Bile Duct Injuries in Laparoscopic Cholecystectomy

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Key Words

Laparoscopic cholecystectomy · Common bile duct injury

Abstract

Objectives: Bile duct injuries were analysed in a prospective study of 1,250 cases of laparoscopic cholecystectomy. The aim of the study was to identify the incidence and causes of bile duct injuries in the course of laparoscopic cholecystectomy, and to recommend the possible ways to avoid this serious complication. **Materials and Methods:** Special computer forms were created to record detailed patient pre-operative, operative, and post-operative follow-up data for later study. Operative cholangiography was done only on a selective basis. Bile duct injuries were classified according to the Bismuth classification. **Results:** Four cases (0.3%) of bile duct injuries were encountered in the study: 2 of them were classified as major (Bismuth classification grade II) and the other 2 as minor (diathermy puncture). All injuries were attributed to distortion of Calot's triangle and failure to clearly identify the anatomy. A recent history of acute cholecystitis, a history of jaundice, pancreatitis and repeated or technically difficult endoscopic retrograde cholangiopancreatography (ERCP) were associated with local inflammatory changes that had possibly contributed to the distorted anatomy at Calot's triangle and consequently to the injury. All injuries were detected during

surgery and immediately repaired. Major bile duct injuries were repaired by choledocho-enterotomy, while minor injuries were treated by simple sutures around the T tube in the common bile duct. All patients were asymptomatic with normal liver function tests on follow-up for a period up to 3 years after surgery. **Conclusions:** The incidence of bile duct injuries in laparoscopic cholecystectomy is comparable to open surgery. Patients with a clinical history of acute cholecystitis, or a recent history of jaundice and repeated ERCP should be considered for operative cholangiography in order to help reduce the chances of bile duct injuries.

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Introduction

Major bile duct injury is a life-threatening complication of cholecystectomy. The incidence of such injury was initially considered to be higher with laparoscopic cholecystectomy than open surgery. As much as 95% of biliary strictures and fistulas are directly related to operative injury [1]. Avoidance of this injury must be continually emphasized to surgeons to avoid the extraordinary financial and morbid cost of such a complication. The objective of this study was to identify the incidence and causes of bile duct injuries during laparoscopic cholecystectomy and suggest ways of avoiding such injuries.

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Table 1. Bismuth classification of bile duct injuries [2]

Bismuth grade	Type of injury
Bismuth type I	hepatic duct stump larger than 2 cm
Bismuth type II	hepatic duct stump smaller than 2 cm
Bismuth type III	no hepatic duct, confluence intact
Bismuth type IV	destruction of hilar confluence
Bismuth type V	right sectorial duct injury, with or without CHD injury

CHD = Common hepatic duct.

Materials and Methods

During the period 1994–1999, 1,250 cases of laparoscopic cholecystectomy were included in a prospective study to monitor the procedure and its complications. All cases of cholecystitis were scheduled for laparoscopic cholecystectomy during the period of the study. However, there were 19 cases of conversion to open cholecystectomy during the surgery.

A special form was created to include the patient's history, clinical examination, findings at surgery, details of the surgical technique, difficulties during surgery, and comments of the surgeon. It was our practice not to operate upon cases with proven acute cholecystitis as evident on clinical findings and ultrasound (US) examination unless otherwise indicated. Pre-operative endoscopic retrograde cholangiopancreatography (ERCP) was performed on the least provocation in cases of raised direct serum bilirubin and/or dilated common bile duct (CBD) on US examination.

Postoperative clinical evaluation, liver function tests and complete blood count were routinely performed for every patient. Post-operative US examination was conducted in cases of elevated direct serum bilirubin. The surgical team comprised 3 consultants experienced in laparoscopic cholecystectomy conveying the technique of the procedure to other surgeons on a 'surgeon-to-surgeon' basis.

Operative cholangiography was not performed unless indicated. The operation was performed through four ports: a subumbilical port (10 mm) for the camera, a 10-mm epigastric port and a 5-mm port in the right hypochondrium as work ports. The fourth port was located in the right midaxillary line, level with the umbilicus for retraction of the fundus of the gall-bladder. The surgeon and the cameraman stood on the left side of the patient, and the assistant stood on the right side of the patient. Dissection was performed by means of diathermy hook starting at Calot's triangle and either the diathermy hook or scissors was used to dissect the gall-bladder. Bismuth classification of major bile duct injuries [2] was used to grade the injuries as shown in table 1.

Results

Of the 1,250 laparoscopic cholecystectomies performed, there were 4 injuries of the CBD. Two were major and were classified as type II. One injury occurred in a

male patient; the other in a female patient. The other 2 were minor CBD diathermy puncture injuries without tissue loss. Both patients were female. The patients' ratio of female to male patients with bile duct injuries was 3 to 1. Their ages ranged from 24 to 59 years. The duration of their illness ranged from 2 to 7 years. A history of acute cholecystitis was present at some stage of the disease in the 4 patients with injuries.

