

Bile Duct Injuries During Laparoscopic Cholecystectomy - Two Years Experience at Sheikh Zayed Hospital

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The introduction of laparoscopic cholecystectomy has been associated with an increased incidence of bile duct injury. Although several studies have shown a low incidence of bile duct injuries during laparoscopic cholecystectomy³⁻⁷, concerns remain because of the sustained increase in the number of referral for biliary reconstruction after the laparoscopic procedure. Three (20%) of fifteen patients with iatrogenic bile duct injuries were indigenous to this hospital while twelve patients have been referred to our institution because of major bile duct injuries after laparoscopic cholecystectomy. The injury was recognized during laparoscopic procedure in 100% of indigenous cases and in only four of the 12 (33.3%) referred patients. Fourteen patients underwent hepaticojejunostomy at least once, one patient of indigenous group required choledochorrhaphy with T-tube drainage. Hepaticojejunostomy above the bifurcation was required in 7 patients (50%), at the bifurcation in 3, and below the bifurcation in 4 patients. Five of the 12 patients in whom the initial repair was performed at the local hospital presented with early stricture (median 7 months). The common denominator of the development of bile duct injuries during laparoscopic cholecystectomy is the failure to identify the structures in Calot's triangle. Specific steps during laparoscopic cholecystectomy to avoid bile duct injuries are described. Expertise in hepatobiliary surgery appears to optimize results of biliary reconstruction.

Key words: Laparoscopic cholecystectomy, bile duct injury, hepaticoduchojejunostomy.

Until the end of the 1980's, open cholecystectomy remained the treatment of choice for symptomatic cholelithiasis because of its efficacy and excellent safety record. Laparoscopic cholecystectomy has replaced open cholecystectomy as the "gold standard" treatment because of the reduction in postoperative pain and pulmonary dysfunction, shorter hospital stay and more rapid return to normal activity⁵. Despite the expertise gained in performing the procedure, bile duct injuries continue to occur at an unacceptable rate, as demonstrated by the increase in referral to experienced centers^{2,3,4} which is a catastrophic event that can lead to significant long-term morbidity (recurrent stricture, cholangitis, cirrhosis and premature death). Although most of these injuries could probably be avoided they are still the main drawback of the laparoscopic technique¹².

The experience with 15 patients managed at Sheikh Zayed Hospital FPGMI, after sustaining a major bile duct injury except in one with minor injury, during laparoscopic cholecystectomy is presented. The purpose of this report is to discuss possible mechanism of injury, emphasize key steps that may avoid bile duct injury during the laparoscopic procedure, recognition of specific risk factors, and review principles of management to be followed when an injury has occurred.

Patients and methods

Three patients of our own hospital and 12 were referred to the Sheikh Zayed Hospital FPGMI during a recent 25 months period (Dec. 1995 to Dec 1997) for management

of major bile duct injuries incurred during laparoscopic cholecystectomy. The information was gathered of referral cases from direct telephone conversation with patients and surgeons, review of operative reports, referral notes, and hospital record. The body mass index (BMI) for each patient was obtained by $[WT (kg)/Height (m^2)]$ equation and clinical obesity is defined as BMI of more than 30.

Results

The 15 patients (11 women, 4 men) ranged in age from 21 to 71 years (median 41.6 year). Three patients were clinically obese with a BMI over 30. Technical difficulties that may have predisposed to bile duct injuries are described in Table 1 & II. Scarring at the area of the triangle of Calot and acute inflammatory changes were reported in 53%. During laparoscopic cholecystectomy, electrocautery was used in 87% of the patients. A drain was placed in 41% of the patients. In 7 patients (47%), 3 indigenous and 4 referral, the procedure was converted to an open cholecystectomy, and the bile duct injuries was recognized and repaired.

The postoperative symptoms that preceded a definite diagnosis of bile duct injury in the other 8 patients with unrecognized injury were summarized in Table-3. The time of hospitalisation after laparoscopic cholecystectomy tender to be longer in these patients than would be expected after an uncomplicated procedure (median, 5 days, range 1 to 10 days). Pain and jaundice were the most common symptoms in 75% of the patients. Time of onset of postoperative symptoms ranged between 24 hours and

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15 days, with a median 2 days. Diagnostic studies to reach or confirm the diagnosis of major bile duct injury are shown in Table 4.

For the 12 referred patients, seven with untreated injuries were repaired within a median time of 12 days after laparoscopic cholecystectomy at Sheikh Zayed Hospital. The remaining five patients underwent initial reoperation at the local hospital within a median time of 13.5 days after laparoscopic cholecystectomy. Of these 5 patients, stricture developed at the repair site in 4 patients within a median time of 7 months (range 4 to 15 months), and the remaining one patients have persistent leakage of bile.

