Gallstones, Common Bile Duct Stones, CBD Injury: The Surgeon

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No disclosures
• Making Laparoscopic Cholecystectomy safer
• Causes of Bile Duct Injuries
• Management of Common Bile Duct Injuries
• Management of Post operative Biliary strictures
• Common Bile Duct Stones
• Alternative procedures for cholecystectomy
The SAGES Safe Cholecystectomy Program

• Strategies for Minimizing Bile Duct Injuries: Adopting a Universal Culture of Safety in Cholecystectomy
  – Patients benefit from reduced pain, faster return to normal activities, and reduced risk of surgical site infection with a laparoscopic approach compared to an open operation.
Strategies employed to develop safe cholecystectomy

1. Use the Critical View of Safety (CVS) √
2. Perform an Intra-operative Time-Out during laparoscopic cholecystectomy prior to clipping, cutting or transecting any ductal structures. √
3. Understand the potential for aberrant anatomy in all cases √
4. Make liberal use of cholangiography or other methods to image the biliary tree intraoperatively ？
5. Recognize when the dissection is approaching a zone of significant risk and halt the dissection before entering the zone √
6. Get help from another surgeon when the dissection or conditions are difficult. √
Laparoscopic bile duct injuries

magnitude of the problem

- incidence 0.1%-0.5%
- bile leak 0.3% - 0.5% (85% from cystic duct)
- 34%-49% of surgeons in USA and British Columbia
- 50%-75% missed during the operation
- 60%- 80% delayed recognition
bile duct injury is serious

- leads to considerable morbidity
- inappropriate treatment may cause death
- long-term sequel may be devastating
- reduces QOL

15% of all surgical indemnities are for BDI may ruin a surgeon’s career
survival after bile duct injury

collected series (15) 602 patients

no of deaths 17 (2.8%)

Flum et al JAMA 2003
Impaired Quality of Life 5 Years After Bile Duct Injury During Laparoscopic Cholecystectomy
A Prospective Analysis

Djemila Boerma, PhD,* Erik A. J. Rauwe, PhD,† Yolande C. A. Keulemans, PhD,* Jacques J. G. H. M. Bergman, PhD,† Huug Obertop, PhD,* Kees Huibregtse, PhD,† and Dirk J. Gouma, PhD*

From the Departments of *Surgery and †Gastroenterology, Academic Medical Center, Amsterdam, The Netherlands
Health and financial disaster

• Cost: 4.5-26 X uncomplicated cases
  – (total cost $ 51,411)
  – average 32 days hospital stay
  – 10 days outpatient care days
  – 2 deaths 4%

• 43% intraoperative recognition
  – The inflation-adjusted mean total cost of repair was R215 711 (range R68 764 - 980 830).
  – Theatre costs 22%
  – ICU costs 21%

Hofmeyr SAMJ. 2015
Causes of bile duct related complications

•misidentification of biliary anatomy

•technical errors

  - cystic duct leak
  - thermal injuries
  - bleeding
  - “tenting”
Way has used scientific principles from human factor research and cognitive psychology to understand BDI—misconception leading to misidentification of anatomy—skills error leading to dangerous dissection. How does this occur?

“Laparoscopic bile duct injury is a result of misperception; not from inadequate knowledge of how to proceed or deficiencies in manual skills........”

“Nor should it be misconstrued as a character defect; cognitive biases are normal features of the way humans reason”.

how can we make it a safer procedure?

- training
- identifying the high risk patient
- operative cholangiography
- refinements to operative technique
  - “Subtotal Cholecystectomy”
- built in “stopping rules”
who are at risk for bile duct injury?

