Iatrogenic biliary injuries in patients who underwent laparoscopic cholecystectomy

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Background The rate of biliary injuries (BIs) is more common after laparoscopic cholecystectomy (LC) than open surgery especially in the case of acute cholecysititis.

Aim The present work was performed to study the causes, clinical presentation, diagnosis, and treatment of BIs after LC.

Patients and methods The study was carried out on 60 patients presented with BIs after LC, the rate being more common after LC than open surgery especially in the case of acute cholecysititis and complicated cases. The BIs in patients who underwent an LC was classified according to the site of injury as follows: (a) partial transection of the common bile duct, (b) injury to common hepatic duct due to clips or cautery, (c) cystic duct stump leaks, and (d) bile leaks from bile duct or radicals in the liver bed. The main causes were misapplication of clip at the cystic duct.

Results The results of this study has shown that the symptoms and signs appeared between the fifth and seventh postoperative days. The clinical presentation is in accordance with the magnitude of the bile leak and the time of diagnosis. The guarding and rebound tenderness is the principal manifestation with abdominal bile collection. The endoscopic retrograde cholangiopancreatography gives the most definitive information of the status of the biliary system and allows visualization of retained common duct stones.

Conclusion The ideal treatment in these cases is a minimally invasive procedure, but since the diagnosis is frequently delayed, open surgery was done. The endoscopic retrograde cholangiopancreatography with internal stent has become the treatment of choice in patients with bile leak after LC.
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Introduction

Biliary injuries (BIs) is a major complication that is associated with a potential for higher morbidity. Bile duct injury (BDI) may occur after gallbladder, pancreas, and gastric surgery, with laparoscopic cholecystectomy (LC) responsible for 80–85% of them [1]. BDIs are a complex health problem and, although they usually occur in healthy young people, the effect on the patient's quality of life and overall survival is substantial [2]. The two most frequent scenarios are bile leak and bile duct obstruction. Most of BDIs after LC are recognized transoperatively or in the immediate postoperative period [3]. It requires a prolonged hospital stay, and sepsis may lead to several complementary procedures, even reoperations Soper and colleagues (2011). Most of BDIs after LC are recognized transoperatively or in the immediate postoperative period [4]. Bile leak scenario is easily recognized during the first postoperative week. Constant bile effusion is documented through surgical drains, surgical wounds, or laparoscopic ports. Patients usually complain of diffuse abdominal pain, nausea, fever, and impaired intestinal motility [2]. In addition, bile collections, peritonitis, leukocytosis, and mixed hyperbilirubinemia may be part of the clinical setting [5]. The increased rate of bile collections after laparoscopic procedures has multiple causes: anatomic variations of the biliary tree, difficult dissection due to acute inflammatory reaction, anatomical distortion of the biliary pedicle due to chronic inflammation, and the fact that the majority of surgeons do not routinely drain the gallbladder bed after surgery, which may lead to a delayed diagnosis of biliary leak [6].

Bile collections within the peritoneal cavity have various causes, but they most often occur as manifestation of BDI or some other technical complications of LC. Unless drains have been used, a bile leak lead to accumulation of bile in the abdomen; previous reports have suggested that bile peritonitis, with guarding and rebound tenderness, is the principal manifestation of an abdominal bile collection, but this is actually an uncommon presentation early in the patients course [7].

With the advent of LC, the incidence of bile duct injuries, and hence, bile collections in the abdomen, has increased [8].

Optimal treatment of such problems depends on early recognition and strategic planning of the

therapeutic approach. Endoscopic retrograde cholangiopancreatography (ERCP) has become increasingly important in identifying bile leaks and their source after cholecystectomy. A high index of suspicion is mandatory in patients complaining of discomfort several days after surgery and liberal use of computed tomography (CT) or ultrasound (US) imaging helps identify bile leaks before peritonitis is severe. Once bile leaks or BDI are suspected, ERCP should be performed to confirm the leak, identify its site and causes, and help define a therapeutic plan Ponsky [9].

Patients and methods

This study was conducted on 60 patients presented with BIs and intra-abdominal collections after LC from a total of 420 patients in AL-Zahraa Hospital, Faculty of Medicine for Girls, Al-Azhar University from January 2014 to December 2016. Ethical Committee approved.

All patients will be analyzed in the present study to estimate the clinical presentation, symptoms, causes, methods of diagnosis, time of diagnosis, and treatment. Diagnoses were confirmed either by US, CT scan, or ERCP.

