ENDOSCOPIC MANAGEMENT of DIFFICULT BILE DUCT STONES

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DIFFICULT BILE DUCT STONES

1- DIFFICULT BILE DUCT CANNULATION
   a) Diverticulum
   b) Altered anatomy (Billroth II, Bypass)

2- DIFFICULT STONE EXTRACTION
   a) Large stones
   b) Difficult location (stenosis, intrahep.)
DIFFICULT BILE DUCT STONES

1- DIFFICULT BILE DUCT CANNULATION
   a) Diverticulum
   b) Altered anatomy (Billroth II, Bypass)

2- DIFFICULT STONE EXTRACTION
   a) Large stones
   b) Difficult location (stenosis, intrahep.)
DIFFICULT STONE EXTRACTION
ENDOSCOPIC TOOLS

Mechanical lithotripsy
Extracorporeal Shock-wave lithotripsy
Intracorporeal Shock-wave lithotripsy
Macrodilatation
Endoscopic stenting
DIFFICULT STONE EXTRACTION
ENDOSCOPIC TOOLS

- Mechanical lithotripsy
- Extracorporeal Shock-wave lithotripsy
- Intracorporeal Shock-wave lithotripsy
- Macrodilatation
- Endoscopic stenting
MECHANICAL LITHOTRIPTISY
FAILURES: 5-30% of cases

1. STONE CAPTURE
   POORLY ACCESSIBLE STONES
   (intrahepatic ducts, bile duct stenosis)
   IMPACTED STONES
   GIANT STONES
   STONES COMPLETELY FILLING THE DUCT

2. STONE FRAGMENTATION
DIFFICULT STONE EXTRACTION
ENDOSCOPIC TOOLS

Mechanical lithotripsy

Extracorporeal Shock-wave lithotripsy

Intracorporeal Shock-wave lithotripsy

Macrodilatation

Endoscopic stenting
EXTRACORPOREAL LITHOTRIPSY

ultrasound guided
EXTRACORPOREAL LITHOTRIPSY

15 SERIES (3 US guided) : 765 pts
fragmentation : 89.7 %
bile duct clearance : 77.4 %

LYON, US guided, 27 pts
fragmentation : 55 %
bile duct clearance : 55 %

Morbidity : 0-26 %
Mortality : 0.3 %
EXTRACORPOREAL LITHOTRIPSY LIMITS

**PROBLEM 1 : FRAGMENTATION**

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<tbody>
<tr>
<td>CBD</td>
<td>90 %</td>
</tr>
<tr>
<td>INTRAHEP</td>
<td>70 %</td>
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**REASONS for FAILURE :**
- large number of stones
- impaction of stones (no surrounding water)
- shock-wave damping by liver parenchyma
- risk of pulmonary trauma for the upper segments

**PROBLEM 2 : EXTRACTION OF FRAGMENTS and UNDERLYING BILE DUCT LESION**
EXTRACORPOREAL LITHOTRIPSY LIMITS

Extracorporeal lithotripsy is better indicated in case of:

- limited number of stones
- extrahepatic bile duct stones
- absence of underlying disease (stenosis, …)
DIFFICULT STONE EXTRACTION
ENDOSCOPIC TOOLS

- Mechanical lithotripsy
- Extracorporeal Shock-wave lithotripsy
- Intracorporeal Shock-wave lithotripsy
- Macrodilatation
- Endoscopic stenting
INTRACORPOREAL LITHOTRIPSY RETROGRADE ROUTE

2 methods

FLUOROSCOPIC GUIDANCE

ENDOSCOPIC GUIDANCE
INTRACORPOREAL LITHOTRIPSY
RETROGRADE ROUTE

2 methods

FLUOROSCOPIC GUIDANCE

ENDOSCOPIC GUIDANCE
INTRACORPOREAL LITHOTRIPSY
Fluoroscopic guidance

Electrohydraulic
+ or pulsed laser
INTRACORPOREAL LITHOTRIPSY
Fluoroscopy, electrohydraulic
INTRACORPORREAL LITHOTRIPSY
Fluoroscopy, HOLMIUM LASER

Maydeo GIE 2011

60 pts, 83.3% stone extraction
INTRACORPOREAL LITHOTRIPSY
RETROGRADE APPROACH
Fluoroscopy

The PROBLEM!
INTARCORPOREAL LITHOTRIPSY
RETROGRADE ROUTE

2 methods

FLUOROSCOPIC GUIDANCE

ENDOSCOPIC GUIDANCE +++++
1) Direct choledochoscopy
2) Babyendoscopy
INTRACORPORERAL LITHOTRIPSY
RETROGRADE ROUTE

2 methods

FLUOROSCOPIC GUIDANCE

ENDOSCOPIC GUIDANCE +++++

1) Direct choledochoscopy
2) Babyendoscopy
INTRACORPOREAL LITHOTRIPSY RETROGRADE APPROACH