- elderly, males, obesity
- cholecystitis (previous attacks)
- gallstone pancreatitis
- previous BDS
- Mirizzi syndrome

not for the beginner

No risk factors in 80% of BDI
## Role of Routine Intra Operative Cholangiograms

<table>
<thead>
<tr>
<th>Protagonists</th>
<th>Sceptics</th>
</tr>
</thead>
<tbody>
<tr>
<td>• reduces incidence of BDI</td>
<td>• Does not prevent BDI</td>
</tr>
<tr>
<td>• early recognition</td>
<td>• BDI frequently occur before IOC</td>
</tr>
<tr>
<td>• less severe injury</td>
<td>• BDI may occur as a result of IOC</td>
</tr>
<tr>
<td>• less inclined to misinterpret</td>
<td>• IOC frequently misses BDI</td>
</tr>
<tr>
<td></td>
<td>• BDI may occur after IOC</td>
</tr>
</tbody>
</table>

Ludwig et al Surg Endosc 2002
operative cholangiography

collected series | % bile duct injury
--- | ---
• routine | 0.20 – 0.39
• selective | 0.30 – 0.60
• none | 0.34 – 0.58

Debru et al Surg Endosc 2005
Cholangiography and the risk of common bile duct injury
1.5 million laparoscopic cholecystectomies

<table>
<thead>
<tr>
<th>IOC Use Categories</th>
<th>Rate of CBD Injury, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall*</td>
</tr>
<tr>
<td>&lt;25% (n = 741 742)</td>
<td>0.52</td>
</tr>
<tr>
<td>25%-49% (n = 279 270)</td>
<td>0.54</td>
</tr>
<tr>
<td>50%-75% (n = 211 880)</td>
<td>0.51</td>
</tr>
<tr>
<td>&gt;75% (n = 337 469)</td>
<td>0.43</td>
</tr>
<tr>
<td>All (N = 1 570 361)</td>
<td>0.50</td>
</tr>
</tbody>
</table>

*Differences between the overall rate in the greater than 75% IOC use group compared with all other levels of IOC use were statistically significant (P<.001).
†Differences between CBD rates with and without IOC were all statistically significant (P<.001).

Flum et al JAMA 2003
verdict - operative cholangiography

- routine: continue if that’s the way you were taught
- selective: ? doubt about anatomy
- none: extra care to define biliary anatomy
- IOC is not a substitute for careful delineation of the biliary anatomy
how can we prevent bile duct injury?
there is no substitute for meticulous dissection of Calot’s triangle with the emphasis on identifying the cystic duct / infundibulum junction.

“the critical view of safety”
(Steven Strasberg)
Figure 4. Different appearances of the cystic plate. (A) Critical view of safety (CVS) is seen from in front of the gallbladder as usually shown. The cystic plate is very thin. (B) CVS is seen with the gallbladder reflected to the left so that a posterior view of the triangle of Calot is shown. The cystic plate is thicker and whitish. Both views fulfill criteria for CVS.
Need a bail out procedure to prevent CBDI in the difficult Cholecystectomy

Subtotal Cholecystectomy
Subtotal Cholecystectomy—“Fenestrating” vs “Reconstituting” Subtypes and the Prevention of Bile Duct Injury: Definition of the Optimal Procedure in Difficult Operative Conditions

Steven M Strasberg, MD, FACS, Michael J Pucci, MD, FACS, L Michael Brunt, MD, FACS, Daniel J Deziel, MD, FACS


Figure 6. Subtotal reconstituting cholecystectomy. (A) The free, peritonealized portion of the...
Technical approaches to the Anatomy

• Critical view of safety – routine approach

• Infundibulum approach – sometimes of value but avoid when significant inflammation present

• Start by identifying the cystic duct – common bile duct junction - avoid

• Subtotal cholecystectomy – in very selective cases
Risk for conversion

Preoperative Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Surgery – A Systematic Review and Meta-Analysis of Observational Studies

Josephine Philip Rothman\textsuperscript{a} Jakob Burcharth\textsuperscript{a} Hans-Christian Pommergaard\textsuperscript{a} Søren Viereck\textsuperscript{b} Jacob Rosenberg\textsuperscript{a}