Of 15 patients 14 underwent hepaticojejunostomy at least once, and one patient underwent lateral

choledochorrhaphy with T-tube drainage. The level of biliary-enteric anastomosis performed during the last repair was above the bifurcation in 7 patients, at the bifurcation in 3 patients and below the bifurcation in 4 patients. Stents was used in 7 of these 14 repairs performed at our surgical Department. All patients have returned to their preinjury activities. One patient still experience episodic upper abdominal pain but is without evidence of cholestasis or jaundice. To date, no evidence of recurrent stricture has been found in the patients who underwent hepaticojejunostomy at our institution, (median follow-up period 10 months; range 2 to 25 months).

Table 1 Technical difficulties that may have predisposed to bile duct injuries

Age in years	Sex	Obesity index	Fibrosis in Calot-tri	Acute Cholecystitis	Bleeding	Fat in portaheptis	Clip Applier Malfunction
29	F	32	+ ve	- ve	- ve	+ ve	- ve
24	F	21	- ve	- ve	+ ve	- ve	- ve
35	F	35	+ ve	- ve	+ ve	+ ve	- ve
71	M	25	+ ve	+ ve	- ve	- ve	- ve
58	M	21	+ ve	+ ve	- ve	- ve	+ ve
27	F	28	- ve	- ve	+ ve	- ve	- ve
46	F	29	- ve	+ ve	- ve	+ ve	- ve
53	F	24	+ ve	+ ve	- ve	- ve	- ve
29	F	26	- ve	- ve	- ve	- ve	- ve
32	M	36	- ve	- ve	- ve	+ ve	- ve
2	F	21	- ve	+ ve	- ve	- ve	- ve
26	M	28	+ ve	+ ve	- ve	- ve	- ve
39	F	23	+ ve	+ ve	+ ve	- ve	- ve
46	F	27	+ ve	- ve	- ve	- ve	- ve
51	F	25	- ve	+ ve	+ ve	- ve	- ve

Table 2. Local Risk Factors (n=15)

Risk factors	No. of Pts.	%age
Fibrosis or scarring in Calot Triangle	08	53
Acute Cholecystitis	08	53
Obesity	03	20
Local bleeding	05	33
Fat in portaheptis	03	20

Table 3. Presentation of injury after Laparoscopic Cholecystectomy (n=8)

Presentation	No. of Pts.	%age
Jaundice	06	75
Pain	06	75
Anorexia	04	50
Bile peritonitis/biloma/ Fistula	02	25
Sepsis / Cholangitis	02	25
Ileus	02	25
Abscess	01	12.5

(a) Excludes 7 patients whose operations were converted to open Cholecystectomy

Table 4. Diagnostic study for bile duct injuries (n=8)

Diagnostic Modalities	No. of Pts.	%age	Diagnostic Yield
Ultrasonography	08	100	50%
ERCP	08	100	88%
PTC	05	63	80%
HIDA Scan	03	38	100%

(a) Exclude 7 patients whose operations were converted to open Cholecystectomy

Discussion

The risk of injury to the bile duct during open cholecystectomy is about 1 in 10000⁵⁻⁸. In laparoscopic cholecystectomy, in which the surgeon has considerably more freedom in terms of patient selection, rate of injury to the common bile duct is 0.2% to 3%⁽¹⁻⁴⁾. Despite the fact that laparoscopic cholecystectomy is associated with a risk of injury to the bile duct that is higher than with standard open cholecystectomy and that these injuries are occurring in presumably lower-risk patients, its

popularity continues to grow among medical professional and the lay public. If laparoscopic cholecystectomy is to be considered the standard procedure for treatment of gall stone disease, the incidence of the bile duct injury must be decreased. Even if the difference in the incidence of the bile duct injury between open and laparoscopic procedures is small, a single major bile duct injury has a severe detrimental impact on the life of the affected patients. Several series^(1,5,9) have shown that the incidence of bile duct injury during the laparoscopic procedure should be no higher than with the open procedure. In agreement with other report⁽¹⁰⁻¹²⁾, we believe that most bile duct injuries during laparoscopic cholecystectomy could probably be avoided by understanding the mechanism of injury and practicing certain steps of prevention during the laparoscopic procedure.

Although the incidence of bile duct injury during laparoscopic cholecystectomy are raised, the common denominator is failure to recognize the anatomy of the triangle of Calot. This failure can be attributed to anatomic risk factors, factors inherent in the laparoscopic technique, or inadequate training. Anatomic risk factors may include acute or chronic inflammation, morbid obesity, bleeding, and presence of anatomical anomalies. Factors inherent in the laparoscopic technique include the lack of depth perception, differences in the lines of traction of gallbladder, the difficulty of performing ante grade cholecystectomy, and the use of the electrocautery or laser in a limited field that can be easily obscured by blood or bile. In the present series the injury was recognized during the initial procedure in 47%, (3 indigenous and 4 referral patients), which supports the theory that a clear anatomic identification of the structures of the triangle of Calot had not been made.

