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The outcome of major biliary tract injury with leakage in laparoscopic cholecystectomy

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Abstract
Background: Concern has been expressed regarding the increased rates of biliary tract injury (BTI) at laparoscopic cholecystectomy. The aim of the present investigation was to analyze the outcome of laparoscopic biliary tract injury with leakage.
Methods: Sixteen patients having major laparoscopic BTI with leakage were treated. Thirteen of them were referred to our institution for further treatment. The follow-up was complete and focused on clinical outcome and biochemical analysis.
Results: Eight BTI were identified at the time of laparoscopic cholecystectomy, and the procedure was converted to a laparotomy. In eight additional patients, BTI was recognized postoperatively. In this group one patient died because of lately diagnosed biliary peritonitis, whereas in the seven surviving patients nine attempts to repair the BTI and eight other interventions were performed. In the conversion group 14 attempts to repair the BTI and 11 other interventions were needed to completely solve the problems. Final restoration of the BTI was done by Roux-en-Y hepaticojejunostomy in 11 patients and suture repair with T-tube drainage of the bile duct in 4. During a median follow-up time of 63 months, three patients suffered from recurrent segmental cholangitis. In the other patients, neither clinical nor biochemical evidence of biliary disease has been found up to this writing.
Conclusions: Laparoscopic BTI has a high morbidity and mortality rate that seems comparable to BTI at open cholecystectomy. The number of attempts to repair the BTI as well as additional interventions is too high, but in this patient series the final outcome seemed to be similar after BTI recognized during and after laparoscopic cholecystectomy.

Key words: Cholecystectomy — Laparoscopy — Bile duct — Leakage

Despite a widespread acceptance of laparoscopic cholecystectomy as the treatment of choice for symptomatic cholelithiasis, concern has been expressed regarding the increased rates of biliary tract injury (BTI) associated with this procedure [4, 6, 10]. The incidence of BTI after laparoscopic cholecystectomy (0–0.9%) is about three times that reported after open cholecystectomy (0.2–0.3%) [11, 17].

Several reports have discussed the mechanisms and types of BTI, the clinical presentation, and the diagnostic approach for these patients [2, 6, 10, 12, 15]. Reports focusing on the management and outcome of patients with BTI after laparoscopic cholecystectomy often discuss leakage and stricture together. Herein the success rate after primary treatment of the BTI and the necessity for expertise in hepatobiliary surgery with regard to the outcome seem to be controversial [2, 8, 13, 18].

The aim of the present investigation was to analyze in more detail the outcome of BTI with leakage occurring at laparoscopic cholecystectomy.

Materials and methods

From June 1989 until November 1995, 16 patients with bile leakage due to major BTI during laparoscopic cholecystectomy were treated. Thirteen patients were referred, 12 after receiving primary treatment of BTI. Male to female ratio was 4:12, with a mean age of 51 years (range, 19–76 years). Major BTI was defined as any clinically evident damage to any part of the major extrahepatic biliary system occurring at any time of the laparoscopic cholecystectomy. Primary treatment was defined as the first therapeutic intervention after recognition of BTI. Primary suture repair was defined as a simple suture repair of the injured bile duct.

This study included a retrospective evaluation of the laparoscopic procedure, presenting symptoms of the BTI, type and level of BTI, diagnostic procedures, and therapeutic interventions before and after referral, as well as follow-up to date. Details of the initial laparoscopic and conventional surgical procedure were obtained from transfer records and/or telephone conversation with the operating surgeon. The follow-up (median, 63

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months; range, 29–105 months) was complete and focused on clinical outcome and biochemical analysis.

Results

Laparoscopic cholecystectomy

The indications for laparoscopic cholecystectomy in these patients were chronic calculous cholecystitis in five, acute calculous cholecystitis in four, necrotizing cholecystitis in two, and symptomatic uncomplicated cholelithiasis in five patients. Intraoperative bleeding was a contributory factor for BTI in four patients (two with uncomplicated symptomatic cholelithiasis and two with acute cholecystitis) and for variant anatomy in two patients with uncomplicated symptomatic cholelithiasis.

Intraoperative cholangiography was performed in only two patients (necrotizing cholecystitis), confirming the BTI that had already occurred.

Clinical presentation

Eight BTIs were identified at the time of laparoscopic cholecystectomy, and the procedure was converted to a laparotomy. In the remaining eight patients, the BTI became clinically evident after the laparoscopic procedure with a median time interval of 16 days (range, 5 – 35 days). Clinical presentation was a biliary fistula in four patients, diffuse peritonitis in two patients and biloma in two patients. Three patients underwent surgical exploration after clinical examination, biochemical analysis, and ultrasonography. In addition to these investigations, an endoscopic retrograde cholangiopancreatography (ERCP) was performed in five patients to adequately visualize the type and level of the BTI.

