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BILIARY DISEASE

Choledocolithiasis: Management Strategies?

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Welcome to Philadelphia!

PHILADELPHIA EAGLES
Choledocolithiasis: Management Strategies

- Learning objectives
  - Be familiar with the techniques to diagnose suspected choledocolithiasis
  - Discuss the endoscopic management of routine choledocolithiasis
  - Know the endoscopic options for defiant common bile duct stones

Choledocholithiasis

- Common problem:
  - 10% of patients with symptomatic gallstones
  - up to 15% with acute cholecystitis
  - CBD stones can lead to biliary pain, obstructive jaundice, cholangitis, or pancreatitis.
  - CBD stones may be classified as primary (CBD) or secondary (GB).
Types of Gallstones

- Cholesterol
- Pigment
- Mixed

Diagnosing Suspected Choledocholithiasis

- **Laboratory testing**
  - Liver associated enzymes
    - Elevated conjugated bilirubin > 4mg/dl
    - Transaminases 2-5 x’s the ULN
    - Alkaline phosphatase 2.5 x’s ULN
- **Diagnostic imaging**
  - Trans-abdominal ultrasound
  - Helical CT scan
  - MRI with MRCP
  - EUS/CUSP
Diagnosing Suspected Choledocholithiasis

- Diagnostic imaging
  - Trans-abdominal ultrasound
    - Detection of CBD stone has near 100% accuracy
    - Sensitivity for detection of CBD stones is only 15% to 30%
    - CBD diameter >10 mm in a jaundiced patient predicts CBD stones in > 90% of cases
    - CBD dilation > 6 mm with in situ gallbladder is a strong predictor of CBD stone

Comparing Diagnostic Imaging Tests for Suspected Choledocolithiasis


- 32 consecutive patients with suspected GS pancreatitis
- Studies within 24-72 hrs of admission
- Endoscopic stone extraction as reference standard
Comparing Diagnostic Imaging Tests for Suspected Choledocolithiasis

<table>
<thead>
<tr>
<th>Test</th>
<th>US</th>
<th>CT</th>
<th>MRCP</th>
<th>ERCP</th>
<th>IDUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sens (%)</td>
<td>20</td>
<td>40</td>
<td>80</td>
<td>90</td>
<td>95</td>
</tr>
</tbody>
</table>

- The overall agreement between MRCP and ERCP was 90.6% (k = 0.808, p < 0.01).
- The sensitivity of MRCP decreased with dilated bile ducts (bile duct diameter > 10 mm, 72.7% vs 88.9%).
- MRCP did poorly for small stones (< 3 mm).
- The combination of ERCP and IDUS improved accuracy in the diagnosis of choledocholithiasis.


Diagnosing Suspected Choledocholithiasis

- Diagnostic imaging
  - Endoscopic Ultrasound
    - Sensitivity for the diagnosis of CBD stones by EUS ranges from 92% to 100%
    - Specificity: 95% to 100%
    - However, data obtained at expert centers
    - Not readily available in most centers
**Suspected Choledocolithiasis – Which test?**

- Risk and likelihood dependent
- ERCP for all high-likelihood patients
- EUS for intermediate-likelihood, average-risk patients
- MRCP for intermediate-likelihood, high-risk patients
- No further imaging when low-likelihood

ASGE Guideline GIE 2010;71:1-9

**Predictors of choledolithiasis**

<table>
<thead>
<tr>
<th>Very strong</th>
<th>Strong</th>
<th>Moderate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBD stone on transabdominal US</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical ascending cholangitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilirubin &gt; 4 mg/dL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dilated CBD on US (&gt;6 mm with gallbladder in situ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilirubin level 1.8-4 mg/dL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal liver biochemical test other than bilirubin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age older than 55 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical gallstone pancreatitis</td>
<td></td>
<td></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 |

CBD: Common bile duct
Endoscopic Sphincterotomy
Cholangitis with Choledocolithiasis

Standard Techniques for CBD Stone Removal

<table>
<thead>
<tr>
<th>ES Attempted (#)</th>
<th>Successful ES (%)</th>
<th>Duct Clearance (%)</th>
<th>Morbidity (%)</th>
<th>Mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7939</td>
<td>94%</td>
<td>88%</td>
<td>7%</td>
<td>1.2%</td>
</tr>
</tbody>
</table>

Courtesy: David Lichtenstein, MD
Defiant Bile Duct Stones

- Defy removal by standard techniques
  - Large stones (>12 mm)
  - Impacted stones
  - Multiple stones
  - Odd shaped stones
  - Distorted duct/stone size ratio
- Adjunctive biliary balloon sphincteroplasty
- Mechanical lithotripsy
- Stenting
- Electrohydraulic lithotripsy

Adjunctive Balloon Biliary Sphincteroplasty

- Effective for defiant bile duct stones
- Performed with a new or pre-existing sphincterotomy
- Large diameter balloons (12-18 mm)
- Match to the duct diameter

Cheung, et al. DDW 2009
Biliary Balloon Sphincteroplasty
Defiant Stone Extraction
### Adjunctive BBS: Supporting Data