Direct endoscopy, electrohydraulic
DIRECT CHOLEDOCHOSCOPY

Ultraslim endoscope transnasal approach possible

Insertion on a stiff guide-wire or anchoring system within the intrahepatic bile ducts, using a balloon
DIRECT CHOLEDOCHOSCOPY

Success of insertion:

93%: 13 pts  Kim GIE 2011 Holmium LASER
96%: 48 pts  Lee Endosc 2012
100%: 13 pts  Mori Endosc 2012, duodenal balloon
88%: 41 pts  Itoi Dig Endosc 2013
100%: 22 pts  Huang World J Gastro 2013
90%: 20 pts  Sauer Dig Dis Sci 2013
100%: 4 pts  Parsi World J Gastro 2013, Holmium L.
100%: 76 pts  Prinz World J Gastro 2014, Holmium L.
90%: 42 pts  Weigt J Hepatobiliary PS 2015
88%: 41pts  Itoi Dig Endosc 2014

Lithotripsy success > 90%
DIRECT CHOLEDOCHOSCOPY
Ultraslim endoscope
Guide-wire or anchoring system (balloon)

TRANSNASAL CHOLEDOCHOSCOPY
84 pts
Success of biliary endoscopy: 87%
Lithotripsy (laser, EHL) in 11 pts
Success: 100%

Meves GIE 2014
INTRACORPOREAL LITHOTRIPSY
RETROGRADE ROUTE
2 methods

FLUOROSCOPIC GUIDANCE

ENDOSCOPIC GUIDANCE ++++
1) Direct choledochoscopy
2) Babyendoscopy
BABYENDOSCOPE + Electrohydraulic or pulsed laser
INTRACORPOREAL LITHOTRIPSY
RETROGRADE APPROACH
Mother-baby, electrohydraulic
BABYENDOSCOPY - RESULTS 1985-2000

Laser lithotripsy
- 75-90% success
- 10 series
- 8-25 patients

Electro hydraulic lithotripsy
- 86-94% success
- 3 series
- 5-72 patients
Tsuyuguchi T Surg Endosc 2011
122 pts

Successful stone removal: 96%

Median F-U: 5.5 years (0.2-19.6)
Bile stone recurrence: 16.1%
BABYENDOSCOPY : PROBLEMS

Time-consuming (90 min)

Difficulty to obtain good targeting of the stones and then of the fragments

Vision obscured by clouds of fragments

Cost

Endoscope fragile

2 operators needed
PARSI GIE 2014
Olympus prototype CHF Y0002B
No dedicated duodenoscope
Compatible with all duodenoscopes

32 cases,
mainly strictures before instrument breakdown
SINGLE OPERATOR
SINGLE USE
BABYENDOSCOPE SPYGLASS
Single-use and single-operator BABYENDOSCOPE « Spyglass »

Success:
92%: 60/65 pts  Chen GIE 2011
92%: 24/26 pts  Draganov GIE 2011
97%: 67/69 pts Patel GIE 2013 Holmium laser
  57 extrahepatic
  8 intrahepatic
  5 cystic
mean number of sessions: 1.2 (1-3)
77%: 10/13 pts Thieu Dig Endosc 2015
ENDOSCOPIC MANAGEMENT of DIFFICULT BILE DUCT STONES

Mechanical lithotripsy

Extracorporeal Shock-wave lithotripsy

Intracorporeal Shock-wave lithotripsy

Macrodilatation

Endoscopic stenting
MACRODILATION Following SE

Minami 07, Maydeo 07
Misra 08, Itoi 09
Bang 06, Kochhar 09,
Oh 12, Kuo 2012, Hwang 13,
Zhao 13, Paik 2014,
Guo 2014, Tsuchida 2015

95-100% SUCCESS
ES + Dilatation versus ES

4 metaanalysis
Xu L, Biomed Res Int 2015: 673103
Jin PP, World J Gastroenterol 2014; 20:5548-56
Madhoun MF Diagn Ther Endosc 2014: 309618
Yang XM, World J Gastroenterol 2013; 19:9453-60
ES + Dilatation versus ES


5 RCT, 621 pts

<table>
<thead>
<tr>
<th></th>
<th>Dilation</th>
<th>ES alone</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>complete stone removal rate:</td>
<td>93.7%</td>
<td>92.5%</td>
<td>NS</td>
</tr>
<tr>
<td>duct clearance in 1 session:</td>
<td>82.2%</td>
<td>77.7%</td>
<td>NS</td>
</tr>
<tr>
<td>Mechanical lithotripsy:</td>
<td>15.5%</td>
<td>25.2%</td>
<td>p = 0.003</td>
</tr>
<tr>
<td>ML for stones &gt; 15mm:</td>
<td>24.2%</td>
<td>40%</td>
<td>p = 0.001</td>
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ES + Dilatation versus ES


