

## Biliary Complications after Laparoscopic Cholecystectomy

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### ABSTRACT

**Background:** The reported prevalence of biliary tract disruption following laparoscopic cholecystectomy has ranged from 0% to 7% in early reports. Bile leaks are the most common biliary complication of laparoscopic cholecystectomy.

**Methods:** Total 530 patients who had undergone laparoscopic cholecystectomy from January 2004 to November 2006 at Kathmandu Medical College Teaching Hospital were studied for biliary complications after laparoscopic cholecystectomy.

**Results:** We reviewed 500 laparoscopic cholecystectomies performed at our institution and found 13 cases of bile extravasation and/or biloma formation and/or bile duct injuries (prevalence, 2.6%). One bile duct transection was acutely recognized and treated with hepaticojejunostomy. Three lateral bile duct injuries were also acutely recognized, two of them were managed with primary repair of CBD without T tube and the other was managed with repair and T-tube drainage. Two patients had postoperative generalized biliary peritonitis, one of whom was undergone exploratory laparotomy and found to have lateral injury on CBD which was managed with repair and T-tube drainage, whereas the other was undergone diagnostic laparoscopy with clipping of duct of Lushka. Two patients presented within seven days with biloma, one was treated with percutaneous drainage alone, the other treated with percutaneous drainage was found to be complete transection of CBD on subsequent ERCP and managed with late hepaticojejunostomy. One patient with continued bile leak from surgical drainage tube for more than one week was managed with ERCP, diagnosed to be bile leak from duct of Lushka, managed by sphincterotomy and bile duct stenting. One patient presented with obstructive jaundice 6 months after laparoscopic cholecystectomy was found to have Bismuth type II bile duct stricture and was undergone hepaticojejunostomy. The remaining three had bile leak from surgical drainage which resolved within one week without further complication.

**Conclusions:** Laparoscopic cholecystectomy appears to be associated with a higher incidence of bile duct injury than previous reports of open cholecystectomy. Possible explanations include variant anatomy plus failure to obtain an operative cholangiogram, inadequate dissection, injudicious use of cautery or clip placement, inherent limitations of the procedure, or the learning curve associated with a new technology.

**Key words:** biliary tract, laproscopic cholecystectomy.

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## INTRODUCTION

Over the last decade, laparoscopic cholecystectomy has gained worldwide acceptance and considered to be as gold standard in the surgical management of symptomatic cholelithiasis.<sup>1-3</sup> But along with the introduction of laparoscopic method of cholecystectomy, the incidence of biliary tract complications has also increased.<sup>4-7</sup> Important risk factors for biliary complications include acute cholecystitis and limited experience of the surgeon.<sup>8-10</sup>

Early laparoscopic cholecystectomy is now the regular approach, since the former practice (antibiotic therapy and surgery in the inflammation-free interval) led to a considerable delay, which was often accompanied by massive intra-abdominal adhesions and which resulted in an increase in the conversion rate. Bile leaks are the most common biliary complication of laparoscopic cholecystectomy. The introduction of laparoscopic cholecystectomy has made the identification of bile leaks more difficult because drains are not typically employed. The reported prevalence of biliary tract disruption following laparoscopic cholecystectomy has ranged from 0% to 7% in early reports.<sup>11-17</sup>

The objective of this study was to find out the prevalence of biliary complications after laparoscopic cholecystectomy.

## METHODS

A prospective cross sectional study was conducted in the department of Surgery, Kathmandu Medical College from January 2004 to November 2006. The patient consent was taken. The patient who underwent laparoscopic cholecystectomy was included in the study. All laparoscopic cholecystectomy were performed using the standard four or three-puncture technique. In all patients, the cystic duct was clipped with 9-mm titanium clips. In all cases, the gallbladder dissection was accomplished with electrocautery. Prior to final separation of the gallbladder from the liver, the porta hepatis was closely inspected for bleeding, bile leakage, and clip position. 30 patients needed conversion to open cholecystectomy for other reason than biliary complication and were excluded. Bile leaks of less than 50 cc in drainage tube for 24 hrs and didn't continue to drain for more than 48 hrs and becoming asymptomatic throughout the follow up period were not taken as biliary complication. All patients were retrospectively evaluated for biliary complication. Biliary complication included bile extravasation and/or biloma formation and/or bile duct injuries. Their diagnosis and management were analyzed and compared to other series. The statistical analysis was done by using statistical package for social sciences (SPSS) version 13 for windows.