The risk factors that seem to be involved are the presence of acute or chronic inflammation and scarring in the region of Calot's triangle. Anything that obscures unencumbered visualization of the operative field, such as bleeding or fat, also was an important factor. Our frequent observation of absent common duct and of descriptions of scarring and fibrosis have led us to suspect that ductal injuries result from a combination of factors that may be peculiar to laparoscopic cholecystectomy. The first is that traction during laparoscopic cholecystectomy differs from that open cholecystectomy. In the open procedure, opposing forces on the liver upward and on the duodenum downward tend to straighten the common duct in such a way as to minimize angulations and distortion of the common duct during lateral retraction of the gallbladder (fig-1). During laparoscopic cholecystectomy, traction on the gallbladder is lateral and cephalad. The direction of traction tends to cause the cystic duct and distal common duct to become more or less aligned in the same plane. The common hepatic duct then join these two structures at

an acute angle (Fig 4). The more easily visualized distal common duct may be mistaken for a long cystic duct. It is not hard to imagine how the common hepatic duct may inadvertently be transected during isolation of the cystic duct.

The cephalad traction on the gallbladder tends to collapse rather than to open Calot's triangle. When lateral traction is not sufficient, the course of the common hepatic duct may be posterior to the cystic duct; thus, the surgeon may not appreciate its proximity or insertion to the cystic duct. Even when traction is adequate, the presence of scarring in Calot's triangle may cause the cystic duct to become adherent to the common hepatic duct (fig 2). In this setting, it may be possible to isolate circumferentially the cystic duct and common duct together, believing that only the cystic duct has been isolated. These injuries may be minimized with lateral traction of Hartmann's pouch and thorough dissection at the level of the infundibulum of the gallbladder at its junction with the cystic duct before placing clips or dividing structures in the triangle of Calot. The clip on the cystic duct should be placed as near the junction as possible. The use of a 30° viewing laparoscopic has been recommended to facilitate exposure of the region⁽¹²⁾. Cholangiography is mandatory whenever a question arises about anatomy.^{16,17}

Although many experienced laparoscopic surgeons are reporting favorable results with laparoscopic cholecystectomy for acute cholecystitis, they do so expecting a high rate of conversion to the open procedure and accept scarring in Calot's triangle as a contraindication to further dissection^{13,14,15}. We do not persist with dissection in a field in which the anatomy is obscured by scarring or bleeding. It is likely that many of these ductal injuries could have been avoided with earlier conversion to the open procedure.

After review the mechanisms of injury, the types of bile duct injury sustained during laparoscopic cholecystectomy, and risk factors, we believe that most injuries could probably be avoided by practicing the above steps briefly described as follow;

1. Ensure an optimal view of the operating field.
2. Obtain maximum cephalic traction of the gallbladder⁽¹⁰⁾ (fig-1)
3. Always dissect away from gallbladder.
4. Obtain lateral and inferior retraction of Hartmann's pouch of the gallbladder, pulling it away from the liver¹⁰⁻¹². (fig-1)
5. Start the dissection high in the neck of the gallbladder and carry it in a lateral to medial direction. Dissection should be kept close to the gallbladder. The cystic duct node is a good landmark at which to start

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6. Minimum use should be made of electro coagulation in Calot's triangle.
7. Flip Hartmann's pouch medially for a posterolateral dissection of the serosa of the gall bladder (fig-2).
8. Free the neck of the gallbladder from its hepatic bed.⁽¹¹⁾ This manoeuvre permit clear visualization of the neck of the gallbladder as it narrows into the cystic duct.
9. Obtain clear visualization of both limbs of the clips. Clip should be placed as close to the gallbladder under direct visualization. In instances of a short cystic duct, a tie can be used instead of a clip around the neck of the gallbladder.(fig-6)
10. Perform cholangiography if anatomy is not clear.
11. Keep the dissection close to the gallbladder.
12. Convert to open cholecystectomy in case of difficulty or uncertainty of defining structure.

Conclusion

The purported advantages of laparoscopic cholecystectomy, which include less pain, smaller scar, more rapid return to work, and more satisfied patients, are rapidly erased with a single injury to the bile duct. It is critical that every surgeon who performs laparoscopic surgery be well versed in the advantages and limitations of the newer techniques. Laparoscopic cholecystectomy has not so much revolutionized general surgery as it has provided an optional way to remove a diseased gallbladder. Using this technique appropriately requires considerable surgical judgment. Nevertheless, by understanding the mechanism of injury and practicing specific preventing steps, the incidence of bile duct injury associated with laparoscopic cholecystectomy should equal the incidence associated with an open procedure. Hepaticojejunostomy is the procedure of choice for most reconstructions. Technical expertise in hepatobiliary surgery appears to optimize results of repair.

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