Type and level of BTI

The type of BTI consisted of laceration in eight patients, transsection in six patients, excision in one patient, and thermal injury (coagulation) in one patient. The right hepatic duct was injured in seven patients, the common hepatic duct in six patients, common bile duct in five patients, and the left hepatic duct in two patients. Thus, injury occurred at different levels in four patients. Injury of the right hepatic duct was recognized intraoperatively in only 2/7 patients (28%), whereas injury of the common bile duct was recognized intraoperatively in 4/5 patients (80%).

Treatment of BTI at the time of laparoscopic cholecystectomy

At the time of conversion, a Roux-en-Y hepaticojejunostomy was performed in five patients, primary suture repair with T-tube drainage of the injured bile duct in two patients, and drainage only in one patient. In four of these patients the hepaticojejunostomy had to be reconstructed because of leakage (3 patients) and stricture (1 patient), after a time interval of 19, 111, 150 and 1,620 days, respectively. The two patients that underwent primary suture repair with T-tube drainage of the bile duct developed stricture formation after a median time interval of 88 and 163 days. One patient finally was treated with a Roux-en-Y hepaticojejunostomy, and the other patient underwent a second suture repair with T-tube drainage of the bile duct.

Table 1. Therapeutic interventions after laparoscopic biliary tract injury with leakage

Patient	Attempts to repair BTI	Other interventions	Total
Conversions			
1	2	0	2
2	2	1	3
3	2	2	4
4	2	0	2
5	1	0	1
6	2	2	4
7	1	3	4
8	2	3	5
Total	14	11	25
Nonconversions			
1	1	2	3
2	1	2	3
3	1	2	3
4	1	0	1
5	2	0	2
6	2	1	3
7	1	1	2
8	0	2	2
Total	9	10	19

In one patient only, the surgical procedure at the time of conversion (Roux-en-Y hepaticojejunostomy) was sufficient to offer an uneventful postoperative course. To obtain complete resolution of the BTI in the remaining seven patients, a therapeutic intervention was performed twice in two patients, three times in one patient, four times in three patients, and five times in one patient (Table 1). In three patients, the initially performed Roux-en-Y hepaticojejunostomy had to be reconstructed, in one patient due to unrecognized coagulation trauma of the common hepatic duct, and in two patients because of massive bleeding from a false aneurysm secondary to leakage of the hepaticojejunostomy. One patient underwent hepatic segmentectomy (II + III), because of atrophy with recurrent segmental cholangitis, after suprahilar hepaticojejunostomy.

Treatment of BTI after laparoscopic cholecystectomy

In eight patients, BTI was recognized postoperatively. The average length of time from laparoscopic cholecystectomy until primary treatment of the BTI was 22 days (range, 7–45 days).

Primary suture repair with T-tube drainage of the injured bile duct was performed in five patients. Two of them underwent a Roux-en-Y hepaticojejunostomy after a time interval of 4 and 64 days because of a clinically evident biliary fistula. In the other three patients, the primary repair with T-tube drainage of the bile duct was sufficient to completely solve the symptoms.

One patient initially (at 26 days) underwent peritoneal drainage combined with endoscopic stenting followed by hepaticojejunostomy 10 weeks after laparoscopic cholecys-

tectomy. One 75-year-old man died 10 weeks after the laparoscopic procedure due to multiple organ failure despite two operative drainage procedures. He had undergone a peritoneal drainage for biliary peritonitis on the 20th day. A reconstruction of the bile duct was not feasible considering the local and general septic conditions. In the seven surviving patients nine attempts to repair the BTI and eight other interventions were performed (see Table 1).

Late outcome

Biliary tract continuity was finally restored with Roux-en-Y hepaticojejunostomy in 11 patients: suprahilar (4 patients), hepatic bifurcation (1 patient), right hepatic duct (2 patients), and common hepatic duct (4 patients). Suture repair with T-tube drainage of the bile duct completely solved the problems in four patients. During a median follow-up time of 63 months from the laparoscopic procedure, three patients suffered, after hepaticojejunostomy, from recurrent segmental cholangitis once a year, without dilation of the bile ducts, treated with antibiotics. One patient developed choledocholithiasis without stricture after primary suture repair of the BTI treated by endoscopic papillotomy and stone extraction. At this writing, neither clinical nor biochemical evidence of biliary disease has been found in the other patients.