Table 3. Summary of results from the meta-analysis

<table>
<thead>
<tr>
<th>Risk factors for conversion</th>
<th>Might be a risk factor</th>
<th>Not a risk factor for conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gallbladder wall &gt;4–5 mm on preoperative ultrasound</td>
<td>Previous abdominal surgery</td>
<td>Body temperature</td>
</tr>
<tr>
<td>Age &gt;60 or 65</td>
<td>BMI</td>
<td>Diabetes mellitus</td>
</tr>
<tr>
<td>Male gender</td>
<td>ASA-score</td>
<td>White blood cell count</td>
</tr>
<tr>
<td>Acute cholecystitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contracted gallbladder on ultrasound</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dig Surg 2016;33:414–423
Recognition of bile leaks / duct injuries

- **Intra-operative**
  - bile leak from drain site
  - ascites
  - abnormal LFT’s / Obstructive jaundice

- **Early post-operative**

- **Delayed presentation**
  - consequence of biliary strictture

key to successful outcome
Classification of Injury

Stewart-Way Classification
Laparoscopic Bile Duct Injuries

Type 1

Type 2

Type 3

Type 4

Type 5

Class II

Class IV

Fig. 1. The Strasberg Classification for Laparoscopic Cholecystectomy. (adapted from 1995;180(1):101–125)
Factors that influence outcome not noted

- Vascular injury
- Time at which injury recognised
- Bile leak
  - Ascites
  - Drain site leak
- Portal hypertension
- Atrophy/ Hypertrophy
- Previous repair

Early

Biliary stricture
Intra-operative detection

**partial defect**
- primary repair
- avoid T-tube
- drain

**complete transection**
- hepatico-jejunostomy
  (HPB surgeon)
- drain and refer
Principles of Repair

Ideal Scenario

- Early detection
- Maximum information on biliary anatomy
- Specialised multi-disciplinary unit

Technique

- Tension free hepatico-jejunostomy
- Mucosa to mucosa anastomosis
- Well vascularised BD
Successful outcome after bile duct repair

<table>
<thead>
<tr>
<th>the surgeon factor</th>
<th>success rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>• “injuring” surgeon</td>
<td>17-27%</td>
</tr>
<tr>
<td>• specialist surgeon</td>
<td>79-95%</td>
</tr>
</tbody>
</table>

50-75% repairs are still done by primary surgeon!

Steward & Way  Arch Surg 1995
Flum et al JAMA 2003
Clinical Scenario -
post operative bile leak from drain site

evidence of bile collection

**yes**
- imaging
- drainage

**no**
- observe
- Persist
  - 1 week
  - 500ml
- Review IOC

- MRCP/fistulogram
  - ERCP
  - PTC
Clinical Scenario: Biliary ascites

- US/CT
  - Drainage
  - MRCP
    - Complete
      - PTC
    - Partial
      - ERCP
    - Transection
Complete Transection
Partial Injury
Vascular injuries

- Incidence of hepatic artery injury about 7%
- Ischemic injury to intrahepatic ducts may result in recurrent Hepaticojejunostomy strictures and delayed strictures to IHD’S
- No consensus whether to preform routine angiography
  – complex or high injury
major bleeding

selective angiography

embolization
Timing of definitive bile duct repair

protagonists for early repair (< 1-2 weeks)

• shorter duration of treatment
• less costly
• improve QOL
• equivalent results to delayed repair

Specialised HPB units

Steward and Way Arch Surg 1995
Boerma et al Ann Surg 2001
Sicklick et al Ann Surg 2005
Early repair (< 1-2 weeks) contraindicated

• Sepsis not under control
• Confluence and vascular injury
• Significant diathermy injury
• Surgical expertise not available
Post CBDI stricture