## RESULTS

Laparoscopic cholecystectomy was performed in 530 patients from January 2004 to November 2006 at KMCTH. Age of the patients ranged from 8 years to 82 years old, mean age was 45 years. Among them 150 were male and 380 were female. Conversion to open cholecystectomy was required in 30 (5.6%) patients because of intra-abdominal bleeding, unclear anatomy, or severe inflammation precluding safe dissection of the cystic duct. These 30 patients were excluded from our study. Biliary complication occurred in 13 cases with prevalence of (2.6%). Types of injury included complete bile duct transection in two cases, lateral bile duct injury in four cases, injury to duct of Lushka in two cases, biliary complication of unknown origin in four cases, late biliary stricture in one case. There was no mortality recorded with biliary complication. All patients were followed up routinely by sonogram and liver function test with mean follow up of eight months. There was only one case of morbidity with biliary peritonitis after T-tube removal, while all other cases were uneventful on follow up (Table 1).

**Table 1. Causes of biliary complications after laparoscopic cholecystectomy.**

Etiology	No of cases
CBD lateral injury	4
CBD transaction	2
Duct of Luschka	2
Unknown	4
CBD stricture	1

A multivariate approach was used for the proper diagnosis of biliary complications following laparoscopic cholecystectomy. Per operative diagnosis of bile duct injury was made on four cases. Per operative diagnosis was made on the basis of bile staining of the operative field other than bile from gall bladder or direct visualization of the injury. Exploratory laparotomy was performed on the first post operative day in one case for biliary peritonitis and diagnosed to have lateral injury on common bile duct (Strasburg type D). Post operative diagnostic laparoscopy on first post operative day was performed in one case and was diagnosed to have bile leak from duct of Lushka. Surgical drain was the diagnostic tool in three cases. Sonogram alone was used to diagnose one case of biloma while sonogram followed by endoscopic retrograde cholangiopancreatography (ERCP) was used to diagnose the biliary complication and found to have the injury on right sectoral duct. Late ERCP was done 6 months postoperatively for one case and diagnosed to have Bismuth type II bile duct stricture (Table 2, 3).

**Table 2. Techniques used to diagnose biliary complication.**

Techniques	No of cases
Peroperative visualization	4
Exploratory laparotomy	1
Relaparoscopy	1
USG alone	1
ERCP	3
Surgical drain	3

**Table 3. Management of bile leaks after laparoscopic cholecystectomy.**

Technique	No of performed
Roux-en-Y hepaticojejunostomy	
Early	1
Late	2
Primary repair of CBD	2
Repair of CBD under T tube	2
Laparoscopy and drainage	1
USG Drainage	1
ERCP , ES and Stent	1
No further management	3

## DISCUSSION

The gold standard treatment for cholelithiasis currently is laparoscopic cholecystectomy (LC). Laparoscopic cholecystectomy is a safe and effective method for the treatment of cholelithiasis as compared with the traditional open procedure, it has the benefits of a shorter hospital stay, minimal surgical trauma and earlier return to work.<sup>18,19</sup>

Bile leaks after cholecystectomy are a common phenomenon, occurring in nearly 50% of cases.<sup>20</sup> The majority of these leaks are subclinical and can only be identified when prospective hepatobiliary scintigraphy is used.<sup>21</sup> Clinically important leaks are much more infrequent and occur in less than 5% of cases.<sup>20</sup>

Bile duct injury following laparoscopic cholecystectomy is any clinically evident damage to the biliary system (including the cystic duct stump) occurring at any time during laparoscopic cholecystectomy. During the learning curve phase, bile duct injuries appear to be more numerous and severe than those caused by open cholecystectomy. Bile duct injury and bile leaks are often difficult to diagnose but must be strongly considered in postoperative patients with abdominal pain, fever, jaundice or continued bilious drainage from a surgical drain or intraoperative if bile staining of operating field apart from bile leak from gall bladder.

