

The Incidence of Biliary Leak in Laparoscopic Cholecystectomy at Azadi Teaching Hospital in Kirkuk

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Abstract:

Background: Laparoscopic cholecystectomy has now replaced open cholecystectomy for the treatment of gallbladder diseases. However, laparoscopic cholecystectomy may cause various complications an important one of them is biliary injury. Laparoscopic cholecystectomy has been practiced for close to 25 years. The rate of common duct injury remains somewhere between 0.4 to 0.7 percent and is approximately the same around the world. Recent papers have stressed in which ways laparoscopic common duct injury can be avoided but none of the methods mentioned is foolproof. In addition, this complication can occur to even the most experienced laparoscopic surgeon. This injury to be emphasized by the surgical community as an inherent risk of the operation, and patients should be fully informed of this potential complication.

Aim: Of this study is to assess the outcome of laparoscopic cholecystectomy (LC) by determining the incidence of biliary leak and avoid it.

Settings: Surgical wards of Azadi Teaching Hospital – Kirkuk between 2013- 2015.

Patients and Method: This is a prospective study of 204 patients. We evaluated the data according to outcome measures, such as bile duct injury, morbidity, mortality.

Result: During this period, 204 patients underwent LC, of whom two patients (1%) have minor bile duct injuries.

Conclusion: Biliary tract injury is a major complication of LC. Anatomical anomalies, local pathology, and poor surgical techniques are the main responsible factors.

Key words: Laparoscopic cholecystectomy, Biliary injury, Biliary leak.

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Table of abbreviations:

Abbreviation	Eponyms
BMI	Body mass index
CBD	Common bile duct
ERCP	Endoscopic retrograde cholangiopancreatography
GB	Gall Bladder
L.C.	laparoscopic cholecystectomy
MRCP	Magnetic resonance cholangio- pancreatography
PT	Pro – thrombin time
PTT	Partial thromboplastin time

Introduction:

Laparoscopic cholecystectomy (LC), first introduced in France by Dr. Philippe Mouret in 1987, has been rapidly embraced worldwide as the procedure of choice for cholecystectomy. Compared with open cholecystectomy ⁽¹⁾, LC is associated with less local pain, shorter hospitalization resulting in an early return to work, and a favorable cosmetic outcome.

During the surgical learning curve for this technique there was an initial rise in the reports of bile duct injuries, resulting mainly from the surgeons' inexperience and misinterpretation of the anatomy ^(2, 3). The incidence of biliary injury during laparoscopic cholecystectomy, estimates the rate of major injury to be about (0.55%), and the incidence of minor injuries and bile leaks to be about (0.3%), a total of (0.85%). Limited view, difficult orientation and assessment of depth on a two-dimensional image, and the lack of tactile sensation and unusual manual skills ⁽⁵⁾, that are needed have led to the rise in bile duct injury during laparoscopic cholecystectomy.

A number of different factors are associated with bile duct injury during laparoscopic cholecystectomy, these include: acute or chronic inflammation, obesity, thermal injury, anatomic variations, bleeding, surgical technique

with inadequate exposure and failure to identify structures before ligation or dividing them are the most common causes of significant biliary injury ^(5, 6, 7), the bile duct may be narrow and can be mistaken for the cystic duct, the cystic duct may run alongside the common bile duct before joining it, leading the surgeon to the wrong place; additionally; the cystic duct may enter the right hepatic duct, and the right hepatic duct may run aberrantly coursing through the triangle of Calot and entering the common hepatic duct, also a number of intraoperative technical factors have been implicated in biliary injuries: excessive cephalic retraction of the gallbladder may align the cystic duct with the common bile duct, and the latter is then mistaken for the cystic duct and clipped and divided. The use of an angled laparoscope instead of an end-viewing one will help visualize the anatomic structures line particular those around the triangle of Calot ^(7, 8), an angled scope also will aid in the proper placement of clips , careless use of electro cautery may lead to thermal injury, dissection deep into the liver parenchyma may cause injury to intrahepatic ducts, and clip placement close to the hilar area or to structures not well visualized can result in a clip across bile ^(8, 9, 10) duct. The routine use of intraoperative cholangiography ^{(11, 12,}

¹³⁾ to prevent bile duct injury is controversial, it may limit the extent of injury, but does not seem to prevent it. However, if a bile duct injury is suspected during cholecystectomy, A cholangiogram must be obtained to identify the anatomic features ⁽¹³⁾. It is important to check that the whole biliary system fills with contrast and to be sure there are no leaks. Factors predisposing for biliary tract injuries include:

A. Difficult anatomy:

- I. Anomalies of cystic duct (low insertion, high insertion, short duct, parallel duct).
- II. Right sectoral duct anomalies (in 20% of the sectoral duct join the common hepatic duct).
- III. Intrahepatic GB
- IV. Arterial anomalies (accessory Right hepatic artery, arterial hump).