<table>
<thead>
<tr>
<th>Series</th>
<th>no. of procedures</th>
<th>balloon size (mm)</th>
<th>mean largest stone (mm)</th>
<th>% Success in first session</th>
<th>% Use of lithotripsy</th>
<th>Complications (No. [%])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoz et al¹</td>
<td>58</td>
<td>12-20</td>
<td>16/18</td>
<td>83</td>
<td>7</td>
<td>Overall: 9 (16), Mild: 6 (10), Moderate: 3 (6), Severe: 0, Pancreatitis: 2 (3) (all mild)</td>
</tr>
<tr>
<td>Minami et al²</td>
<td>88</td>
<td>Up to 20</td>
<td>14 ± 3</td>
<td>99</td>
<td>1</td>
<td>Overall: 5 (66), Mild: 4 (5), Moderate: 1 (1), Severe: 0, Pancreatitis: 1 (1) (mild)</td>
</tr>
<tr>
<td>Espinel et al³</td>
<td>22</td>
<td>12-20</td>
<td>13 ± 4</td>
<td>100</td>
<td>5</td>
<td>Overall: 11 (56), Mild: 8 (5), Moderate: 5 (5), Severe: 4 (4) (all mild)</td>
</tr>
<tr>
<td>Yoo et al⁴</td>
<td>166</td>
<td>15–20</td>
<td>16.1 ± 5.4</td>
<td>83</td>
<td>NM</td>
<td>Overall: 11 (69), Mild: 4 (4), Moderate: 4 (2), Severe: 3 (4) (all mild)</td>
</tr>
<tr>
<td>Kann et al⁵</td>
<td>100</td>
<td>12-20</td>
<td>NM</td>
<td>97</td>
<td>8</td>
<td>Overall: 10 (19), Mild: 13 (19), Moderate: 13 (19), Severe: 3 (4) (all mild)</td>
</tr>
<tr>
<td>Park et al⁶</td>
<td>70</td>
<td>15–20</td>
<td>NM (all &gt; 15)</td>
<td>100</td>
<td>16</td>
<td>Overall: 13 (19), Mild: 13 (19), Moderate: 13 (19), Severe: 3 (4) (all mild)</td>
</tr>
<tr>
<td>Cho et al⁷</td>
<td>69</td>
<td>NM</td>
<td>17.5 ± 18.3</td>
<td>91</td>
<td>NM</td>
<td>Overall: 57 (7), Mild: 4 (5), Moderate: 4 (6) (all mild)</td>
</tr>
<tr>
<td>Myoung et al⁸</td>
<td>62</td>
<td>12–15</td>
<td>16</td>
<td>92</td>
<td>5</td>
<td>Overall: 5 (83), Mild: 5 (83), Moderate: 0, Severe: 0</td>
</tr>
<tr>
<td>Cha et al⁹</td>
<td>38</td>
<td>15–20</td>
<td>18.9 ± 5.1</td>
<td>95</td>
<td>3</td>
<td>Overall: 3 (8), Mild: 1 (3), Moderate: 1 (3), Severe: 0</td>
</tr>
<tr>
<td>Cams et al¹⁰</td>
<td>9</td>
<td>13.5–18</td>
<td>21.8</td>
<td>78</td>
<td>33</td>
<td>Overall: 0</td>
</tr>
<tr>
<td>Current study</td>
<td>107</td>
<td>12–16</td>
<td>12.8± 5.4</td>
<td>96</td>
<td>27</td>
<td>Overall: 6 (6), Mild: 2 (2), Moderate: 1 (1), Severe: 3 (3)</td>
</tr>
<tr>
<td>Total</td>
<td>789</td>
<td>12–20</td>
<td>NA</td>
<td>92%</td>
<td>12%</td>
<td>7.6%</td>
</tr>
</tbody>
</table>

Attasaranya et al. Gastrointest Endosc 2008;67:1046-1052

### Through the Scope: Mechanical Lithotriptor

- Easy-to-assemble single use basket
- Choice of wire-guided or rotatable basket for selective cannulation
- Three layer system: basket, inner plastic sheath, outer metal sheath
- Cannulation with plastic sheathed basket
- Plastic sheath retracted and stone capture with basket
- Stone removed intact or if necessary crushed with closure against metal sheath

Courtesy: David Lichtenstein, MD
Mechanical Lithotripsy: For Large Bile Duct Stones (7 Studies)

<table>
<thead>
<tr>
<th>N</th>
<th>Stone Diameter Range (mm)</th>
<th>Stone Captured</th>
<th>Duct Clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>592</td>
<td>4-80</td>
<td>525</td>
<td>515 (87%)</td>
</tr>
</tbody>
</table>

Stenting for Defiant/Retained Stones

- Ensure drainage
- Stone erosion
- Subsequent clearance
- Temporizing measure

Bergman et al. GIE 1995
Chopra et al. Lancet 1996

Courtesy: David Lichtenstein, MD
Stenting for Defiant/Retained Stones

Nasobiliary

Paired Straight

Lee et al. GIE 2002

Double Pigtail

Image Guided Therapy

Modified from Takan et al., Tokyo Medical University
Single Operator Cholangioscopy

- Single operator
- 4 direction steering
- Single use catheter-based
- Reusable fiber
- Dedicated processor and light source
- 10 Fr OD, 1.2 mm WC
- 4 channels
- Facilitates
  - Direct visualization
  - Biopsy
  - Stone therapy
- Optics are crude
  But they will get better!

SOC Guided EHL
Choledocolithiasis: Management Strategies

- Laboratory and imaging studies can be used to effectively identify patients apt to benefit from ERCP
- Most CBD stones can be managed with simple sphincterotomy and stone extraction
- Defiant CBD stones may be effectively managed with adjunctive techniques
  - Biliary balloon sphincteroplasty
  - Mechanical lithotripsy
  - Stents
  - Cholangioscopy with EHL/laser lithotripsy

Yo! Enjoy your time in Philly!