5 RCT, 621 pts

<table>
<thead>
<tr>
<th>Morbidity</th>
<th>Dilation</th>
<th>ES alone</th>
<th>NS</th>
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<tr>
<td>post-ERCP pancreatitis</td>
<td>4.0%</td>
<td>5.0%</td>
<td>NS</td>
</tr>
<tr>
<td>perforation</td>
<td>0.3%</td>
<td>0.9%</td>
<td>NS</td>
</tr>
<tr>
<td>acute cholangitis</td>
<td>1.3%</td>
<td>1.3%</td>
<td>NS</td>
</tr>
</tbody>
</table>

Morbidity: 7.9% Dilation, 10.7% ES alone, NS
ES + Dilatation versus ES

Long-term outcomes

Lu Y, Eur J Gastroenterol Hepatol 2014; 26:1367-73

F-U: 663 pts
36.7-77.6 months.

Multivariate analysis: protective factor of ELBD for cholangitis, stone recurrence, and cholecystitis.
DIFFICULT STONE EXTRACTION
ENDOSCOPIC TOOLS

Mechanical lithotripsy

Extracorporeal Shock-wave lithotripsy

Intracorporeal Shock-wave lithotripsy

Macrodilatation

Endoscopic stenting
Temporary metal stents


Jun CH, Gastrointest Endosc. 2015; 82:719-23.
CB DUCT STONES: ENDOSCOPIC SPHINCTEROTOMY
FAILURE OF EXTRACTION

MECHANICAL LITHOTRIPSY
or
MACRODILATION

INTRACORPORAL LITHOTRIPSY
DIRECT or SPYGLASS

EXTRACORPORAL LITHOTRIPSY
ENDOSCOPIC MANAGEMENT of DIFFICULT BILE DUCT STONES

COMMON BILE DUCT STONES

INTRAHEPATIC BILE DUCT STONES
PERCUTANEOUS LITHOTRIPSY
PERCUTANEOUS LITHOTRIPSY
PERCUTANEOUS LITHOTRIPSY
E. Herriot Hospital experience 1990-2013

CHOLEDOSCOPY:
123 patients, 161 procedures

METHODS
- general anesthesia (tracheal intubation)
- progressive dilation of the tract/3 weeks (2 steps)
- sterile environment (surgical room)
- prophylactic antibiotics

MORBIDITY
53.7 % (first 41 pts) → 5 %
bleeding, sepsis
PERCUTANEOUS LITHOTRIPSY
RESULTS: 1998-2014

28 series, lithotripsy in 14 series

2831 pts (1693 pts in 3 series)
Complete extraction: 2560 pts (91 %)

Recurrence:
15.8 % (4 years), 27.5 % (5 years)

Complementary tt (dilat, 1y drainage)
DEVELOPMENT OF CHOLANGIOCARCINOMA

STONE - CONTAINING BILE DUCT :
HYPERPLASIA ➔ DYSPLASIA ➔ ADENOCARCINOMA IN SITU ➔ PARietal INV ➔ INTRADUCT SPREADING

FOLLOW-UP of pts with HEPATOLITHIASIS

<table>
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<tr>
<th>Author</th>
<th>FU duration</th>
<th>Total</th>
<th>Cancer</th>
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<tbody>
<tr>
<td>CHEN Cancer 1993</td>
<td>9 years</td>
<td>1105</td>
<td>5 %</td>
</tr>
<tr>
<td>SHEEN-CHEN J Surg Oncol 2001</td>
<td>7 years</td>
<td>101</td>
<td>5 %</td>
</tr>
<tr>
<td>CHIJIWA Arch Surg 2003</td>
<td>8 years</td>
<td>109</td>
<td>7.3 %</td>
</tr>
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LIMITED LITHIASIS, ABSENCE OF BILE DUCT LESIONS
(uncommon)

→ Retrograde approach + extracorporeal lithotripsy

NUMEROUS STONES or BILE DUCT LESIONS, ...

HIGH SURGICAL RISK

→ Percutaneous approach
or hepaticocutaneous jejunostomy

LOW SURGICAL RISK

DIFFUSE BILE DUCT LESIONS, ADVANCED CIRRHOSIS

→ Percutaneous approach,
then liver transplantation

LOCALIZED BILE DUCT LESIONS, NO or LIMITED CIRRH.

→ Hepatic surgery:
resection > hepaticojejunostomy
INTRACORPOREAL LITHOTRIPSY
RETROGRADE ROUTE

2 methods

FLUOROSCOPIC GUIDANCE
ENDOSCOPIC GUIDANCE
BILE DUCT STONES: ENDOSCOPIC SPHINCTEROTOMY
FAILURE OF EXTRACTION

MECHANICAL LITHOTRIPSY
or
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INTRACORPOREAL LITHOTRIPSY
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EXTRACORPOREAL LITHOTRIPSY