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Bile duct complications after laparoscopic cholecystectomy

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Summary. A retrospective review and analysis of patients referred to the Division of Gastroenterology and the Section of Gastrointestinal Surgery with common bile duct complications after laparoscopic cholecystectomy was undertaken in order to identify injury patterns, management, and outcome. Sixteen patients were identified over a 20-month period. Twelve patients had major common bile duct injuries and four had minor injuries (cystic duct leaks). Seventy-one percent of injuries occurred with surgeons who had done more than 13 laparoscopic cholecystectomies. Eighty-three percent of patients who had major ductal injury did not have a cholangiogram prior to the injury. Sixteen percent of patients with major common bile duct injuries had findings of acute cholecystitis and 58% of these major injuries were "easy" gallbladders. One-third of major injuries were recognized at operation. Two-thirds of immediate repairs failed. All cystic duct leaks were managed nonoperatively.

It appears that bile duct complications after laparoscopic cholecystectomy are more common in the community than is reported. Bile duct complications occur with surgeons who are experienced and inexperienced with laparoscopic cholecystectomy. Common bile duct injuries, unrecognized at laparoscopic cholecystectomy in the majority of cases, usually occur with "easy" gallbladders. Operative cholangiography is not utilized in the majority of common bile duct injuries. When immediate repair of common bile duct injuries is undertaken, the majority are unsuccessful. Endoscopic retrograde cholangiopancreatography (ERCP) is invaluable in the diagnosis and management of bile duct complications. Cystic duct leaks may be managed successfully with endoscopic stents.

Key words: Laparoscopic cholecystectomy – Common bile duct injury – Cystic duct injury

Injuries to the extrahepatic biliary tree have been called the Achilles' heel of laparoscopic cholecystectomy. After open cholecystectomy injuries to the common bile duct have been reported to range from 0.07 to 0.5% [1, 7]. An acceptable rate of common duct injuries after cholecystectomy is one per thousand. Although the incidence of major bile duct complications after laparoscopic cholecystectomy has been reported to be low, major biliary tract complications have been reported with increasing frequency since the introduction of laparoscopic cholecystectomy [5, 10].

Subjects and methods

A retrospective review and analysis of patients referred to the Division of Gastroenterology and the Section of Gastrointestinal Surgery with bile duct complications after laparoscopic cholecystectomy over a 20-month period from August 1990 to March 1992 was undertaken. Major injuries were defined as injuries to the common bile duct or common hepatic ducts. Minor injuries were defined as injuries to the cystic duct. Sixteen patients (11 women, 5 men) with an age range from 20 to 88 years (mean 46.5 years) had bile duct complications after laparoscopic cholecystectomy. There were 12 major injuries and four minor injuries.

Results

Operative techniques

A straight telescope was used to perform laparoscopic cholecystectomy in all cases. Electrocautery was used in 15 cases and the KTP laser in one. Intraoperative cholangiogram was utilized in four cases, two before injury to the common bile duct and two after injury.

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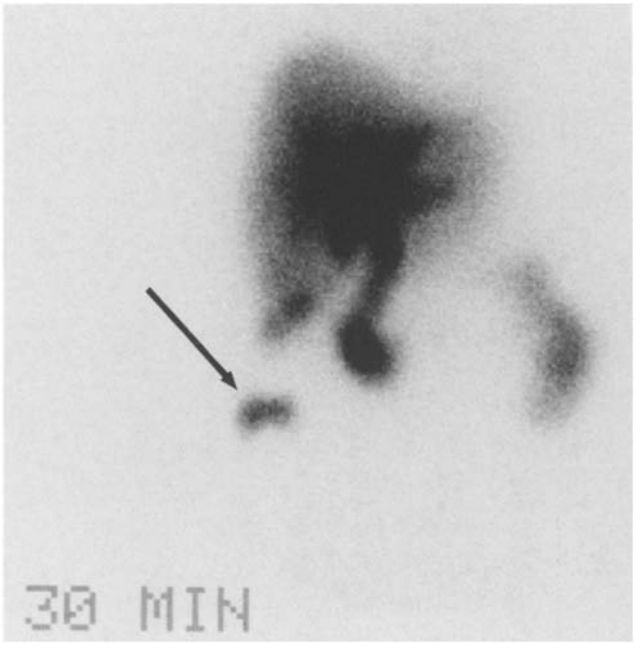