Two of these patients with injuries had to be deliberately operated upon during the acute attack of cholecystitis because of the frequent recurrence of acute inflammation in 1 patient and the high risk in the other of developing recurrent jaundice by small stones passing into the CBD. The other 2 patients were scheduled for surgery 2 months after episodes of acute cholecystitis, but they were found to have unexpected acute inflammation in addition to chronic cholecystitis during surgery. A history of jaundice was found in 3 patients with bile duct injuries. These 3 patients had ERCP before surgery. It was repeated 3 times in 1 of them because of technical difficulty during stone retrieval, and it was done twice in another patient in order to stent the CBD to avoid the recurring jaundice by small stones slipping into the CBD. Empyema of the gall-bladder was found in 2 patients. Table 2 shows the timing of surgery in relation to acute cholecystitis, jaundice, and ERCP. Difficulty in identifying the anatomy during surgery was observed in the 4 cases of bile duct injury. Calot's triangle was distorted by adhesions and bulky fibrous tissue reaction as a result of chronic inflammation. The continued dissection in this area was followed by leakage of clear oil bile, which was considered to be a sign for the surgeon to convert to open surgery and look for bile duct injury. Immediate repair was performed in all cases. Bismuth II CBD injuries were repaired by choledochojejunostomy in 1 patient and choledochoduodenostomy in the other. Minor CBD injuries were managed by the insertion of a T tube and intra-operative cholangiography after completion of cholecystectomy. The patients were followed up for a period of 1–3 years (table 3) by clinical history, liver function tests (LFT) and US of the abdomen. All patients were symptom-free with normal LFT and US.

Discussion

The incidence of bile duct injury in open cholecystectomy is reported to be 0.0–0.4% [3–8] while that of laparoscopic cholecystectomy is 0.0–0.1% [9–18]. We have encountered an incidence of 0.15% of major and 0.15% of

Table 2. Timing of surgery in relation to the risk factors

	Type of injury	Acute cholecystitis before surgery	Jaundice and ERCP before surgery
Case 1	Bismuth II	2 months	2 months
Case 2	Bismuth II	2 months	–
Case 3	puncture injury	3 days	2 months
Case 4	puncture injury	5 days	3 days

Table 3. Follow-up of patients after surgery

	1 month	6 months	1 year	2 years	3 years
Patient 1: Bismuth II	+	+	+	+	+
Patient 2: Bismuth II	+	+	+		
Patient 3: puncture injury	+	+	+	+	+
Patient 4: puncture injury	+	+	+	+	

Table 4. Risk factors associated with the bile duct injuries

	Type of injury	Recent acute cholecystitis	History of jaundice	ERCP	Acute pancreatitis
Case 1	Bismuth II	+	+	3 times	+
Case 2	Bismuth II	+	–	–	–
Case 3	diathermy puncture	+	+	–	–
Case 4	diathermy puncture	+	+	twice	–

minor bile duct injury. Our findings are not consistent with the multicentric study of 114,005 cases of laparoscopic cholecystectomy in which the authors suggested a higher incidence of bile duct injury in laparoscopic cholecystectomy than open surgery [19].

Failure to identify the anatomy is the major leading factor for bile duct injury during laparoscopic cholecystectomy [20]. Faulty surgical technique may also be responsible for bile duct injury [21]. Excessive or erroneous traction may lead to mistaking the CBD for the cystic duct [22]. The CBD may be injured by the spread of diathermy current through clips or during difficult dissection with unclear anatomy [23]. In this study, difficulty in identifying the anatomy was encountered in all injury cases. The difficulty was attributed to the local inflammatory processes that lead to thickening and adhesion of the gall-bladder in close proximity to the major bile ducts. The addition of a bulk of fibrous tissue obliterated Calot's triangle and was associated with troublesome dissection that led to bile duct injuries.

There was noticeable association between the difficulty in identifying the anatomy and several risk factors that may be held responsible for the associated injury (table 4). Recent attacks of acute cholecystitis (3 patients), history of obstructive jaundice (4 patients), technically difficult and repeated ERCP (2 patients) and pancreatitis following the procedure (1 patient) were incriminating risk factors. Technical difficulty in ERCP may indicate some underlying pathology that led to the difficulty. On the other hand, CBD injury may be due to the inflammatory reactions that have been induced by manipulation during the difficult ERCP.

Although many surgeons elect to operate upon acute cholecystitis, this was not the practice in the current study. All injuries were inflicted by consultants experienced in laparoscopic surgery, noticed during surgery and immediately repaired. The authors have observed the leakage of clear oily bile at the onset of injury in contrast to the turbid or deep green bile of the gall-bladder. The leakage of such bile was a sign for the surgeon to convert to open surgery.

The value of routine operative cholangiography is debatable in the literature [24, 25]. Operative cholangiography is not a prerequisite for safe cholecystectomy by many authors [26]. A large percentage of CBD injuries (44%) have occurred before cannulation of the cystic duct for operative cholangiography [27]. In this study, operative cholangiography was performed in only 5 cases of multiple small gall-bladder stones and widely dilated cystic duct that were not on the other hand associated with any injury. Pre-operative ERCP was performed on the least provocation in cases of elevated direct serum bilirubin or dilated CBD on US scanning. Excellent results were obtained by immediate repair. All patients were symptom-free with normal LFT and US finding on follow-up for a period of up to 3 years.

Conclusions

The incidence of major injury (Bismuth II) in this study of 1,250 cases was found to be 0.15%. History of jaundice, recent attacks of acute cholecystitis, repeated ERCP, and acute pancreatitis were observed to be risk factors associated with the difficulty in identifying the anatomy and the CBD injury. Patients with such clinical history should have an operative cholangiography decided liberally during surgery to map up the biliary tree for easier and safe dissection. This is especially true in cases of difficult anatomy. Operative cholangiography in such cases may help to avoid CBD injuries. It is important for the laparoscopic surgeon to know when to convert to open cholecystectomy in order to avoid such a serious complication. Immediate repair of the CBD injury had a very good outcome.

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