Bile Duct Injury during cholecystectomy

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« No surgeon is immune from the risk of bile duct injury, and no case is simply routine »

<table>
<thead>
<tr>
<th>Country</th>
<th>Incidence</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany (2010)</td>
<td>0.1 %</td>
<td>172368</td>
</tr>
<tr>
<td>Denmark (2006-2009)</td>
<td>0.1 - 0.25 %</td>
<td>24240</td>
</tr>
<tr>
<td>USA, nationwide (1995-2008)</td>
<td>0.1 %</td>
<td></td>
</tr>
<tr>
<td>Authors</td>
<td>Period</td>
<td>Patients</td>
</tr>
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<td>------------------</td>
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<tr>
<td>Vereecken</td>
<td>1992</td>
<td>3244</td>
</tr>
<tr>
<td>Gigot</td>
<td>&lt; 1997</td>
<td>9959</td>
</tr>
<tr>
<td>Vandesande</td>
<td>1997</td>
<td>10.595</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11.628</td>
</tr>
<tr>
<td>Vandesande</td>
<td>2000</td>
<td>14.715</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16.915</td>
</tr>
<tr>
<td>Navez</td>
<td>2012</td>
<td>1089</td>
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Surg Endosc 2012

« It is not evident that the benefits of SILS Cholecystectomy, as currently performed do outweigh the potential increased risk .... of bile duct injury »
Single incision laparoscopic cholecystectomy is associated with a higher bile duct injury rate: a review and a word of caution

Joseph M, Phillips MR, Farell TM, Rupp CC


- 45 studies, 2826 patients
- 9.4% cholecystitis

- **BDI rate: 0.72%**


RISK FACTORS for BDI during LC

1. factors inherent to the laparoscopic approach
2. inadequate training of the surgeon
3. local risk factors (cholecystitis)
4. inappropriate surgical technique
5. lack of IOC performance
6. lack of adequate conversion in difficult cases
1. RISK FACTORS INHERENT TO THE LAPAROSCOPIC APPROACH

- loss of depth perception
- loss of manual palpation
- surgeon's dependance to the equipment
- oblique and tangential view
- limited field easily obscured by bile or blood or used videocamera/light source
2. DUE TO THE SURGEON’S INEXPERIENCE

- anonymous survey on 9959 LC
- 65 patients with BDI (0.5%)

<table>
<thead>
<tr>
<th>Surgeon’s experience (Nb of LC)</th>
<th>absent</th>
<th>present</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 50 cases</td>
<td>55 %</td>
<td>45 %</td>
</tr>
<tr>
<td>&gt; 50 cases</td>
<td>24 %</td>
<td>76 %</td>
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</tbody>
</table>

\[ p = 0.03 \]

\[ GIGOT, \ Surg \ Endosc \ 1997, \ 11 : \ 1171-1178 \]
MECHANISMS of BDI

→ misidentification of cystic duct: the « classical » injury

- with CBD duct during IOC during dissection 6 %
  35 % 43 %
- with cystic artery 1.5 %

→ cystic duct avulsion
→ CBD tenting
→ Clipping/cautery during urgent haemostasis
3. LOCAL RISK FACTORS

- acute or severe chronic inflammation !!! (65 %)
- large impacted stone in the Hartman pouch (16 %)
- MIRIZZI syndrome +/- bilio-biliary fistula (4%)
- Morbid obesity
- Anatomical variations

→ complete cholangiogram !
In SEVERE CHOLECYSTITIS with anomalous RHD

You can perform a **Subtotal cholecystectomy**

→ leave a piece of gallbladder wall on the Calot triangle and at the level of the Hartman Pouch
Closure of Residual Hartman pouch?  
NOT RECOMMENDED

drawbacks

1) **Biliary leak** from unsecured remnant

2) **Recurrence of biliary symptoms**  
(retained calculi) $\rightarrow$ redo LC
SEVERE CHOLECYSTITIS

THE INSIDE APPROACH OF THE GALLBLADDER

!!! DOES AVOID CALOT’S TRIANGLE DISSECTION !!!