Discussion

Good knowledge concerning the mechanisms of injury, the risk factors, and accurate surgical technique are important in the prevention of BTI. Bile duct injuries during laparoscopic cholecystectomy are best avoided by maintaining a low threshold for conversion to laparotomy in any case during which the anatomy cannot be precisely identified [6]. Another feature of laparoscopic bile duct injuries has been late recognition with consequent increased morbidity due to peritonitis. Richardson [12] reported a higher incidence of intraoperative identification (±50%) than experienced in previous laparoscopic series, suggesting that early repair leads to an improved outcome. This high intraoperative identification rate of BTI might be due to a high overall conversion rate of 13.9%, because intraoperative cholangiography was performed on a selective basis (in 8.8% of procedures). Intraoperative cholangiography may help recognition of BTI and subsequently minimize its severity [5]. In the current series, injury of the right hepatic duct was often (72%) recognized postoperatively. The use of routine gallbladder bed drainage is justified for the purpose of recognizing bile leakage early in the postoperative period [1] and eventually preventing biliary peritonitis.

Immediate operative management of major BTI during and after laparoscopic cholecystectomy includes primary repair or Roux-en-Y hepaticojejunostomy [9]. Although direct ductal reanastomosis can be accomplished when transection has occurred without loss of tissue, the overall success rate of this repair is about 50% [14]. If the major BTI is recognized in the immediate postoperative period and the local condition is acceptable, single-stage repair with a Roux-en-Y hepaticojejunostomy is the procedure of choice, especially in the case of a segmental defect longer than 1 cm. If an injury presents at an interval after laparoscopic cholecystectomy, external biliary drainage is advocated to bring local and systemic septic conditions under control.

In this study, the number of attempts to repair the BTI seems to be higher in the conversion group (14/8 vs. 9/7), but the study is too small to project a statistically significant difference. The fact that 7/8 conversions needed a secondary treatment indicates that initial treatment was not optimal, but involved technical difficulties of repairing BTI in patients with normal-size bile ducts and difficult local conditions caused by the extent of the injury and/or contributory factors such as inflammation, variant anatomy, and bleeding.

This study was too small for drawing conclusions regarding the optimal treatment center for patients with BTI. The reason why the majority of the patients in this series needed further therapeutic interventions was multifactorial. Besides the local conditions, the experience of the hepatobiliary team played a role, as illustrated by the number of patients with ischemia and/or leakage requiring reïntervention after primary hepaticojejunostomy. A ruptured false aneurysm of the right hepatic artery following necrosis of the hepaticojejunostomy was treated in two patients, and a necrotic hepaticojejunostomy had to be reconstructed in one patient due to an unrecognized coagulation trauma of the hepatic duct.

Another important factor that contributed to this high number of interventions was the fact that the site of bile leakage or BTI was not recognized during the first surgical exploration, once in the conversion group and three times in the nonconversion group. Because the majority of these patients were referred to our institution after treatment failure, the number of successful primary treatments outside our institution is unknown.

The outcome of patients who have laparoscopic BTI with leakage is determined by the type, level, and extent of the injury as well as by the timing, type, and appropriateness of the initial treatment. In this study, the final outcome seemed to compare with that for BTI recognized during and after laparoscopic cholecystectomy, except for one patient in the nonconverted group who died due to lately recognized biliary peritonitis. The follow-up was too short for drawing definitive conclusions regarding the long-term outcome. Of particular concern is the risk of late bile duct stricture consequent to bile leak and fibrosis [6]. Although no patient with late stricture in this study was treated endoscopically, this can be a valuable therapeutic option in some patients [18].

Good results with low morbidity have been reported after primary repair of bile duct injury during conventional cholecystectomy. The majority of these injuries were limited to a single extrahepatic bile duct. The overall mortality rate ranged from 9.5% to 11% [3, 16]. Gouma [7] described a complication rate of 34% versus 31% and a mortality rate of 6.25% versus 8.9% for repair of bile duct injury after laparoscopic versus conventional cholecystectomy, respectively. Despite the need for reoperations in many patients, the mortality rate in our study was 6.25%. Thus, laparoscopic BTI has a high morbidity and mortality rate that seems to compare with that of BTI at open cholecystectomy.

Conclusions

Contributory factors were present in the majority of the patients who had laparoscopic BTI with leakage. Late recognition of the biliary tract injury remains a problem. This delay may be shortened by the placement of a drain after laparoscopic cholecystectomy. The number of attempts to repair the BTI and the additional interventions are too high, but the final outcome seems to be similar after BTI recognized during and after laparoscopic cholecystectomy. This may be explained by nonoptimal initial treatment, especially in the conversion group.

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