Bile duct injury (BDI) can be 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 (Strasberg types A to D). Major BDI was defined as any disruption (ligation, avulsion, resection) of the extrahepatic biliary system (Strasberg type E).<sup>22</sup>

A combination of diagnostic imaging studies is used to diagnose the postoperative biliary complication. Most commonly, duplex ultrasonography and computed tomographic (CT) scan are used to demonstrate intrahepatic ductal dilatation, fluid collections, and hepatic atrophy or hypertrophy. Endoscopic retrograde cholangiopancreatography (ERCP) and magnetic resonance cholangiopancreatography (MRCP) are applied to identify the location of stricture or bile leak and to reduce or eliminate bile leakage. ERCP sphincterotomy with stent placement is used.

We were able to recognize acutely the injury to the bile duct in four of our cases. We don't routinely perform the intra-operative cholangiogram but we always put low threshold for conversion keeping in mind that conversion is not a failure but a safety to the patient. Because laparoscopic cholecystectomy is more of visual sensation and orientation, we always take help from another experienced surgeon's eyes to confirm the anatomy in any doubt. If there is no confirmation on four eyes, we decide to convert to open.

The most common presentation of a post-cholecystectomy bile leak would be abdominal pain anywhere from 1 to 8 days after surgery. Our two patients presented with generalized biliary peritonitis on the first postoperative day and were diagnosed on clinical basis. Tests can be normal to slight LFT elevation. HIDA scans, CT and ERCP are used in the diagnosis. Ultrasound is less helpful. But our patients who are not affordable to the expensive investigations, ultrasound has been the first line of investigation and has helped us in most of the cases.

Management strategies include sonogram guided percutaneous drainage, laparotomy and drain placement, laparoscopy and drain placement, ERCP and drainage and CT-guided percutaneous drainage.

Case 1 was acutely diagnosed as having complete bile duct transection (Strasburg type E) peroperatively. On reinspection and dissection it was found that CBD was completely transected. The patient underwent Roux-en-Y hepaticojejunostomy on the same setting. Case 2-4 were also acutely recognized as having lateral tear in CBD (Strasburg type D). On careful inspection the operative field was stained with bile other than the spillage from gall bladder. On further dissection and inspection the lateral tear on CBD was confirmed. Two of the cases were managed with primary repair of CBD

without T tube and the other managed with repair under T-tube drainage. Case 5, 6 presented with generalized biliary peritonitis on the first postoperative day. One was undergone exploratory laparotomy and was found to have lateral injury on CBD (Strasburg type D) and was managed with repair and T-tube drainage. The other was undergone diagnostic laparoscopy and was diagnosed to have bile leak from duct of Lushka (Strasburg type A). Duct of Lushka was clipped and followed by closed suction drainage. Case 7, 8 presented within 7 days with dull aching pain abdomen with tachycardia. On abdominal USG they were diagnosed to have biloma. One was treated with USG guided percutaneous drainage alone, the other was treated with percutaneous drainage followed by ERCP. On ERCP it was found to be complete transection of CBD and was managed with late Roux-en-Y hepaticojejunostomy. Case 9 continued bile leak from surgical drainage tube for more than one week post operatively. Patient was undergone ERCP, diagnosed to have bile leak from duct of Lushka (Strasburg type A) and was managed by sphincterotomy and bile duct stenting. Case 10 presented with obstructive jaundice 6 months after laparoscopic cholecystectomy was found to have Bismuth type II bile duct stricture and was undergone Roux-en-Y hepaticojejunostomy. Case 11-13 presented with bile leak from surgical drainage tube more than 50 cc per day and continued for more than 48 hours but resolved spontaneously within one week without further complication. The source of the leaks was never determined.