B. Difficult pathology:

- I. Acute cholecystitis ⁽¹⁴⁾.
- II. Scleroatrophic GB (contracted GB).

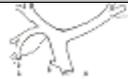
- III. Mirrizi syndrome (stone impacted in the Hartman pouch).
- IV. Chronic cholecystitis
- V. Frozen Calots's triangle ^(7, 8).

C. Difficult in terms of technique:

- I. Improper placement of trocars.
- II. Bulky and hanging falciform ligament ⁽¹⁵⁾.
- III. Bulky Quadrante lobe.
- IV. Undue haste exercised in clamping or clipping in the event of bleeding.
- V. Injudicious use of electro cautery in Calot's triangle.
- VI. Surgeons experience- the "learning curve effect" which implies that the bile duct injuries and the experience of the surgeon are inversely proportional.

Classification of biliary injury: is Strasberg classification represented in table (1) and figure (1): This classification includes all possible types of injuries, both leaks and strictures.

Figure (1): Strasberg classification.

Strasberg Classification Description		
A		Minor bile duct leak
B		Occluded right posterior sectoral duct.
C		Leak from right posterior sectoral duct
D		Lateral injury to extra-hepatic duct
E1		Transection with stricture >2cm from hilum
E2		Transection with stricture <2cm from hilum
E3		Hilar: stricture with right and left duct in continuity.
E4		Hilar: stricture with separation of right and left duct incontinuity.
E5		Stricture of main bile duct and right posterior sectoral duct

Type A leak from minor ducts like cystic duct or duct of Lusaka. Type B Ligation of aberrant right sectoral duct. Type C Division of aberrant right sectoral duct.

Type D Lateral injury the major extra hepatic duct. Type E Classical laparoscopic cholecystectomy bile duct injury E1, E2, E3, EA, E5.

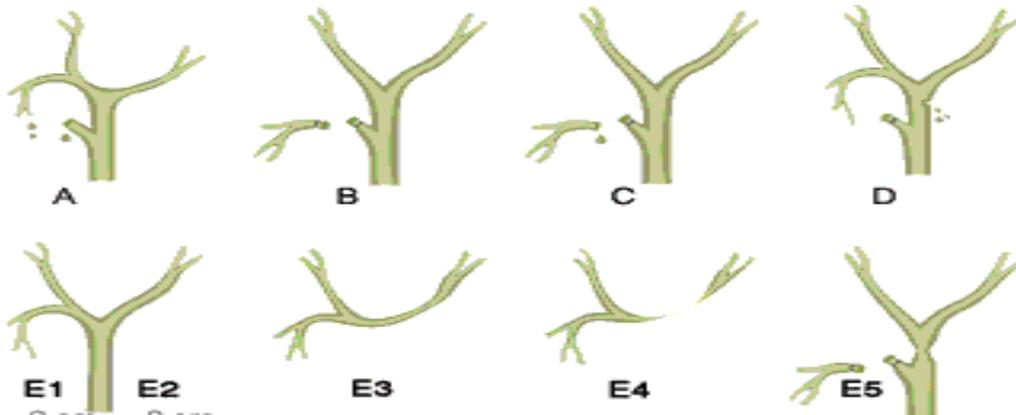


Figure (2): Strasberg Classification.

Stewart & Way classification figure (3) this is more practical based on the different operative scenario, where injuries occur.

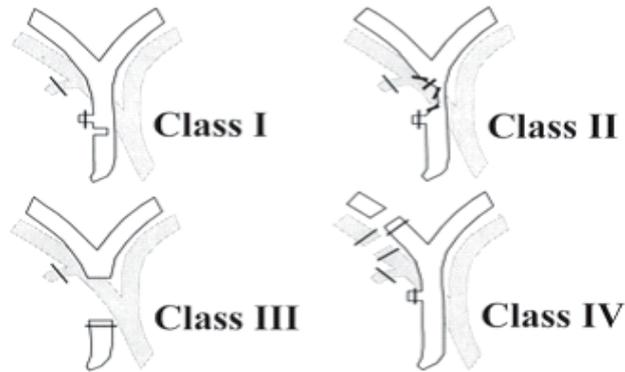


Figure (3): Stewart & way classification.