- Surgery remains the gold standard against which other techniques must be compared
- Most series from before the 90’s
- 80-90% success with low re-stricture rate
- Referral to proper skills – first repair best chance of success
- Avoid bile duct to bile duct anastamosis
  - Terreblache and Northover description of blood supply
Lillimoe: Johns Hopkins Medical Institute
– 156 patients
  • 41% had previous repair
    – Half at time of initial surgery
    – Bile duct to bile duct repair 50% of cases
  • LC injuries more likely to be Bismuth 3,4,5,
  • Surgery
    – Hepatico-jejunostomy
    – All stented for prolonged period
    – 90% success
      » Repair by general surgeon success 17%
      » Repair in referral centre success 94%
• Role for hepatic resection
• Role of trans-anastomotic stents remain controversial

• Follow up – long term
  – 2/3 failure within 2 years
  – 80% within 5 years
  – 20% after 5 years
Endotherapy vs Surgery

Up to 2 stents; replaced 3 monthly and placed for 1 year

AMC Non Randomised

STENT 66
F/U 42/12

Early morbidity 8%

Late morbidity 26%

Recurrent stricture 17%

SURGERY 35
F/U 50/12

Early morbidity 26%

Late Morbidity 0%

Recurrent stricture 17%

Davids PH. Ann Surg 1993;217
Endotherapy vs Surgery

Tocchi
42 patients
retrospective review
F/U 60/12

STENT 20
1 – 3 stents
Good 80%
Morbidity 9%

SURGERY 22
HJ/CDJ
Good 77%
Morbidity 2%

“Support surgery but definite place for stenting”

Arch Surg 2000;135
Endotherapy

• High recurrence rates
• Multiple procedures
• Need for surgery

• New data emerging about MES particularly fully covered and even biodegradable
Successful Management of Benign Biliary Strictures With Fully Covered Self-Expanding Metal Stents

<table>
<thead>
<tr>
<th>Group</th>
<th>Patients</th>
<th>Percent resolution (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resolved</td>
<td>Total</td>
</tr>
<tr>
<td>CP</td>
<td>94</td>
<td>118</td>
</tr>
<tr>
<td>OLT</td>
<td>28</td>
<td>41</td>
</tr>
<tr>
<td>CCY</td>
<td>13</td>
<td>18</td>
</tr>
</tbody>
</table>

P = .32 for between group difference

Figure 4. Stricture resolution after FCSEMS placement.

Gastroenterology 2014;147:385–395
CONCLUSIONS: In a large prospective multinational study, removal success of FCSEMS after extended indwell and stricture resolution were achieved for approximately 75% of patients. ClinicalTrials.gov number, NCT01014390.

\[ P = .21 \]
Recommendations

• Start with endotherapy (Bismuth 1 & 2)
  – If failed at 1 year go to surgery
• Complete transection – surgery
• Early unsuccessful surgical repair repeat surgery - percutaneous intervention have good results here
• Endo therapy does not preclude surgery but often surgery precludes later endo- therapy
Common Bile Duct Stones

• Prediction of CBDS
  – CBDS 10-33% of symptomatic cholecystolithiasis
  – 10-40% will still have normal CBD at ERCP
  – Silent Stones 5-10%
  – Retained stones after ERCP 2-15%
  – MRCP Sen 95%; Specificity 97%
Management Approach

• Single procedures vs Two Stage procedures

  **Single**

  – LC / LCBDE
  – Open Cholecystectomy and CBDE

  **Two Stage**

  – LC / ERCP
    • ERCP
      » Preoperative
      » Intraoperative
      » Post operative
• LCBDE
  – No ES (theoretical)
    • Avoids Duodenal biliary reflux
    • Avoids ERCP complications
    • ES stenosis
    • Avoids metaplasia of CBD
Pre op ERCP

• No clear evidence to support or refute this
  – Specific indications
    • Cholangitis
    • Indicated in SAP
    • Persistent OJ
    • All others option exist
• Intra operative ES
  – Technically difficult
  – Rendezvous technique and therefore may reduce complications of ERCP
• Post op
  – Ramping up approach
    • Transcystic stent inserted
Outcomes