Repeat laparoscopy has the advantage of allowing the surgeon the opportunity to cleanse the peritoneum and inspect the porta hepatis. The disadvantages of repeat laparoscopy are that it requires general anesthesia and drainage may not be uniformly successful. Furthermore, only limited information can be gained about the source of the leak.<sup>23</sup>

The outcome for patients who have biliary complications is determined by the type, level, and extent of the injury, prompt detection of the injury, the timing, type, and appropriateness of the initial treatment and timing of the surgery.

The optimal management of postoperative bile leaks remains to be defined. This series presents a variety of different management options which were pursued by the individual surgeons based on their preference and judgment.

Although experience is essential to avoid high rates of morbidity in any surgical procedure, in laparoscopic cholecystectomy the effect of the learning curve does not seem to be the most important factor in minimizing the possibility of BDI because most BDIs are related to

anatomic misdiagnoses and lapses from basic principles of biliary surgery. Other factors that may be related to BDI include certain pitfalls believed to be inherent to the laparoscopic approach: the two-dimensional view, insufficient tactile sensation, different traction forces to the gallbladder, and electrocautery inside Calot's triangle.<sup>24-26</sup> Bile duct injury during LC is best avoided if the surgeon maintains a low threshold for conversion to laparotomy in any case where the anatomy cannot be precisely identified.<sup>24,27</sup> Clips on the cystic duct must not include a portion of the adjacent hepatic or common bile duct. Adequate knowledge of the mechanisms in biliary complications and adequate surgical training are essential to avoid the biliary complications.

Another feature of laparoscopic BDI is its late recognition, with consequent increased morbidity resulting from peritonitis. Richardson et al reported a higher incidence of intra-operative identification of BDI than experienced in previous laparoscopic studies, suggesting that early repair leads to an improved outcome.<sup>28</sup> This high intra-operative identification rate for BDI could be associated with the high overall conversion rate of 13.9% because intraoperative cholangiography was performed on a selective basis (only 8.8% of the procedures). Intraoperative cholangiography may facilitate the recognition of BDI, thereby minimizing its severity.<sup>29-31</sup> Immediate operative management of major BDI during and after laparoscopic cholecystectomy includes end-to-end anastomosis of the injured bile duct or Roux-en-Y hepaticojejunostomy. Although direct ductal reanastomosis can be accomplished when transection has occurred without loss of tissue, the overall success rate of this repair is approximately 50%.<sup>32</sup> If a major BDI is recognized during 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.<sup>33</sup>

Huang et al. analyzed different factors that could predict long-term outcomes after surgical repair. He found statistical significance only for perioperative inflammation ( $p = 0.04$ ) and primary repair performed by a non referral surgeon ( $p = 0.02$ ).<sup>34</sup> These authors also stated that serum alkaline phosphatase levels higher than 400 IU at postoperative month 6 predict long-term nonsuccess. For this reason, these patients should be treated as early as possible using therapeutic endoscopy or interventional radiology.

As Smadja stated, it is important to give the patient the best treatment for his problem from the very beginning.<sup>35</sup> Each re-anastomosis requires a higher dissection in the pedicle, with subsequent damage to the vascularization of the bile duct. Alan Koffron et al reported that 61%

of patients with biliary injuries for whom the primary repair attempt failed had an associated vascular lesion.<sup>36</sup> The higher the stenosis was, the greater the incidence of vascular associated lesions: 71% for Bismuth type 4, 63% for Bismuth type 3, and 33% for Bismuth type 2.

## CONCLUSIONS

Laparoscopic cholecystectomy appears to be associated with a higher incidence of bile duct injury than previous reports of open cholecystectomy. Possible explanations include variant anatomy plus failure to obtain an operative cholangiogram, inadequate dissection, injudicious use of cautery or clip placement, inherent limitations of the procedure, or the learning curve associated with a new technology. Conversion to an open procedure should not be considered a complication when marked inflammatory changes or difficulties in outlining the confluence of the cystic and common bile duct lead to this decision.

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