- fundus: dissection of gallbladder bed
- anterior/inferior incision of infundibulum
- allow easy determination of the precise limits of the gallbladder infundibulum wall both from inside
- evacuate gallbladder content into an endobag
- search the cystic duct from inside
  * cannulate the cystic duct for IOC with a balloon catheter
  * close the cystic duct from inside by suturing techniques
  * destroy residual GB mucosa with Argon Beam Coagulator
Inflammation

Fibrosis
Galbladder wall left in place

ARGON

Suture of Cystic duct
39/552 pt (7%)

**Indication:**
- Gangrenous (2) or Severe fibrotic inflammation (37)
- Coexistent Anomalous Right Hepatic Duct (24)
- Coexistent Mirizzi syndrome (7)

**AIM**: to prevent BDI
If not achieved

- Proceed with further dissection of gallbladder body
- Reexplore Calot’s triangle closer to infundibulum
- IOC
- Consider fundus-first technique
- Consider subtotal cholecystectomy
- Consider conversion
And what to do now if unfortunately BDI has occurred?
Detection of BTI

1. Recognition of Duct transsection during dissection
2. Unexplained bile in the operating field
3. When conversion for hemostasis (arterial injury)
4. Intra-Operative Cholangiogram
   - Contrast extravasation
   - No opacification of Common Hepatic Duct
   - Incomplete Intra-hepatic ducts
Intra-Operative Cholangiogram (I.O.C.)

Detection of BTI at 2 conditions

- Must be performed at the end of the dissection
- Good interpretation by the surgeon

(23% of misinterpretation in Belgian series)
A completed and correctly interpreted IOC

1. increases the chance of detection
2. decreases the severity of injury
3. decreases the related mortality and morbidity
Performing IOC (and diagnosing BDI) will prevent worsening of a lateral injury to a complete transsection or excision.

« classic injury » : 43 %
BDI during LC

**SEVERITY**

- lateral injury: 48%
- complete transsection: 32%
- resection: 10%
- thermal: 11%

**SITE (BISMUTH classification)**

- type I: 51%
- type II: 28%
- type III: 9%
- type IV: 3%
- type V: 9%

52% 21%

GIGOT, Surg Endosc 1997; 11: 1171
CLINICAL PRESENTATION

- **peroperative detection (29)**: 44.5%

- **external biliary leak (8)**: 12%

- **biliary peritonitis**:
  - localized (biloma) (3): 6%
  - diffuse (19): 29% !!!

- **biliary stricture**:
  - early (3): 4.5%
  - late (3): 4.5%

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_BDI during LC: the Belgian Registry_ 65 patients
Bile Duct Injury during Lap Chole

* the best: to avoid injury

* the best when BDI occurs:
  to diagnose immediately the injury
  and to repair properly

* the worst: to diagnose late
  to try to repair in difficult conditions

Failure to recognize a BDI
- increases patient morbidity from delayed diagnosis
- makes further repair more difficult.
CBD INJURY
Factors predisposing to lawsuits

1) Misinterpretation of abnormal cholangiograms

2) Delay in BDI diagnosis and complications

3) Treatment failure in perop recognized CBDI

Successful outcome from repair:
- primary surgeon: 27%
- referral surgeon: 79%

Laparoscopic cholecystectomy = *minimally invasive* procedure

BDI = *maximally invasive* situation

→ change your philosophy
→ treat properly
→ medico-legal consequences
**TIMING of REPAIR**

* **IMMEDIATE REPAIR**:  
  (intraop or 2-3 first days)  
  * small caliber of non dilated ducts  
  * but absence of local inflammation

* **EARLY REPAIR**:  
  (<2months)  
  * non dilated ducts !!!  
  * local inflammation  
  * sepsis and poor patients condition

* **LATE REPAIR**:  
  (>2-3 months)  
  * optimized conditions  
  * presence of ductal dilatation with fibrotic tissues
### 1. Early REPAIR of BDI

**Thermal Injury**
- In 1/3 of BDI

**Vascular Injury**
- 30-50%
- Type IV: 60%

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<table>
<thead>
<tr>
<th>Patients</th>
<th>Mortality</th>
<th>Biliary complic.</th>
<th>Reinterv.</th>
<th>FU (mo) median</th>
<th>Recurrent Stricture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perop. detect.</td>
<td>7 %</td>
<td>24 %</td>
<td>14 %</td>
<td>46</td>
<td>29 %</td>
</tr>
<tr>
<td>Peritonitis</td>
<td>20 %</td>
<td>50 %</td>
<td>23 %</td>
<td>53</td>
<td>47 %</td>
</tr>
</tbody>
</table>

- FU (mo) median: Median follow-up time in months.
- Recurrent Stricture: Percentage of patients experiencing recurrent stricture.
Intraop BDI detection

- Immediate repair:
  - only by a surgeon with experience in reconstructive hepatobiliary surgery
  - If not available: insert a subhepatic drain and refer to a unit with experience in this type of injury
High suspicion for BDI should be maintained for any patient who do not recover normally and quickly after LC.

The mean delay for reoperation in the Belgian registry was ... 11 days (1 – 21)
Bile Duct Injury during Lap.Chole.