Class I CBD mistaken for Cystic duct, but recognized by the surgeon.

Class II +Lateral damage to common hepatic duct due to clips or cautery.

Class III CBD mistaken for cystic duct CBD, common hepatic duct resected.

Class IV Right hepatic duct mistaken for cystic duct, right hepatic artery mistaken for cystic artery, right hepatic artery transected. Lateral damage to right hepatic duct due to clips or cautery..Bismuth classification is shown in figure (4).This is used for strictures but the main drawback is it does not include all possible biliary injuries during Laparoscopic Cholecystectomy.

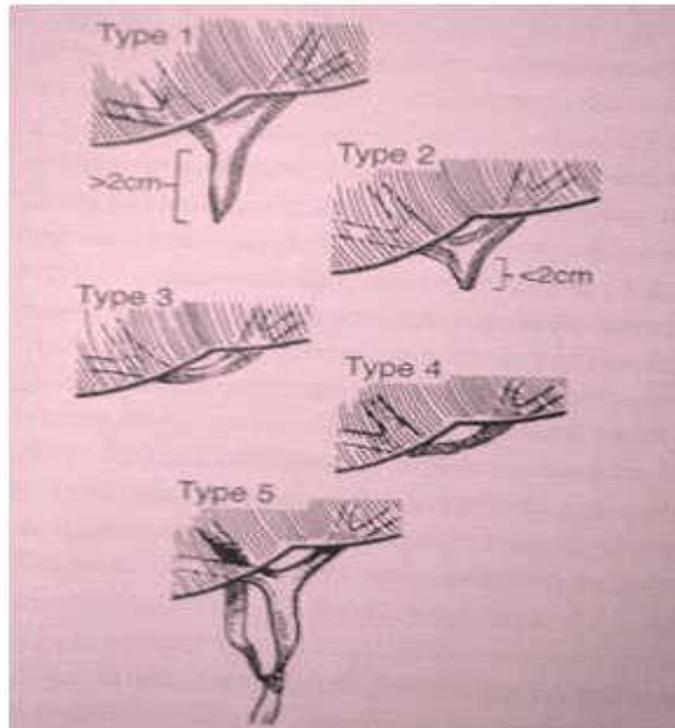


Figure (4): Bismuth Classification.

Type I is a low injury with a stump length more than 2cm.

Type II is a middle level injury with a stump length less than 2 cm.

Type III Hilar , confluence of right and left ducts intact.

Type IV involves loss of hepatic confluence with no communication between right and left ducts.

Type V involvement of the intrahepatic ducts.

Aim of study:

The aim of this study is to assess the incidence of biliary leak during laparoscopic cholecystectomy (LC) Azadi Teaching Hospital at Kirkuk.

Patients and Methods:

This is a randomized prospective study of 200 patients undergoing laparoscopic cholecystectomy between January 2013 to January 2015 at Azadi teaching hospital. Most of the patients underwent elective cholecystectomy for symptomatic cholelithiasis. All patients had symptoms consistent with biliary colic and other symptoms of chronic cholecystitis.

Data have been taken from the history like: age, gender, BMI presentation,

history of previous surgery. Clinical examination and investigations like liver function test, hematocrit, & abdominal ultrasound were done to all patients preoperatively to assess the GB size, latter thickness of the wall, presence of stones, location and number of the stones, & diameter of the CBD. For some patients we needed to do upper esophagogastroduodenoscopy, MRCP, prothrombin time & partial thromboplastin time (PTT). The patients have been admitted a day before operation and all patients had endotracheal intubation & general anesthesia, the anaesthetized patient is positioned on the table & the pneumoperitoneum is created

Nasogastric tube was put in stomach at the time of operation to deflate the stomach, The laparoscopic cholecystectomy was done after CO₂ insufflations. And best viewing laparoscope equipped with a video camera used. Monopolar electrocautery was used. The insertion of intra-operative peritoneal drain or insertion nasogastric tube depended on the surgeons' preference and opinion, four ports is placed in the abdomen; one in the umbilicus, one in the epigastrium & the other two are lateral; the Calot's triangle is laid open by dividing the peritoneum on the posterior & on the anterior aspect, then the cystic duct is carefully defined & the cystic artery is divided & clipped, then the gall bladder is removed from the gall bladder bed & once free removed via the epigastric port. The data was evaluated according to outcome measures, such as bile duct injury, morbidity, mortality.