- Duct Clearance
- M&M
- Conversion
- Length of stay (LOS)
- Cost
  - Meta-analysis and Cochrane reviews
• Cochrane review 2013
  – 2005
  – 16 RCT
    • Include open CBDE vs ERCP

• WJG 2012
  – 7 RCT LC/LCBDE vs LC and ERCP
    • Clearance, morbidity, mortality, conversion. LOS, time,

Two-stage vs single-stage management for concomitant gallstones and common bile duct stones

Jiong Lu, Yao Cheng, Xian-Ze Xiong, Yi-Xin Lin, Si-Jia Wu, Nan-Sheng Cheng
### Stone Clearance

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk difference</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.1 Preoperative ERCP + LC vs LC + LCBEDE</td>
<td>82</td>
<td>98</td>
<td>180</td>
<td>16.3%</td>
<td>0.01 [-0.09, 0.11]</td>
<td>1999</td>
</tr>
<tr>
<td>Squiraakis et al.</td>
<td>27</td>
<td>32</td>
<td>59</td>
<td>13.8%</td>
<td>-0.01 [-0.19, 0.17]</td>
<td>2002</td>
</tr>
<tr>
<td>Noble et al.</td>
<td>26</td>
<td>26</td>
<td>52</td>
<td>14.4%</td>
<td>-0.44 [-0.61, -0.28]</td>
<td>2009</td>
</tr>
<tr>
<td>Banai et al.</td>
<td>13</td>
<td>15</td>
<td>28</td>
<td>12.7%</td>
<td>0.07 [-0.28, 0.15]</td>
<td>2010</td>
</tr>
<tr>
<td>Rogers et al.</td>
<td>30</td>
<td>31</td>
<td>61</td>
<td>14.3%</td>
<td>-0.09 [-0.08, 0.25]</td>
<td>2010</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>212</td>
<td>260</td>
<td>472</td>
<td>71.4%</td>
<td>-0.08 [-0.27, 0.10]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>172</td>
<td>181</td>
<td>353</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.04, I² = 26.23, df = 4 (P < 0.0001); I² = 85%
Test for overall effect: Z = 0.91 (P = 0.36)

#### 1.1.2 LC + postoperative ERCP vs LC + LCBEDE

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk difference</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodes et al.</td>
<td>30</td>
<td>40</td>
<td>70</td>
<td>13.5%</td>
<td>0.00 [-0.19, 0.19]</td>
<td>1998</td>
</tr>
<tr>
<td>Nathanson et al.</td>
<td>32</td>
<td>45</td>
<td>77</td>
<td>15.1%</td>
<td>-0.26 [-0.41, -0.11]</td>
<td>2005</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>85</td>
<td>81</td>
<td>166</td>
<td>28.6%</td>
<td>-0.14 [-0.41, 0.13]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>62</td>
<td>70</td>
<td>132</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.03, I² = 5.16, df = 1 (P = 0.002); I² = 81%
Test for overall effect: Z = 1.62 (P = 0.31)
Test for subgroup differences: Z = 1.01 (P = 0.31)

#### Total (95% CI)

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk difference</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>267</td>
<td>288</td>
<td>555</td>
<td>100.0%</td>
<td>-0.10 [-0.24, 0.04]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>234</td>
<td>251</td>
<td>485</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.03, I² = 33.55, df = 6 (P < 0.0001); I² = 82%
Test for overall effect: Z = 1.39 (P = 0.17)
Test for subgroup differences: Z = 1.11 (P = 0.27)

