Management of Retained Common Bile Duct Stones

Nefertiti A. Brown, MD
SUNY Downstate Medical Center
Morbidity and Mortality Conference
October 25, 2012
Case Presentation.. of the **SAME** patient...

- POD#7- normal t-tube cholangiogram
- POD#8- discharged home
- POD#16 - Clinic f/u \(\rightarrow\) increase in drain output
- POD#27- t-tube cholangiogram showed distal CBD filling defect
Case Presentation... of the **SAME** patient...

- Readmitted POD#36 with cholangitis
  - discharged 5 days later

- Barriers to ERCP- duodenal diverticulum

- Plan: OR for Percutaneous biliary exploration
Case Presentation

• OR
  - Percutaneous biliary exploration, Intraoperative Cholangiogram (IOC)
  - IOC demonstrated stone, choledochoscope advanced through the biliary tree to the duodenum
  - no stone was visualized

• Repeat on-table cholangiogram showed no evidence of stone
But...

- POD#1: formal T-tube cholangiogram
  - large impacted stone in the distal CBD just proximal to the ampulla of Vater
Case Presentation

• Returned to the OR
  - Percutaneous endoscopic biliary exploration, holmium laser lithotripsy, stone extraction
  - on table IOC normal

• Postop course
  - Discharged 2 days later
  - f/u t-tube cholangiogram (8/8) was normal
Goals

• History
• Classifying stones
• The problem
• Preoperative, Intraoperative, and Postoperative identification of CBD stones and approaches in management
• Complications in management
• Tailoring decision making to patient’s circumstances
1889 Abbe – Choledochotomy
1890 Ludwig Courvoisier – CBD exploration
1932 Mirizzi – Intraoperative cholangiography
1941 Mclver – Rigid choledochoscopy
1968 McCune – ERCP
1972 Burhenne- removal of retained common duct stones through a T-tube tract
1974 Kawai- Endoscopic sphincterotomy
1983 Staritz - Papillary endoscopic balloon dilatation
Describing stones

- Primary stones (usually brown pigment stones), which form in the bile ducts
- Secondary stones (usually cholesterol), which form in the gallbladder but migrate to the bile ducts
- Residual stones, which are missed at the time of cholecystectomy (evident < 3 yr later)
- Recurrent stones, which develop in the ducts > 3 yr after surgery
The problem

- Choledocholithiasis occurs in 15–20% of patients with cholelithiasis.
- After biliary tract surgery, 2–5% of patients present with residual biliary stones.
- 5.2%-12% asymptomatic.

Etiology

- Na+ transport → bile concentrates in Ca^{2+} & cholesterol
- Gallbladder motility
- Biliary stasis
- Biliary tract infection
- Cholangitis and gallstone pancreatitis.
Preoperative Diagnosis

- Blood tests (elevated LFT’s)
- Abdominal U/S
  - 15-30% sensitivity, If CBD >10mm → 90%
- EUS
  - Sensitivity and specificity 92-100%
- MRCP
  - 90% sensitive, 100% specificity
- ERCP
ERCP

Diagnostic and therapeutic

Endoscope into 2\textsuperscript{nd} portion of duodenum

Papilla visualized & cannulated
  \begin{itemize}
  \item Radioopaque dye injected under fluroscopy
  \item Stones appear as filling defects
  \end{itemize}

Performed in conjunction with sphincterotomy and stone extraction

Stats: 99\% success rate, 6\% morbidity, 0.2\% mortality
Complications

• Pancreatitis (3.5%)  
• Cholangitis (<1%)  

Contrast related

• Duodenal perforation (0.1 to 0.6%)

• Bleeding (1.3%)

3-10% not suitable for ERCP
Localizing stones intraoperatively

- Intraoperative cholangiogram (IOC)
- Intraoperative ultrasound
- Common bile duct exploration
Intraoperative Cholangiogram (IOC)
• Time consuming (>16 min)
• Film often inadequate
• Lower success rate (47%)
• Visualization of anatomy more difficult
• Difficulty in differentiation between stones and air bubbles
IOC

- Less time consuming (<5 min)
- Better quality and higher resolution
- **In real time**, higher success rate (96%)
- Possibility of interaction with the findings
- Required for transcystic exploration of CBD
- +/- issues w/availability

IOC complications

- Bleeding
- Infection
- Pancreatitis
- Damage to the common bile duct
Intraoperative U/S

- Success rate ~90%
- High sensitivity and specificity (~94%)
- Safer
- Procedure time <10 min
- Low resolution
- Operator dependent

CBD exploration (CBDE)

- Laparoscopic vs. Open
  - Lap: Transcystic vs. transductal approach
  - Open
- Surgeon’s comfort
Transcystic:

- Stone < 6 mm
- Cystic duct > 4 mm
- CBD < 6 mm
- Stone location distal to the cystic duct/CBD Junction
- Fewer than 6 to 8 stones within the CBD
Laparoscopic CBD Exploration

