional options for stone remediation:
  - Mechanical Lithotripsy
  - Cholangioscopy directed Laser lithotripsy
  - Electric (NK) lithotripsy (for distal impaction).
  - ESWL
Take-Home Points
Take Home Points

1. Diagnosing choledocholithiasis is not always easy.
2. Prompt ERCP is indicated for cholangitis, a visualized stone, or Tb >4 and a dilated bile duct.
3. Any other combination = risk stratifying test.
4. Impaction (or distal stricture) may make biliary access challenging, even for a “simple stone.”
5. Double wire technique (DGW) is an easy, powerful tool for biliary access... especially if en passant.
6. PD wire manipulation = PD stent placement (and indomethacin).
Take Home Points

7. Small stones should be removed with endoscopic sphincterotomy + balloon sweep.

8. Balloon papillary dilation (EPBD) should be the second line approach to larger stones, w/o a distal stricture.

9. Defer mechanical lithotripsy unless you have experience / confidence extricating a trapped basket.

10. When in doubt – place two 7-8.5 Fr plastic stents and refer to a dedicated interventional endoscopist.
Questions?