### Mortality

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk ratio</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>L.1 Preoperative ERCP/EST + LC vs LC + LCBEDE</td>
<td>17</td>
<td>136</td>
<td>153</td>
<td>32.0%</td>
<td>0.79 [0.44, 1.37]</td>
<td>1999</td>
</tr>
<tr>
<td>Squiraakis et al.</td>
<td>6</td>
<td>32</td>
<td>38</td>
<td>8.0%</td>
<td>1.95 [0.36, 0.97]</td>
<td>2001</td>
</tr>
<tr>
<td>Noble et al.</td>
<td>14</td>
<td>47</td>
<td>61</td>
<td>29.6%</td>
<td>0.69 [0.30, 1.20]</td>
<td>2009</td>
</tr>
<tr>
<td>Rogers et al.</td>
<td>5</td>
<td>55</td>
<td>60</td>
<td>8.9%</td>
<td>0.86 [0.28, 2.67]</td>
<td>2010</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>270</td>
<td>262</td>
<td>532</td>
<td>78.4%</td>
<td>0.79 [0.33, 1.57]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>42</td>
<td>51</td>
<td>93</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.52, df = 3 (P = 0.91); I² = 0%
Test for overall effect: Z = 1.29 (P = 0.20)

#### 1.1.2 LC + postoperative ERCP/EST vs LC + LCBEDE

<table>
<thead>
<tr>
<th>Study or subgroup</th>
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<th>Control Events</th>
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<th>Weight</th>
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<th>Year</th>
</tr>
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<tbody>
<tr>
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<td>6</td>
<td>40</td>
<td>46</td>
<td>10.5%</td>
<td>0.86 [0.32, 2.33]</td>
<td>1998</td>
</tr>
<tr>
<td>Nathanson et al.</td>
<td>6</td>
<td>45</td>
<td>51</td>
<td>11.0%</td>
<td>0.78 [0.29, 2.13]</td>
<td>2005</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>85</td>
<td>81</td>
<td>166</td>
<td>21.6%</td>
<td>0.82 [0.40, 1.66]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>12</td>
<td>14</td>
<td>26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.02, df = 1 (P = 0.90); I² = 0%
Test for overall effect: Z = 0.56 (P = 0.58)
Test for subgroup differences: Z = 0.00 (P = 0.99)

#### Total (95% CI)

<table>
<thead>
<tr>
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<th>Year</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>355</td>
<td>343</td>
<td>708</td>
<td>100.0%</td>
<td>0.79 [0.58, 1.01]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>54</td>
<td>65</td>
<td>119</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.55, df = 5 (P = 0.59); I² = 0%
Test for overall effect: Z = 1.40 (P = 0.16)
Test for subgroup differences: Z = 0.00 (P = 0.99)

### C

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Risk ratio</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squiraakis et al.</td>
<td>1</td>
<td>32</td>
<td>33</td>
<td>34.7%</td>
<td>2.84 [0.11, 62.23]</td>
<td>2002</td>
</tr>
<tr>
<td>Noble et al.</td>
<td>2</td>
<td>136</td>
<td>138</td>
<td>65.5%</td>
<td>1.96 [0.18, 21.31]</td>
<td>1999</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>168</td>
<td>161</td>
<td>329</td>
<td>100.0%</td>
<td>2.19 [0.33, 14.67]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.02, df = 1 (P = 0.89); I² = 0%
Test for overall effect: Z = 0.81 (P = 0.42)
## D

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental</th>
<th>Control</th>
<th>Risk ratio</th>
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<tr>
<td></td>
<td>Events</td>
<td>Total</td>
<td>Events</td>
</tr>
<tr>
<td>1.4.1 Preoperative ERCP/EST + LC vs LC + LCDBE</td>
<td>20</td>
<td>136</td>
<td>20</td>
</tr>
<tr>
<td>Cuschi et al[35]</td>
<td>5</td>
<td>32</td>
<td>4</td>
</tr>
<tr>
<td>Spouarakis et al[36]</td>
<td>20</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>Noble et al[37]</td>
<td>2</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Bansal et al[38]</td>
<td>1</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Rogers et al[39]</td>
<td>283</td>
<td>277</td>
<td>81.1%</td>
</tr>
<tr>
<td>Subtotal (95% CI)</td>
<td>48</td>
<td>21</td>
<td>0.38, 8.35, df = 4 (p = 0.08); I² = 52%</td>
</tr>
<tr>
<td>Total events</td>
<td>386</td>
<td>358</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total events</td>
<td>51</td>
<td>43</td>
<td>0.57, 8.13, df = 6 (p = 0.03); I² = 57%</td>
</tr>
</tbody>
</table>