Fig. 1. Nuclear biliary scan shows collection of radiopharmaceutical agent outside biliary and gastrointestinal tract (*black arrow*) in patient with cystic duct leak

Fig. 2. Stricture of common hepatic duct (*white arrow*) which developed in postoperative period in patient who had "easy" laparoscopic cholecystectomy

Surgeon experience and training

Most laparoscopic cholecystectomies were performed by surgeons who had performed more than 25 laparoscopic cholecystectomies. The mean number of laparoscopic cholecystectomies was 76 with a range of 1 to 500. Eleven surgeons had done more than 25 laparoscopic cholecystectomies, and their patients had 8 major and 3 minor injuries. Four surgeons had done less than 13 laparoscopic cholecystectomies, and their patients had 3 major and 1 minor injury. One major and one minor injury occurred with two surgeons assisting a resident surgeon. Two surgeons had more than one patient in the study. Surgeons received training in laparoscopic cholecystectomy in proprietary courses in 11 cases, residency training in 2, and preceptorship outside the surgeon's institution in 1. The mean number of years in practice for the fourteen surgeons was 15.3 years with a range of 1 to 34 years. There were 2 surgeons who had been in practice less than 5 years and five surgeons who had been in practice more than 25 years.

Minor injuries

There were four minor complications involving the cystic duct. Diagnosis of three was with biliary nuclear scan (Fig. 1); endoscopic retrograde cholangiopancreatography (ERCP) confirmed the diagnosis in all patients. Two of these were treated with endoscopic biliary stent placement. One was treated with an endoscopic stent and percutaneous catheter drainage, and one patient was unable to be stented and was managed expectantly. The bile leak resolved in all cases. Three of these patients are alive and well at follow-up, and one died of a myocardial infarction 3 months after laparoscopic cholecystectomy.

Major injuries

Of the 12 major injuries, there were 6 transections of the common bile duct or common hepatic duct, 3 common hepatic duct strictures, 2 clipped common bile ducts, and 1 partial transection of the common bile duct.

Operative findings in the common bile duct injuries included acute cholecystitis in two patients and chronic cholecystitis in 10. The surgeon described the cholecystectomy as an "easy" gallbladder in seven cases and as a difficult dissection in five. The diagnosis of the common bile duct injury was made at laparoscopic cholecystectomy in four cases and was delayed in eight cases. Of the four patients with common bile duct injuries who had cholangiograms, two of these were normal; these two patients developed hepatic duct strictures in the early postoperative period (Fig. 2). One cholangiogram was done after partial transection of the common duct; the common bile duct was mistaken for the cystic

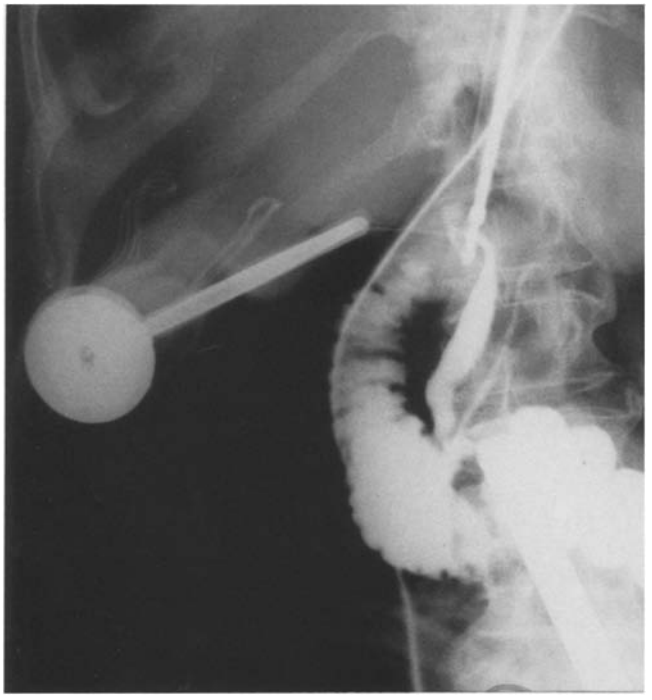

Fig. 3. Laparoscopic cholangiogram shows distal common bile without filling of hepatic ducts. Common bile duct had been mistaken for cystic duct prior to choledochotomy and cannulation of common bile duct

