Outcome of 49 Repairs of Bile Duct Injuries after Laparoscopic Cholecystectomy

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Abstract. Treatment of bile duct injuries after laparoscopic cholecystectomy is still under discussion. The aim of this study was to evaluate the results of end-to-end or biliodigestive anastomosis for various types of bile duct injury. Patient charts of 49 (0.81%) classified bile duct injuries from a national survey of 6076 laparoscopic cholecystectomies in The Netherlands were analyzed. The median follow-up after repair was 183 days (range 14–570 days). Statistical analysis showed that an end-to-end anastomosis was preferred by the surgeons for less severe bile duct injuries and a biliodigestive repair for more severe injuries. Three patients died owing to a delayed detected bile duct injury. Twelve bile duct strictures occurred after repair, leading to a stricture rate of 25%. The time elapsed between repair and occurrence of a stricture was 134 days (range 13–270 days). The type of repair or the severity of the bile duct injury did not determine the outcome of the repair. Histologically proved cholecystitis predisposed a stricture at the repair site. It was concluded that treatment of bile duct injuries is associated with a high stricture rate. After its introduction a few years ago, the complications of laparoscopic cholecystectomy are becoming apparent [1–5]. The main problem of laparoscopic cholecystectomy is the bile duct injury detected either immediately during the laparoscopic approach or at follow-up. The treatment of bile duct injuries has several options: stenting, end-to-end anastomosis with or without T-tube drainage; Roux-en-Y-, choledocho-, or hepaticojunostomy; choledochoduodenostomy; and hepatogastrostomy [6–11]. The various types of repair for the bile duct injury are prone to complications such as bile leakage, cholangitis, biliary cirrhosis, and recurrent strictures. Bile duct strictures can occur at any time after repair and may disable the patient.

From a national survey of 6076 laparoscopic cholecystectomies, 49 bile duct injuries were identified [12] and classified as to severity [13]. The aim of this study was to evaluate which repair procedure was applied for each type of bile duct injury in this national survey and to examine the outcome of the different treatments.

Methods

From spring 1990 until April 1992 a national survey revealed 49 bile duct injuries after laparoscopic cholecystectomy in The Netherlands [12, 13]. The 49 injuries occurred in 35 hospitals, and each institution was visited by one of the authors (F.P.G.S.) to analyze the clinical and outpatient charts for each patient individually. The 49 bile duct injuries were classified as to severity. Class I (tangential lesion), II (clip injury), and IIIa (bile duct transection without tissue loss) injuries are considered to be less severe than class IIIb (bile duct transection with tissue loss) and IV (injury of one of the hepatic ducts) injuries. In addition, it was noted whether the bile duct injury was detected and confirmed during the primary laparoscopic operation or later on at the second procedure by laparotomy. The repairs were classified as end-to-end anastomosis of the bile duct with or without T-tube drainage and biliodigestive anastomosis. The severity of the bile duct injuries was correlated with the type of repair. The results and the early and late complications during follow-up were evaluated. Early complications consisted of bile leakage at the anastomotic site, hemorrhage, wound infection, intraabdominal infection, and death. Late complications were strictures at the repair site, which became apparent by the appearance of jaundice, cholangitis, or elevated liver function tests. Patients were considered as uncomplicated cases if they were symptom-free and had normal liver function tests during follow-up. The types of repair of the bile duct injuries that strictured and the original classification of these injuries were analyzed. The time span between repair and the occurrence of a stricture was examined. The outcome of the repair was correlated with the type of repair and with the severity of the bile duct injury. The outcome was also correlated with the histologic presence of inflammation of the gallbladder during cholecystectomy. Finally, the treatment of patients with a stricture in their repaired bile duct injury was analyzed.