Test for overall effect: Z = 1.06 (p = 0.29)

## E

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental</th>
<th>Control</th>
<th>Mean difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Total</td>
</tr>
<tr>
<td>Rhodes et al[35]</td>
<td>3.5</td>
<td>2.5</td>
<td>40</td>
</tr>
<tr>
<td>Cuschi et al[36]</td>
<td>6</td>
<td>2.125</td>
<td>150</td>
</tr>
<tr>
<td>Noble et al[37]</td>
<td>3</td>
<td>1.25</td>
<td>47</td>
</tr>
<tr>
<td>Rogers et al[38]</td>
<td>4.1</td>
<td>3.5</td>
<td>55</td>
</tr>
<tr>
<td>Bansal et al[39]</td>
<td>4</td>
<td>2.25</td>
<td>15</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>307</td>
<td>306</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 8.28; I² = 209.31, df = 4 (p < 0.0001); I² = 98%

Test for overall effect: Z = 0.73 (p = 0.45)

## F

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Experimental</th>
<th>Control</th>
<th>Mean difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Total</td>
</tr>
<tr>
<td>Rhodes et al[35]</td>
<td>105</td>
<td>48.75</td>
<td>40</td>
</tr>
<tr>
<td>Spouarakis et al[36]</td>
<td>105</td>
<td>48.75</td>
<td>32</td>
</tr>
<tr>
<td>Rogers et al[38]</td>
<td>183</td>
<td>39</td>
<td>55</td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>127</td>
<td>125</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Heterogeneity: I² = 0.18, df = 2 (p = 0.92); I² = 0%

Test for overall effect: Z = 1.70 (p = 0.09)

---

Figure 3: Forest plot of meta-analysis. A: Two-stage (endoscopic retrograde cholangiopancreatoscopy (ERCP)/endoscopic sphincterotomy (EST) + laparoscopic cholecystectomy (LC)) vs single-stage (LC + laparoscopic common bile duct exploration (LCDBE) in stone clearance from the common bile duct. B: Two-stage (ERCP/EST + LC) vs single-stage (LC + LCDBE) in postoperative morbidity. C: Two-stage (ERCP/EST + LC) vs single-stage (LC + LCDBE) in mortality. D: Two-stage (ERCP/EST + LC) vs single-stage (LC + LCDBE) in conversion to other procedures. E: Two-stage (ERCP/EST + LC) vs single-stage (LC + LCDBE) in length of hospital stay. F: Two-stage (ERCP/EST + LC) vs single-stage (LC + LCDBE) in total operating time. CI: Confidence interval.
Interfering variable

• Routine practice in a centre
• Level of Skill and experience
• Available equipment
• Multidisciplinary teams
Issues not addressed

• Size of Stone
• Number of Stones
• Size of Duct
• Previous ERCP
Techniques for LCBDE

• Trans Cystic
• Trans Ductal
• Primary closure vs T Tube

• Indication for TC
  – Stones smaller than cystic duct
  – Small number
  – Stones distal to cystic duct junction

• Indication for TD
  – CBD diameter > 8-10mm
  – IOC
  – Stone > cystic duct
  – >5CBD stones
  – Low or medial cystic duct
  – CBD junction
  – CHD stones

**RCT** | **Stone Clearance** | **Bile leak** | **Morbidity**
---|---|---|---
ERCP | 52.9-97% | 1% | 9.1-38.3%
TC | 80.4-100% | 1.7% | 7-10.5%
TD | 58.3-100% | 11% | 18.4-26.7%