Result:

Two hundred and four (204) patients were initially included in this study. (L.C) was accomplished successfully in two hundred patients (200), four patients have been converted to the conventional open method due to sever adhesions or unclear anatomy and they were excluded from this study. Conversion rate is (1.9%).

Table (2) shows the base line characteristics of our patients with mean age about 35 years (15-65 y), age distribution is shown in table (3). Patients of the laparoscopic group who got previous lower abdominal surgery were 40(20%), 30 of them caesarian section, 2 had surgeries for inguinal hernia, 4 had appendectomy, and the remaining 2 have abdomenoplasty this didn't interfere with port insertion. Patients whom were diagnosed as acalculous cholecystitis in our study were 4 (2%). Patients whom presented with vascular anomalies at operation were 10(5%), and 40(20%) patients have a history of systemic diseases (like D.M. and H.T).

Nasogastric tube was left as a drain after the operations in 60(30%) of patients with a mean insertion time of 8 hour in sub-hepatic space . A tube drain was in with a mean insertion time of 24 hours. The postoperative complication rate was (11%) (22 patients) as shown in table (4).

These complications don't carry the same degree of importance and some of them are specific and some are general. Biliary injury and biliary leak reported in 2 cases of laparoscopic group (1%). One of them managed by re-exploration while the other was managed intra operatively as shown in table (5).

Table (1): Sex distribution and conversion rates in 204 planned laparoscopic cholecystectomies.

Geder	LC	open cholecystectomy	Total
Male	6(2.9%)	0	6(3%)
Female	194(95.1%)	4(1.9%)	198(97%)
Total	200(98%)	4(2%)	204(100%)

*L.C. laparoscopic cholecystectomy.

Table (2): The baseline characteristics of patients undergoing L.C

Features	Number & percentage
Age(mean)	35(70%)
Previous lower abdominal incision	40(20%)
Acalculous cholecystitis	4(2%)
Systemic diseases	40(20%)
Vascular anomalies	10(5%)

Table (3): Age distribution.

Age (by year) gender	15-25	26-35	36-45	46-55	>55	Total
Male	0	0	0	4	2	6
Female	10	130	44	6	8	198
Total	10	130	44	10	10	204

Table (4): Type and rate of complications in sex p in 22 of 200 laparoscopic cholecystectomies.

Gender Complications	Male	female	Total
Wound infection	6(3%)	4(2%)	10(5%)
Pulmonary infection	1(0.5%)	3(1.5%)	4(2%)
Ischemic chest pain	0	0	0
Biliary injury	1(0.5%)	1(0.5%)	2(1%)
Spillage of gallstone to the peritoneal cavity	2(1%)	4(2%)	6(3%)
Mortality	0	0	0
Total	10(5%)	12(6%)	22(11%)

Table (5): Surgical treatment for biliary injury.

Management	T- tube	choledochojejunostomy	drainage
No. of patient	0	0	2

Discussion:

The major complications in our study were due to anatomical anomalies of the biliary tree. The first case was female (40 years old age) who had LC for symptomatic cholelithiasis; during operation she had signs of chronic cholecystitis^(16, 17) with adhesion & fibrosis. so during clipping of the cystic duct by clipper which causing complete transection of the duct which managed intra-operatively by safe re-clipping⁽¹⁸⁾ then put drain and the patient was discharge to well with drain to return back after three days for removal of drain which show no evidence of bile leak and clinically very well.

The second case male (50 years old age), who had intra-hepatic gallbladder and very tortuous hepatic artery in front of the origin of the cystic duct (Moynihan s caterpillar hump) and his operation was otherwise apparently classical with no any complications were recorded so the patient was discharged on the next day, three day later the patient presented with abdominal pain, mild fever, tachycardia, and jaundices, so the patient was admitted, and abdominal U\l. MRCP ERCP were done which revealed evidence of sub-hepatic fluid collection with normal biliary tract, so the patient

was re-explored and bile leak from gall bladder bed was found. Closure of the liver bed drainage and wash were done, and drain was inserted and the patient kept for seven days and then discharged well. So these two cases were classified as type A injury according to Strasberg classification. A recent audit of 1522 LCs performed in Thailand revealed a bile duct injury rate of (0.59%)⁽¹⁹⁾ i.e., about four times the incidence reported for open cholecystectomy; this injury rate is lower than that found in our study (1%), this difference is due to the fewer No. of patients in our study. In Jordan in 2001 of 791 patients with chronic cholecystitis (CC) and 207 with acute cholecystitis (AC) who underwent LC. extra-hepatic bile duct injuries were reported in only three cases⁽²⁰⁾. After 1995, a median incidence rate of (0.3%) was documented in data from both retrospective and prospective series^(20, 21). The single most important factor responsible for bile duct injuries is misinterpretation of the patient's anatomy.