MANAGEMENT of BILE DUCT INJURY DIAGNOSED EARLY AFTER LAPAROSCOPIC CHOLECYSTECTOMY

3 types of postoperative clinical presentations:

- external biliary fistula
- bile peritonitis
- obstructive jaundice from biliary stricture
A. Postoperative Biliary Fistula

RADIOLOGICAL EVALUATION

AVOID to REOPERATE ... before complete evaluation

PURPOSE

1. to define site and severity of BDI
2. to evaluate the intraabdominal bile leakage
3. to detect coexistent injury

TYPE of IMAGING STUDIES

1. CT with contrast injection is superior to US
2. MRI is a “all-in” exam (cholangio + angio-MRI) to define lesions
3. ERCP is the most useful tool in partial injury
   (excepted if complete obstruction or transsection)
POSTOPERATIVE BILIARY FISTULA DIAGNOSTIC STRATEGY

CT or (MRI)

- diffuse bile peritonitis
  - SURGERY

- localized biloma
  - Percut. RX drainage

- * no collection
- * good clinical condition
  - WAIT
    - amount of bile / 24 h.
    - evolution of biliary leak

if - persistent > 1 week or worsening
- LFTs elevated (obstruction ?)
- total biliary diversion

ERCP
POSTOPERATIVE BILIARY FISTULA TREATMENT STRATEGY

ERCP

to define - type / site / severity

- cystic, Luchka ducts
- * partial injury
- * lateral clipping
- * complete transsection
- * resection

ES + prosthesis or surgery

ENDOSCOPIC MANAGEMENT

SURGERY
MANAGEMENT of BILIARY PERITONITIS

EMERGENCY TREATMENT

* septic condition (infected bile)
* long standing peritonitis

SURGERY

* peritoneal lavage
* biliary drainage
  - bilio-digestive anastomosis
  .... if possible
  - otherwise, external diversion

* good clinical condition
* recent peritonitis

ERCP

complete laceration

partial laceration, cystic or Luchka duct

1. endoprosthesis
2. percutaneous or surgical drainage (lap or open)

• clinical improvement
• no residual bile collections on repeat CT examination
TOTAL BILIARY DIVERSION

INDICATIONS

• when a biliary repair is impossible or unsafe
  - proximal thermal necrosis
  - severe inflammation
  - tiny proximal duct

TECHNIQUE

• drain into the proximal biliary stump
• multiples large sub-hepatic drains
  .... NOT too close of the hepatoduodenal ligament .... risk of vascular injury !
• (large sub-hepatic omentoplasty)
if SURGICAL EXPLORATION
for POSTOP BILE PERITONITIS or BILIARY FISTULA

**classification of injury by IOC**
- type
- severity

- partial injury
- complete transsection
- wide resection
- thermal necrosis

- suture + T-tube
- suture + T tube HJA
- HJA
- Excise and HJA diversion
Type of Biliary Repair in case of "EARLY" detection

- **Repair of a lateral injury**
  - Resection of necrotic margins
  - Transversal suture
  - T-Tube introduced at distance of the suture

- **End to end choledoco-choledocostomy + T-Tube (complete CBD transsection)**
  - Good vascularisation of bile duct stumps
  - Tension-free Suture (absorbable 5/0)
  - T-Tube introduced at distance of the anastomosis
CAUSES of FAILURES

* loss of ductal tissue
* tension on the suture line
* inadequate blood supply (thermal injury)
* small caliber of the ducts
* proximal location of BDI
**BDI due to an ANOMALOUS R. HEPATIC DUCT**

**STRATEGY OF TREATMENT**

- **do a selective cholangiography !!**

  - if limited biliary sector (1 segment) then, close it permanently
  - if large biliary sector and large stoma make a repair (suture + Tube or HJA)
  - if large biliary sector and thin duct clip temporary and come back later, when dilated
Hepatico-jejunal anastomosis:
The HEPP-COUINAUD APPROACH
Hepatico-jejunal anastomosis: The HEPP-COUINAUD APPROACH

« mucosa-to-mucosa » hepatico-jejunostomy
HEPATIC RESECTION

- BDI + Vascular injury
- Major RHD injury + severe atrophy/sepsis right liver
  (vascular injury or prolonged biliary obstruction)

LIVER TRANSPLANTATION

- BDI + Vascular injury
  - Acute liver failure
  - Biliary cirrhosis
Long-term follow-up (at least 10 years) is mandatory before definitive conclusions about the outcome of BDI.

- Female, 74y
- 1994: type IV BDI post lap chole → Hepp-Couinaud HJA
- FU once a year in outpatient clinic (biology and cholangioMRI)
- Completely asymptomatic with normal follow-up until June 2009
- April and June 2009: Cholangitis
- Normal LFT (after cholangitis)
- MRI: ! Stenosis at the level of the LHD