Gallstone and Choledocholithiasis

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Gallstones & Choledocholithiasis

• In US, 500,00 to 700,000 cholecystectomies are performed every years
• The prevalence of gallstones was 7.1% and cholecystectomy rate was 5.3%
• The prevalence of bile duct stone is less well defined
• In Western countries bile duct stone typically originate from gallbladder- often mixed or cholesterol

Gastroenterology 2011;140:508

Gallstones & Choledocholithiasis

• In surgical series of CCX for uncomplicated gallstones, the incidence of bile duct stones is <5%
• In patients with acute biliary pancreatitis who undergo early ERCP, 47% have CBD stones

NEJM 1997;336:237.

Natural history of CBD stones

• 20-30% pass within 4-6 weeks
• Stones size <5 mm was independent predictor of passage
• Smaller stone passage is asymptomatic
• Larger stone passage can cause acute pancreatitis, biliary colic, cholangitis
• Chronic obstruction can cause secondary biliary cirrhosis or portal HTN
• Patients with suspected CBD stones should be evaluated and if stones are identified, these should be removed

GIE 2010;71:1.

Evaluation of suspected CBD stones

• LFTS
  – NPV 95-98 percent
  – PPV is only 15%
• Transabdominal US
  – Sensitivity <50%
  – NPV of nl bile duct size 95%
• Predictors of CBD stones
  – High (>50%): cholangitis or TB >4 or CBD >6 mm + TB 1.8-4
  – Intermediate (10-50%): age>55, ABP, abn LFTs
  – Low (<10%): None

Gastroenterology 2009;136;1545-1550.
Imaging in the diagnosis of CBD stones

- MRC
  - Sensitivity 85-92%
  - 71% for stones < 5 mm, 100% for stone 10 mm
  - Specificity 93-97%
  - False+ air bubbles or bilo-enteric anastomosis
  - Non-invasive
- EUS
  - Sensitivity 93%
  - Specificity >95%
  - Not affected by the size of sbd or stone
- Diagnostic ERCP: replaced by EUS, MRC
- Resource availability and patient preference determines the choice between EUS and MRC

Ann Intern Med 2003;138:547
GUE 2008;67:235

Imaging for suspected CBD stones

- High suspicion for CBD stones
  - Therapeutic ERCP
- Intermediate or low suspicion for CBD stones
  - NPV of EUS 96%
  - EUS 1st approach avoided ERCP in 67%
  - The use of EUS reduced risk of overall adverse events (RR 0.35) and post-ERCP pancreatitis (RR 0.21)
  - Cost saving may be higher if same session EUS and ERCP


Treatment of Bile Duct Stones

- Endoscopic papillotomy is the standard method of treating bile duct stones
- Approximately 85-90% of bile duct stones can be extracted using a retrieval balloon or basket after papillotomy
- Removal of bile duct stones may be difficult in 10-15% of patients

McHenry L and Lehman G. Current Treat Options Gastroenterol 2006;9:123.

What are “Difficult-to-treat” Bile Duct Stones?

- Anatomical situation
  - Altered anatomy, periampullary diverticulum
- Character of stones
  - Large, multiple stones
- Location of stones
  - Intrahepatic stones, stones above strictures, impacted stones (Mirizzi syndrome)
- Patient’s condition
  - Very poor general condition, elderly, coagulopathy, pregnancy


Distal CBD Diameter & Stone Size

A


Distal CBD Length & Angulation

A

Kim et al. GIE 2007:65:115A.
Endoscopic Techniques for Management of “Difficult-to-treat” Bile Duct Stones

- Endoscopic papillotomy (“Cut”)
- Endoscopic papillary balloon dilation (“Dilate”)
- Endoscopic papillotomy followed by large papillary balloon dilation ("Cut & dilate")
- Mechanical lithotripsy
- Intra-ductal shock-wave lithotripsy

Endoscopic Papillotomy “Cut”