Transductal:
- Failed laparoscopic transcystic exploration or preoperative endoscopic stone extraction
- Stone > 6 mm
- Cystic duct < 4 mm
- CBD > 6 mm
- Multiple stones
- Stone location proximal to the cystic duct/CBD junction
Multiple centers (19, n=226)
- 8.5% preop ERCP w/ sphincterotomy
  - < ½ cases w/ successful extraction
- 83% removed transcystically, 17% transductal

Conversion to open: 5%
- Transcystic, 19%
- Transductal

7% morbidity

Retained stones seen in 2.6% of cases

Complications
  - Bile duct leak (2-6%)
  - Subhepatic abscess (0.7%)
  - Retained stone

Berci, et al 1994
  Rojas-Ortega S, Arizpe-Bravo D, Marín López ER, Cesin-Sánchez R, Roman GR, Gómez C.
  Thompson MH, Tranter SE.
  Tai CK, Tang CN, Ha JP, Chau CH, Siu WT, Li MK.
  Poulose BK, Arbogast PG, Holzman MD.

- Stone clearance rates ranging from 85% to 95%, vs. ERCP, less cost, <LOS
- Morbidity rate of 4%–16%, - CBD laceration, stricture, 
- Mortality rate of around 0%–2% bile leak
## Summary of randomized trials comparing endoscopic common duct clearance plus surgery against surgery alone

<table>
<thead>
<tr>
<th>Reference (year)</th>
<th>Treatment</th>
<th>n</th>
<th>Successful duct clearance</th>
<th>Mortality</th>
<th>Morbidity (Total)</th>
<th>Morbidity (Major)</th>
<th>Additional procedures required</th>
<th>Median hospital stay (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neoptolesos</td>
<td>ES</td>
<td>55</td>
<td>50</td>
<td>2</td>
<td>18</td>
<td>9</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>(1987)</td>
<td>S</td>
<td>59</td>
<td>54</td>
<td>1</td>
<td>13</td>
<td>5</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Stain</td>
<td>ES</td>
<td>26</td>
<td>17</td>
<td>0</td>
<td>4</td>
<td>1</td>
<td>n·a·</td>
<td>5</td>
</tr>
<tr>
<td>(1991)</td>
<td>S</td>
<td>26</td>
<td>23</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>n·a·</td>
<td>6</td>
</tr>
<tr>
<td>Stiegmann</td>
<td>ES</td>
<td>16</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>n·a·</td>
</tr>
<tr>
<td>(1992)</td>
<td>S</td>
<td>18</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>n·a·</td>
</tr>
<tr>
<td>Hammarstrom</td>
<td>ES</td>
<td>39</td>
<td>35</td>
<td>0</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>n·a·</td>
</tr>
<tr>
<td>(1995)</td>
<td>S</td>
<td>41</td>
<td>37</td>
<td>0</td>
<td>9</td>
<td>4</td>
<td>4</td>
<td>n·a·</td>
</tr>
<tr>
<td>Targarona</td>
<td>ES</td>
<td>50</td>
<td>44</td>
<td>3</td>
<td>8</td>
<td>5</td>
<td>n·a·</td>
<td>5</td>
</tr>
<tr>
<td>(1996)</td>
<td>S</td>
<td>48</td>
<td>45</td>
<td>2</td>
<td>11</td>
<td>4</td>
<td>n·a·</td>
<td>11</td>
</tr>
<tr>
<td>Kapoor</td>
<td>ES</td>
<td>16</td>
<td>11</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>10.6</td>
</tr>
<tr>
<td>(1996)</td>
<td>S</td>
<td>17</td>
<td>13</td>
<td>0</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>11.3</td>
</tr>
<tr>
<td>Suck</td>
<td>ES</td>
<td>97</td>
<td>67</td>
<td>3</td>
<td>13</td>
<td>13</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>(1998)</td>
<td>S</td>
<td>105</td>
<td>75</td>
<td>1</td>
<td>13</td>
<td>5</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Rhodes</td>
<td>ES</td>
<td>40</td>
<td>37</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>3.5</td>
</tr>
<tr>
<td>(1998)</td>
<td>S</td>
<td>40</td>
<td>30</td>
<td>0</td>
<td>7</td>
<td>2</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Cuschieri</td>
<td>ES</td>
<td>133</td>
<td>82</td>
<td>2</td>
<td>17</td>
<td>9</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>(1999)</td>
<td>S</td>
<td>133</td>
<td>92</td>
<td>1</td>
<td>21</td>
<td>9</td>
<td>17</td>
<td>6</td>
</tr>
<tr>
<td>Sgourakis</td>
<td>ES</td>
<td>42</td>
<td>27</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>(2002)</td>
<td>S</td>
<td>36</td>
<td>24</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>7.4</td>
</tr>
<tr>
<td>Nathanson</td>
<td>ES</td>
<td>45</td>
<td>43</td>
<td>0</td>
<td>11</td>
<td>6</td>
<td>3</td>
<td>7.7</td>
</tr>
<tr>
<td>(2005)</td>
<td>S</td>
<td>41</td>
<td>40</td>
<td>0</td>
<td>12</td>
<td>7</td>
<td>3</td>
<td>6.4</td>
</tr>
<tr>
<td>Hong</td>
<td>ES</td>
<td>93</td>
<td>85</td>
<td>0</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>4.2</td>
</tr>
<tr>
<td>(2006)</td>
<td>S</td>
<td>141</td>
<td>126</td>
<td>0</td>
<td>22</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>ES</td>
<td>652</td>
<td>503</td>
<td>11</td>
<td>106</td>
<td>58</td>
<td>72</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>705</td>
<td>565</td>
<td>6</td>
<td>128</td>
<td>43</td>
<td>52</td>
<td>8.2%</td>
</tr>
</tbody>
</table>
Indications