Statistical Analysis

The correlation of the severity of the bile duct injury with the type of repair was statistically evaluated using a Yates chi-square test (statistical software SPSSPC). The same test was used for correlations on the outcome of repair with the type of repair and with...
with a median age of 41 years (range 21-74 years). The median
Transcutaneous drainage -- 1
Table
Planned for biliodigestive anastomosis
Biliodigestive anastomosis -- 1
Repair I II IIIa IIIb IV Total
injury.
follow-up after the repair operation was 183 days (range 14-570)
The study group contained 43 women (87%) and 6 men (13%)
statistically significant.
the severity of the bile duct injury; p < 0.05 was considered
Results
The study group contained 43 women (87%) and 6 men (13%)
with a median age of 41 years (range 21–74 years). The median
follow-up after the repair operation was 183 days (range 14–570)
days. It was 156 days (range 14–570 days) for patients without
strictures and 267 days (range 30–425 days) for patients with a
stricture after repair. In 16 patients the bile duct injury was
detected immediately during the laparoscopic cholecystectomy,
and in 33 patients there was a delay in detection. The type of
repair after detection of the bile duct injury, ordered according to
classification, is given in Table 1. The surgeons preferred to repair
the less severe bile duct injuries (class I, II, IIIa) with an
end-to-end anastomosis with or without T-tube drainage; more
severe injuries (class IIIb, IV) were repaired with a biliodigestive
anastomosis (p < 0.05). All 16 patients with a bile duct injury
detected at the laparoscopic approach and 29 patients with
delay-detected injuries underwent an immediate repair procedure
upon discovery or confirmation. Four patients with a delay-
detected injury had temporary drainage before the repair: In two
patients one or both ends of the bile duct injury were sutured
around the legs of a T-tube; in two other patients transcutaneous
drainage of a subhepatic fluid collection was undertaken. Two of
these patients received a biliodigestive anastomosis, respectively,
200 and 210 days thereafter. One patient was planned for an
anastomosis, and one was treated with only transcutaneous drain-
age.
The early complications after repair of the bile duct injuries are
summarized in Table 2. Three patients treated with a biliodiges-
tive anastomosis after delay-detected class II, IIIb, and IV injuries
died respectively from (1) massive pulmonary emboli, (2) irrevers-
ible gastric hemorrhage, and (3) sepsis with respiratory distress
syndrome due to necrosis of the anastomosis. There was no
significant difference in the occurrence of early complications
after end-to-end repair or biliodigestive anastomosis (p = 0.94) or
whether the injury was detected and confirmed at the first
procedure or during following procedures (p = 0.47). Two
patients had a reoperation to control an intraabdominal hemor-
hage. Two patients with bile leakage after a successful end-to-end
anastomosis and two patients after a biliodigestive anastomosis
had a reoperation to repair it by additional sutures. The other
patients with early complications were managed conservatively.
The 12 strictures that occurred as a late complication after the
repair are described with their original class of bile duct injury in
Table 3. The occurrence of jaundice in seven patients, relapses of
cholangitis in three patients, peritonitis in one patient, and
increased liver function tests in another patient raised suspicion of
a stricture. The median time span between repair and stricture
was 134 days (range 13–370 days). The type of repair (end-to-end
versus biliodigestive anastomosis) did not determine the outcome
of the repair (p = 0.91). The severity of the bile duct injury (class
I, II, IIIa versus class IIIb and IV) had no influence on the
outcome of the repair (p = 0.67). Eight patients had histologically
proven acute cholecystitis at cholecystectomy. Of these patients,
one with a class II injury and three with a class IIIb injury
developed a stricture after repair. Strictures developed more
often in patients operated for acute cholecystitis than if this entity
was absent during cholecystectomy (p < 0.05). Three of the 12
patients with a stricture in their repaired anastomosis were
reoperated and were given a biliodigestive anastomosis, one of
which restricting within 30 days. This patient received a new
biliodigestive anastomosis and became symptom-free. Four pa-
tients were stented, and two patients were treated with observa-
tion. Three patients were planned for a new biliodigestive anas-
tomosis. The median follow-up of these 12 patients was 78 days
(range 0–158 days). Ten patients were still under medical super-
vision on an outpatient basis at the on-site data registration in the
involved hospitals.
Discussion
The survey showed an incidence of 0.81% for bile duct injuries at
laparoscopic cholecystectomy early after introduction of this
operation in The Netherlands [13]. The treatment of bile duct
injuries is still a major concern and is accompanied by high
long-term morbidity. This study reports a 25% stricture rate after
various repair procedures of several types of bile duct injury over
a relatively short follow-up. This rate may be high compared to
other series, but it includes a nonselected group of patients with
different types of bile duct injury. Most of these patients were not
treated in a specific referral center [1, 3, 14]. Many did not have
an elective repair procedure in relatively optimal circumstances
but had an emergency procedure because of serious symptoms
caused by the injury. Although in this study the strictures all
occurred within a year after repair, more strictures might appear
in this group in the near future. Long-term follow-up therefore is
advocated for these patients [11, 15].
In this series the less severe injuries (class I, II, IIIa) were
mostly detected during the primary laparoscopic approach and
were repaired with an end-to-end anastomosis. The more severe
(class IIIb and IV) injuries were usually repaired by a biliodiges-
tive anastomosis. Current literature [16–18] reports a higher rate
of biliodigestive anastomoses for the repair of laparoscopic bile
duct injuries than was used in this series because most repairs are
performed as secondary procedures. In our series the postopera-
tive complications are not significantly different for the two types
of repair. However, the three patients who died had undergone a
delayed repair with a biliodigestive anastomosis. Therefore we
accept that the two groups are not comparable.
There was no difference in the number of strictures after the
two types of repairs, which is probably due to the limited number
of patients in each group. A significantly higher number of
strictures were mainly found in patients with cholecystitis during
cholecystectomy. Acute cholecystitis should therefore be seen as a
contributing factor to stricture formation.

Table 1. Type of repair after detection of bile duct injury, by class of
injury.

<table>
<thead>
<tr>
<th>Repair</th>
<th>I</th>
<th>II</th>
<th>IIIa</th>
<th>IIb</th>
<th>IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transcutaneous drainage</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>End-to-end anastomosis ± T-tube</td>
<td>11</td>
<td>4</td>
<td>9</td>
<td>2</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Drainage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biliodigestive anastomosis</td>
<td>--</td>
<td>1</td>
<td>15</td>
<td>2</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Planned for biliodigestive</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>anastomosis</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The occurrence of jaundice in seven patients, relapses of