Management of bile duct injury during and after laparoscopic cholecystectomy


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Abstract
Background: Bile duct injury (BDI) is perhaps the most feared complication of laparoscopic cholecystectomy (LC). Proper management of iatrogenic BDI is mandatory to avoid immediate or later life-threatening sequelae. The results of surgery depend mainly on the type of injury, prompt detection of the injury, and timing of the surgery.

Methods: Twelve patients with BDI after LC were treated. Eight of them were referred to our institution for further treatment. The follow-up evaluation was focused on clinical outcome and biochemical analysis.

Results: Five of the patients had minor BDI with leakage. In all of them, the BDI was recognized postoperatively. Two of these patients were managed by endoscopic retrograde cholangiopancreatographic sphincterotomy and stent placement. The other three patients underwent open laparotomy and bile duct ligation. Seven of the patients had major BDI. In two patients, biliary injuries were identified at the time of LC, and the procedure was converted to laparotomy. At the time of conversion, primary suture repair with T-tube drainage of the injured bile duct was performed. Strictures developed in these patients after 2 and 6 months, respectively, and they were treated with a Roux-en-Y hepaticojejunostomy. In five additional patients, BDI was recognized postoperatively. One of these patients died because of delayed detection of biliary peritonitis. At this writing, during a median follow-up period of 52 months (range, 6–78 months), neither clinical nor biochemical evidence of biliary disease has been found in the remaining patients.

Conclusions: Laparoscopic BDI has a high morbidity and mortality rate. Late recognition of the BDI remains a problem.

Key words: Bile duct injury — Biliary peritonitis — Laparoscopic cholecystectomy

Laparoscopic cholecystectomy (LC) has become the treatment of choice for many patients with cholelithiasis [4, 23, 24]. An increased incidence of biliary tract complications is the main disadvantage of this method [1, 12, 13, 21]. Important risk factors include acute cholecystitis and limited experience of the surgeon with the procedure [8, 26, 29]. Knowledge of the mechanisms involved in bile duct injury (BDI) and adequate surgical training are the keys to reducing the number of complications and to achieving their early and best management [3, 10, 16].

The current study aimed to analyze in detail the outcome of BDI associated with LC in our department.

Materials and methods

Between November 1994 and October 2000, 12 patients with BDI during LC were treated in our department. The male-to-female ratio was 3:9, and the mean age of the patients was 50 years (range, 36–75 years). Eight patients were referred to our department, which covers a population of about 300,000. Four patients received primary treatment of BDI before referral.

This study included a retrospective evaluation of the laparoscopic procedure, involving symptoms of the BDI, type and level of the injury, diagnostic and therapeutic interventions before and after referral, and follow-up evaluation to the time of this writing. Details of the initial laparoscopic and conventional surgical procedure were obtained from transfer records, telephone conversation with the operating surgeon, or both. The patients were seen regularly after hospital discharge over a median follow-up period of 52 months (range, 6–78 months).

Definitions

Laparoscopic cholecystectomy (LC) was defined as any cholecystectomy intended to be performed laparoscopically, regardless whether conversion to an open procedure was necessary. Bile duct injury was defined as any clinically evident damage to the biliary system (including the cystic duct) occurring at any time during LC. For practical purposes, BDI was classified as minor or major, depending on the nature of the lesion. Minor BDI was defined as any injury occurring in concert with intact ductal anatomy that has no associated stricture. This group of injuries included lesion types A to D according to the classification of Strasberg et al. [34]. Major BDI was defined as any disruption (ligation, avulsion, resection) of the extrahepatic biliary
system. This group included type E lesions according to the classification of Strasberg et al. [34] (Fig. 1).

**Outcome measurements**

The outcomes of operative BDI repair were graded according to a classification that takes into account both subjective criteria (pain, jaundice, and cholangitis) and objective criteria (serum liver function tests and need for reintervention) [22]. The patient outcomes were graded as excellent (asymptomatic and normal serum liver function test results), good (asymptomatic and mildly abnormal liver function test results), or poor (symptomatic and abnormal liver function test results). Cases requiring postoperative intervention for management of recurrent strictures were considered treatment failures.

**Results**

The indications for LC were chronic calculous cholecystitis in four patients, acute calculous cholecystitis in two patients, and symptomatic cholelithiasis in six patients. Intraoperative cholangiography, performed in only two patients, confirmed, the major BDI that had already occurred.

**Diagnostic and therapeutic strategy**

A combination of preoperative diagnostic imaging studies were used. Most commonly, duplex ultrasonography and computed tomographic (CT) scan were used to demonstrate intrahepatic ductal dilation, fluid collections, and hepatic atrophy or hypertrophy. Endoscopic retrograde cholangiopancreatography (ERCP) and magnetic resonance cholangiopancreatography (MRCP) were applied to identify the location of stricture or bile leak. To reduce or eliminate bile leakage. ERCP sphincterotomy with stent placement was used. The management algorithm used in this series is shown in Fig. 2.

**Minor BDI**

Five patients had minor BDI with leakage. In all of these patients, the BDI was recognized postoperatively. Four patients had type A lesions. In one of them, a duct of Luschka was not noticed during dissection of the gallbladder, and biliary peritonitis developed. One patient had a type D lesion. In this patient, one of the clips used to occlude the cystic duct was placed at the junction with the common bile duct in a way that rendered a portion of the common hepatic duct ischemic, and a biliary fistula ensued. The type of the injury is shown in Fig. 1. The mechanism of BDI, the clinical presentation, the diagnostic procedures, and the therapeutic strategy are shown in Table 1.

**Major BDI**

Seven patients had total transection and/or partial excision of the common hepatic or common bile duct (type E injuries) (Fig. 1). Six of these patients were referred to