**Conclusion** Stone clearance rates are comparable between the three modalities, but TD stone extraction is associated with a higher risk of bile leaks and should only be performed by highly experienced surgeons. TC stone extraction seems a more accessible technique with lower complication rates. If unsuccessful, per- or postoperative endoscopic stone extraction is a viable option.
Systematic review with meta-analysis of studies comparing primary duct closure and T-tube drainage after laparoscopic common bile duct exploration for choledocholithiasis

Mauro Podda¹ · Francesco Maria Polignano¹ · Andreas Luhmann¹ · Michael Samuel James Wilson¹ · Christoph Kulli¹ · Iain Stephen Tait¹


**Conclusions**  This comprehensive meta-analysis demonstrates that PDC after LCBDE is feasible and associated with fewer complications than TTD. Based on these results, primary duct closure may be considered as the optimal procedure for choledochotomy closure after LCBDE.
<table>
<thead>
<tr>
<th>Comparison</th>
<th>Outcome Measure</th>
<th>PDC</th>
<th>PDC+BD</th>
<th>TTD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post operative biliary peritonitis</td>
<td>OR 0.22; 95% CI 0.060 – 0.76</td>
<td>7.4%</td>
<td>13.2%</td>
<td>11.6-16.2%</td>
</tr>
<tr>
<td>Operating time</td>
<td>WMD, -22.27, 95% CI -33.26 to -11.28</td>
<td>7.4%</td>
<td>13.2%</td>
<td>11.6-16.2%</td>
</tr>
<tr>
<td>Postoperative hospital stay</td>
<td>WMD, -3.22; 95% CI -4.52 to – 1.92</td>
<td>7.4%</td>
<td>13.2%</td>
<td>11.6-16.2%</td>
</tr>
<tr>
<td>Median hospital expenses</td>
<td>SMD, -137, 95% CI -1.96 to -0.77</td>
<td>7.4%</td>
<td>13.2%</td>
<td>11.6-16.2%</td>
</tr>
<tr>
<td>Postoperative hospital stay decreased in PDC + BD vs TTD</td>
<td>WMD, -2.68; 95% CI -3.23 to -2.13</td>
<td>7.4%</td>
<td>13.2%</td>
<td>11.6-16.2%</td>
</tr>
</tbody>
</table>
Main complications

- Biliary Fistula
- CBD stricture
  - PDC increased stricture if CBD <7mm

Biliary peritonitis lower in PDC

- PDC vs TTD $P = 0.02$
Fig. 2 Meta-analysis of primary outcomes of interest. Primary duct closure (PDC) versus T-tube drainage (TTD) and primary duct closure + biliary drainage (PDC+) versus T-tube drainage (TTD)
Meta-analysis presented

- Significant heterogeneity
- Randomization at different times (pre-op vs after IOCG)
Alternative Procedures for Cholecystectomy

- Single Incision Cholecystectomy
- Robotics

Interventional Approaches to Gallbladder Disease

Todd H. Baron, M.D., Ian S. Grimm, M.D., and Lee L. Swanson, M.D.


Single-incision laparoscopic and mini-laparoscopic cholecystectomy have failed to gain widespread acceptance because the techniques are more challenging to learn, and the procedures prolong operative time and increase costs. Similarly, robotic-assisted laparoscopic cholecystectomy, which has technological appeal, has not been widely adopted for these reasons, in addition to the lack of proof of clinical benefit, limited access to the technology, and dramatically increased costs.
• Making Laparoscopic Cholecystectomy safer
• Causes of Bile Duct Injuries
• Management of Common Bile Duct Injuries
• Management of Post operative Biliary strictures
• Common Bile Duct Stones
• Alternative procedures for cholecystectomy
12th Biennial E-AHPBA Congress 2017
European-African Hepato-Pancreato-Biliary Association

SAVE THE DATE
May, 23rd – 26th, 2017
Mainz, Germany

Congress chairman:
Professor Dr. med.
Hauke Lang, MA, FACS
University Medical Center, Mainz

Registration & Abstract Submission:
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