- Success rate of removing large stones by papillotomy alone is 12%.
- Technically difficult to perform in patients with altered anatomy, periampullary diverticula or small papilla.
- Complications (bleeding, perforation, pancreatitis, cholangitis) in 5-10 percent


Endoscopic Papillary Balloon Dilation “Dilate”

- Simple, easy to perform, lower risk of bleeding, cholangitis but higher risk of severe pancreatitis than papillotomy
- Efficacy similar or less than papillotomy
- Indicated for patients with altered anatomy, coagulopathy, duodenal diverticula


Endoscopic Papillotomy followed by Large Balloon Dilation “Cut” and “Dilate”

- Technique is not standardized
  - “limited or “maximum” papillotomy
    - Altered anatomy, periampullary diverticulum, small papilla
  - Duration of dilation: 10 s to 60 s; 2 min to 6 min
  - Size of balloon: 12 mm to 20 mm, proportionate to CBD and stone

Dig Dis Sci 2013;58:1100
Mechanical Lithotripsy
• Stones > 20 mm
• Inexpensive, readily available
• Success rate 79 to 92 percent
• Failure in impacted stone, very large stone
• Complications (bleeding, pancreatitis): 6-13 %
• Technical complications: impaction/wire fracture in 4 %

Intra-ductal Shock Wave Lithotripsy
• 2nd line method of stone therapy
• Shock wave may be generated in a fluid medium by a bipolar probe capable of generating a spark (electrohydraulic lithotripsy) or by pulsed dye laser systems (laser lithotripsy)
• Performed under direct cholangioscopy for accurate stone targeting and avoid injury to the bile duct wall
• BD stones above a stricture, impacted stones, failure of conventional techniques
• Limited availability

Intraductal Shock Wave Lithotripsy
• Mother-baby cholangioscope
  – High cost, requires 2 skilled endoscopists, difficult maneuverability, fragile
  – Stone clearance rate 90%, safe

• Ultra-slim cholangioscope
  – 2 mm channel
  – Direct insertion through the ampulla is technically difficult

Single Operator Cholangioscopy

<table>
<thead>
<tr>
<th>Total patient</th>
<th>SOC-directed stone therapy</th>
<th>EHL</th>
<th>Stone clearance success rate</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-center study (15 centers in US &amp; Europe)¹</td>
<td>297</td>
<td>66</td>
<td>50</td>
<td>76%</td>
</tr>
<tr>
<td>US single center study²</td>
<td>75</td>
<td>26</td>
<td>26</td>
<td>92%</td>
</tr>
<tr>
<td>Rutgers-NJMS experience</td>
<td>125</td>
<td>45</td>
<td>45</td>
<td>88%</td>
</tr>
</tbody>
</table>

²Draganov PV, et al. GIE 2011;73:971.

Altered Anatomy
• Billroth-II, Roux-en-Y anastomosis
  – Difficult access because of long afferent limb
  – Pediatric colonoscope, standard EGD scope, or duodenoscope (Success rate 33% to 92%)
  – Overtube or balloon assisted (success rate 63%)
  – Lack of dedicated long accessories
  – Short DBE (success rate 81%)
• Success rate at Rutgers-NJMS in altered anatomy 77%
### Elderly

- Frequently have morbid underlying diseases, peri-ampullary diverticula & large multiple CBD stones
- Increased CP events, bleeding, 2 to 4 fold increase in mortality among octo- & nonagenarians
- EPLBD is as safe as ES
- ML or EHL may increase procedure time, which may result in increased CP events

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### Summary

- CBD stone 1-2 cm, CBD stone >lower CBD, altered anatomy
  - Papillotomy + conventional techniques if fails then “cut & dilate” with rescue ML; if failure then EHL
- CBD stone 2-3 cm
  - ML after papillotomy, if fails then EHL
- CBD stone >3 cm or impacted stone
  - EHL, if fails then refer to surgery