- Patients:
  - w/ CBD stones undergoing open cholecystectomy
  - who failed or suffered complications from Lap CBDE
  - w/ severe Triangle of Calot inflammation
  - when laparoscopic equipment, experience, and/or resources are limited
Open CBDE

- Anterior duct exposed
- Stay sutures laterally
- CBD opened vertically
- Catheter irrigation
- +/- Fogarty, basket, stone forceps, scope
- Place t-tube
- Close choledochotomy
Dealing with difficult CBD stones: Open drainage procedures

Indications:

- Multiple CBD stones
- Recurrent choledocholithiasis
- Unsuccessful sphincterotomy
- Impacted large CBD stones
- Markedly dilated CBD

Choices:

- Transduodenal sphincteroplasty
- Choledochoduodenostomy
- Choledochojejunostomy
Postoperative Management

- Post-op ERCP

- Dissolution
  - Ursodeoxycolic acid
  - Methyl tert-buthyl ether (MBTE)

- Lithotripsy
  - Mechanical (crushing technique)
  - Extra-corporeal shock wave (electromagnetic)
  - Intra-corporeal (laser)
Lithotripsy

- Electrohydraulic Lithotripsy (EHL)
  - direct high voltage
  - cholangioscopy or under fluoroscopy
  - reserved for CBD packed with multiple stones or a large impacted stone
  - Tissue damage, bleeding

- Extracorporeal Shockwave Lithotripsy (ESWL)
  - Percutaneous sound waves
  - done before ERCP
  - clearance rates of 83% to 90%
  - not common approach in US
Laser lithotripsy

- amplified light energy
- under direct vision with cholangioscopy or under fluoroscopic control
- rate of duct clearance for retained CBDS using is 64-97%
Ten years of Swedish experience with intraductal electrohydraulic lithotripsy and laser lithotripsy for the treatment of difficult bile duct stones: an effective and safe option for octogenarians.


- Retrospective study (1995-2006)
- 44 patients with a median age of 80 years underwent EHL or ILL
- Success in 34 (77%). The others required multiple attempts. All but one achieved complete clearance (recurrent CBD stones)
- Median f/u 53 mths
CBDS Algorithm

CBD stones

Gallbladder in situ

Consider cholecystectomy ± CBD exploration, preferably laparoscopic if indicated and available

Sequence according to local policies

Advanced endoscopic/percutaneous techniques e.g. mechanical lithotripsy or ESWL if available

Irretrievable stones; CBD stent inserted

BS+ESE

Patient unfit or surgery not appropriate

Biliary stent as definitive treatment?

Previous cholecystectomy

www.downstatesurgery.org

biliary sphincterotomies (BS)
endoscopic extraction (ESE)

Conclusions

- All patients with symptomatic cholelithiasis must be evaluated for possible CBD stones
- Multidisciplinary approach to CBD stones
- Exploration of the CBD should be performed in all patients with CBD stones who have either failed, or are not candidates for, endoscopic therapy and who do not have medical conditions that prohibit surgical intervention
- Laparoscopic CBD exploration is safe, cost-effective and carries low morbidity and mortality rate
- Surgeon’s experience, level of clinical suspicion, resources and patient factors determine:
  - Lap vs. open approach. +/- drainage procedure
  - use of other modalities
References

- Aoki, Takeshi; Murakami, Masahiko; Yasuda, Daisuke; Shimizu, Yoshinori; Kusano, Tomokazu; Matsuda, Kazuhiro; Niiya, Takashi; Kato, Hirohisa; Murai, Noriyuki; Otsuka, Koji; Kusano, Mitsuo; Kato, Takashi. Intraoperative fluorescent imaging using indocyanine green for liver mapping and cholangiography. Journal of Hepato-Biliary-Pancreatic Sciences vol. 17 issue 5 September 2010. p. 590 – 594.
Question 1

The most common gallstones in the developed world are:

A) Brown pigment  
B) Black pigment  
C) Cholesterol  
D) Quartz
Question 2

The most common complication of ERCP is:

A) Perforation
B) Pancreatitis
C) Cholangitis
D) Bleeding
Which of the following statements is true?:

A) Laparoscopic CBDE carries low morbidity and mortality rate, but is not cost effective

B) There is potential use for lithotripsy in elderly & frail patients with CBDS w/acceptable results

C) Surgeon’s comfort means favorite OR, not resources to operate
Why didn’t this patient undergo ERCP with sphincterotomy post-cholecystectomy?

A) Previous h/o cholangitis
B) Duodenal diverticulum
C) Abnormal anatomy
D) Age