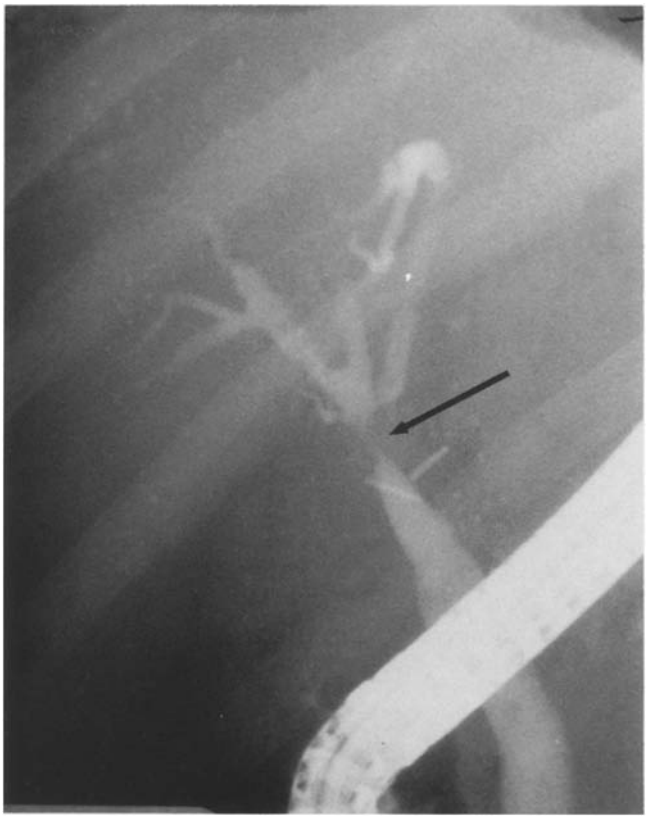

Fig. 4. Stricture in proximal common hepatic duct (*black arrow*) which developed after end-to-end repair of common hepatic duct transection at laparoscopic cholecystectomy

duct (Fig. 3). The other cholangiogram identified the hepatic ducts after complete transection of the common bile duct.

Repair of the injury was undertaken by the primary surgeon in eight cases. In four cases, the repair was unsuccessful; in two cases successful immediate repair was done. The two other cases had external biliary drainage. Of the failed operative primary repairs, there was one choledochoduodenostomy, one end-to-end anastomosis of the common hepatic duct and common bile duct, one anastomosis of a Roux-en-Y jejunal limb to the cystic duct remnant, and one primary repair of the common bile duct (Fig. 4). Three of these were done at the time of injury and one was delayed. Operative repair after referral was done in three cases; two underwent hepaticojejunostomy and one had external biliary drainage with a common duct T-tube. Nonoperative management after referral in six patients included four ERCPs with stent placement, one percutaneous transhepatic biliary drainage, and one ERCP with stent placement and percutaneous catheter drainage of bile ascites.

Follow-up ranges from 2 to 20 months with a mean of 12.3 months; five patients had early success after operation. One is awaiting operation, one has completed successful endoscopic treatment, and five are being managed with ongoing endoscopic treatment.

Discussion

In the initial reports of laparoscopic cholecystectomy, the incidence of major bile duct injury was approximately 1% [11, 15, 19, 21]. Zucker coined the phrase "learning curve" and postulated that complications would diminish as surgeons acquired more experience with the procedure [21]. In the analysis of data from the Southern Surgeons Club, there was a significant difference in the incidence of common duct injuries with surgeons who had done less than 13 laparoscopic cholecystectomies (2.2%) compared to those who had done greater than 13 laparoscopic cholecystectomies (0.1%) [16]. In experienced hands, the incidence of major bile duct injuries with laparoscopic cholecystectomy is similar to that of open cholecystectomy [2–4, 9, 16, 17, 20]. Based on a recent experience with complicated injuries to the common bile duct, Moossa observed that the incidence of common bile duct injuries after laparoscopic cholecystectomy in the community is higher than that previously reported [10]. The number of bile duct complications referred to the Medical University of South Carolina appears to be higher than that seen prior to the introduction of laparoscopic cholecystectomy. In the 24-month period from 1988 to 1989 there were six patients referred to the Division of Gastroenterology with bile duct complications after open cholecystectomy, none with common duct transection.

Operative technique has been noted to be a factor involved in common bile duct injuries by several authors. Hunter suggested that an angled telescope is

better than the straight telescope in defining the anatomy in the triangle of Calot [8]. Easter and Moossa commented that the use of the laser was a factor in the severity of injuries during laparoscopic cholecystectomies [6]. No surgeons used an angled scope and the KTP laser was used in only one case in this series.