Compared to the open operation, injuries sustained during LC are more often severe (e.g. excision of a segment of the CBD) and generally extend to higher levels. Acute inflammation around Calot's triangle makes the tissue friable and difficult to grasp. Dissection in such conditions leads to excessive bleeding. This, together with the distorted anatomy, increases the risk of bile duct injuries during laparoscopic cholecystectomy⁽²³⁾. On the other hand, extensive fibrosis around Calot's triangle in cases of chronically inflamed and fibrosed gallbladders may make them extremely difficult to dissect. The probability of complications in the patients who underwent laparoscopic cholecystectomy was significantly

higher in those patients diagnosed with complicated gallstone disease⁽²⁴⁾.

A review of 74 patients referred with bile duct injuries sustained during laparoscopic cholecystectomy done at the Vanderbilt University Medical Center, Nashville, suggested that these injuries are frequently severe and are related to cautery and high clip ligation^(18, 25). According to the literature, the leak may be minor⁽¹⁸⁾, arising from a small, accessory bile duct and clinically insignificant. Such cases should be treated conservatively. Injuries to the accessory bile duct⁽²⁶⁾ are the most common postoperative complications.

On the other hand, a major leak^(19, 27) due to injury to a main duct or a retained stone in the CBD⁽²⁸⁾ may leak result in biliary fistula, Peritonitis, or biloma. Biliary fistula following LC is a common outcome in many studies however; we hadn't faced any case in our study. Mostly, this complication results from improper in of clips or the clips slipping⁽²⁸⁾. ERCP helps in application diagnosis and removes any doubts regarding possible major ductal injuries. The condition resolves spontaneously provided there is no distal obstruction. In bile duct excision, a portion of the bile duct is lost and simple repair may be done in transaction and laceration, as is not possible⁽²⁹⁾.

The chances of late stricture⁽¹⁹⁾ are greater in bile duct transection than in bile duct laceration, as the axial vascular supply of the CBD is damaged in transection. Biliary obstruction in the presence of peritonitis, combined vascular and bile duct injuries or injuries at or above the level of the biliary bifurcation were significant independent predictors of poor outcome⁽²⁸⁾. In our study, all patients had excellent recovery and were discharged in a good

condition: however, long-term follow-up was not available. Strictures may develop early (within days or weeks) or may take years to develop and vary in both diameter and length ⁽³⁰⁾. Early strictures may develop due to intra-operative procedures such as clamping, ligation or clipping of the duct or thermal injury. Local infection may also result in both early and delayed stricture formation.

Thermal injury and occult malignancy are important causes of delayed stricture formation.

Since injuries occurring at laparoscopic cholecystectomy are frequently more severe and extend to a higher level than those that occur during open cholecystectomy, prevention should always be the aim ⁽³¹⁾.

Table (6): Comparison between the result of our study and other study.

Study	Our study	Thailand	Jordan
Result %(total)	1%(200)	0.59%(1522)	0.4%(791)

Conclusion:

Biliary injury is the Achilles' heel of laparoscopic Cholecystectomy. It can have devastating effects, it mainly results from anatomical anomalies and errors of surgeon judgment and are thus preventable to some extent. The costs are reduced and outcome improved if these injuries are diagnosed early.

Adding the experience gained from open cholecystectomy on the one hand and the advantages of laparoscopic cholecystectomy will help in reducing the incidence of such complications.

Recommendations:

1. Careful selection of patients for L.C. with prompt conversion on requirement is crucial for safe L.C.
2. Cholecystectomy related biliary injury once happened should be managed, by expert team to provide stepwise management according to circumstances with referral to specialized center if needed is a corner stone for proper management to lessen the tragedy of its morbidity and mortality.
3. Specialized training to heighten awareness of the possible problems relating to the anatomy of the Calot's triangle is essential.

4. Use of intraoperative cholangiography.

5. Use of 30° telescope & avoidance of diathermy close to the common hepatic duct.

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