Although operative cholangiography may prevent common bile duct injuries [14], in one patient who underwent intraoperative cholangiography the common duct was mistaken for the cystic duct and cholangiography was done through a choledochotomy. This injury illustrates how ductal injuries which are due to misinterpretation of normal anatomic variations may not be prevented by cholangiography.

The majority of the surgeons involved in this study were experienced surgeons who had been in practice more than 5 years and had undertaken training in laparoscopic cholecystectomy at proprietary courses in the United States. Most were experienced laparoscopic surgeons and only four surgeons had done less than 13 laparoscopic cholecystectomies. Experienced laparoscopic surgeons undertake more difficult cases and may assume risks which jeopardize the bile duct.

Although we labeled cystic duct leaks as a minor complication, all bile leaks are a source of major morbidity. In the early postoperative period, symptoms of cystic duct leak are similar to those of major injury to the common bile duct. Biliary scan was used to make the diagnosis in three of the four patients with cystic duct leaks. ERCP was used in all patients with cystic duct leaks, and two patients were readily managed with ERCP and stent placement. Percutaneous catheter drainage was utilized to treat a patient with bile ascites which had become infected with *Candida albicans*. One patient was treated expectantly because endoscopic stenting was not possible.

Although many major injuries to the common bile duct may have been prevented by converting to open cholecystectomy, the majority of injuries occurred to patients with "easy" gallbladders. Hemorrhage and severe inflammation, factors related to bile duct injury at open cholecystectomy, were noted infrequently in this series. In two cases, multiple clips had been placed in the region of the common bile duct, producing an injury similar to that of blind clamping used with open cholecystectomy.

Patients who developed common hepatic duct strictures represented major management problems. One was related to a misplaced cystic duct ligature which incorporated the common duct. It was readily managed with endoscopic stenting. The two other strictures of the common hepatic duct had no identifiable cause. One was an isolated stricture of the common hepatic duct which occurred after an "easy" cholecystectomy. The other involved strictures of the right hepatic duct and common hepatic duct in a patient with a difficult dissection for chronic cholecystitis. Electrocautery dissection may be the cause of postoperative hepatic duct strictures [5], and should be used infrequently and with great care in Calot's triangle.

Diagnosis of the injury at the time of operation was made in only four patients. Timely postoperative diagnosis of bile duct injuries requires a high index of suspicion. Bile peritonitis, abdominal sepsis, cholangitis, and biliary fistula are late manifestations of bile duct injury. Patients who present early with bile ascites have an indolent disease characterized by vague abdominal pain and mild nausea [13]. An elevated alkaline phosphatase may be the first clue to bile ascites and serum bilirubin and the leukocyte count may be normal. Patients who have unusual abdominal pain early after laparoscopic cholecystectomy should be evaluated with a biliary scan. If the biliary scan is positive, an ERCP should be obtained.

The results of delayed repairs of injury to the common bile duct are inferior to those with repairs recognized at the time of injury [18]. One patient who had a delayed repair of an unrecognized common bile duct transection was treated with choledochoduodenostomy and subsequently developed anastomotic stenosis associated with cholangitis. Because of associated cardiac risk factors, he has been treated with internal stenting with placement by a combined radiologic and endoscopic approach. In two cases, end-to-end anastomosis of the transected common bile duct and common hepatic duct undertaken at the time of injury was unsuccessful due to anastomotic stricture. Both patients have been treated with endoscopic stents. One patient who had injury recognized at the time of laparoscopic surgery had Roux-en-Y anastomosis of the jejunum to a large cystic duct. This was satisfactory in the early postoperative period, but 3 months after surgery the patient developed stenosis of this anastomosis and required revision with Roux-en-Y hepaticojejunostomy. Follow-up on patients who have been treated with hepaticoenterostomy is short; the long-term success rate with repair of biliary strictures requires follow-up of at least 2 years, and recurrent strictures may not appear until 9–10 years after operation [12].

ERCP is invaluable in the diagnosis and management of biliary tract injuries after laparoscopic cholecystectomy. Although the biliary nuclear scan is helpful in identifying extravasation, ERCP is more specific in identifying a specific site. In many cases, ERCP with endoscopic stenting may be therapeutic. With cystic duct leak and with some strictures, endoscopic treatment may be definitive. In patients who are otherwise unfit for major abdominal/biliary tract surgery, ERCP may provide a long-term solution.

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