The BIs in the patients who underwent LC were classified according to the site of injury as follows: (a) partial transaction of the common bile duct (CBD), (b) injury to common hepatic duct due to clips or cautery, (c) cystic duct stump leaks, and (d) bile leaks from bile duct in the liver bed.

The preoperative diagnoses were chronic cholecystitis (270 cases), acute cholecystitis (125 cases), and miscellaneous (25 cases).

All patients with symptomatic postoperative biloma were diagnosed by abdominal US or CT with or without ERCP.

Statistical analysis

Data were summarized using mean and SD or median and percentiles for quantitative variables and frequency and percentage for qualitative variables.

Relative percentage change was calculated to get the actual change in each time measure:

$$\text{Relative percentage change} = \left[\frac{(\text{post measurepre measure})}{\text{pre measure}}\right] \times 100.$$

Comparison between groups was done using independent sample *t*-test for quantitative variables.

Repeated measures analysis of variance test was conducted to compare the different measures at different time situations with post-hoc Bonferroni test for pairwise comparisons.

Pearson's correlation coefficient (*r*) was calculated to test the association between quantitative variables.

Results

In 48% of the patients, symptoms and signs appear early in the first 3 postoperative days with mild symptoms especially pain located within the upper right quadrant. In the other 52% of the patients, symptoms and signs appeared after the fourth postoperative days: abdominal pain 25 (41%) patients, malaise five (8%) patients, nausea and vomiting eight (13%) patients, jaundice four (7%) patients, fever six (10%) patients, abdominal tenderness nine (15%) patients, and abdominal distention three (6%) patients (Table 1).

BIs were not observed in any of these patients at the initial operation. In 15 (25%) patients, it was impossible to determine the cause of bile leak, and the patients were treated medically. In the other 45 (75%) patients, the main causes of the postoperative bile leak could be clearly identified. There was a cystic perforation proximal to the clips in 14 (31%) cases; misapplication of clips (crossed or loose) was identified in 20 (49%) cases; and minimal perforation of the CBD proximal to the cystic junction in 11 (20%) cases (Table 2).

The methods used for the diagnosis of BIs after LC: ultrasonography was performed in all 60 patients, it did not show early bile leakage in 40 (68%) of them. A total of 20 (32%) patients demonstrated subhepatic

Table 1 Symptoms and signs of patients with biliary injuries after laparoscopic cholecystectomy

Symptoms and signs	In first 3 postoperative	After fourth postoperative	Total [*n* (%)]
Abdominal pain	10	15	25 (41)
Malaise	1	4	5 (8)
Nausea and vomiting	6	2	8 (13)
Jaundice	–	4	4 (7)
Fever	3	3	6 (10)
Abdominal tenderness	1	8	9 (15)
Abdominal distention	–	3	3 (6)

collection after fifth postoperative day; 39 (64.5%) patients demonstrated subphrenic collection; and 14 (22%) patients presented with diffuse collection after 10th postoperative day (Fig. 1). ERCP was performed in 29 (48%) patients, it demonstrated bile leak in all cases (Fig. 2). CT scan was performed in 18 (29%) patients to confirm bile collection and diffuse collection after 10th postoperative day (Fig. 3).

The treatment of BIs: In 13 (21%) patients conservative treatment give good results; eight (14%) patients underwent relaparoscopy and clipping to cystic duct; 20 (32%) patients were treated by ERCP; 16 (27%) patients managed operatively hepaticojejunostomy and choledochojejunostomy was done with successful outcomes, diffuse bile collection was identified in three (6%) patients; and then laparotomy was performed to achieve a better peritoneal lavage and placed an adequate subhepatic continuous suction drain, with no mortalities.

Discussion

In the present study, our findings show that LC is associated with an increased rate of bile duct leaks. Yi-Kin and colleagues [15] who stated that elective LC presents fewer technical difficulties for dissection of the gallbladder pedicle or gallbladder bed which is the procedure for acute cholecystitis.

In this study, 48% of the patient (21 patients) symptoms and signs appear in the first 3 postoperative days; in the other 52% of the patients (39 patients), symptoms and signs appeared after the fourth postoperative days. Such observation with Waker and colleagues (2011) who reported that patients with BIs presented with clinical features only from the third to 21st postoperative days (mean: 5 days). The clinical presentation is in accordance with the magnitude of the bile leak and the time of the diagnosis. Ultrasonography is the first diagnostic tool, but under these circumstances, especially when it is done early after surgery, its accuracy is low; the results are equivocal and errors are frequent. According to Brooks *et al.* [10], positive results were more than 70% for early postoperative ultrasonography.

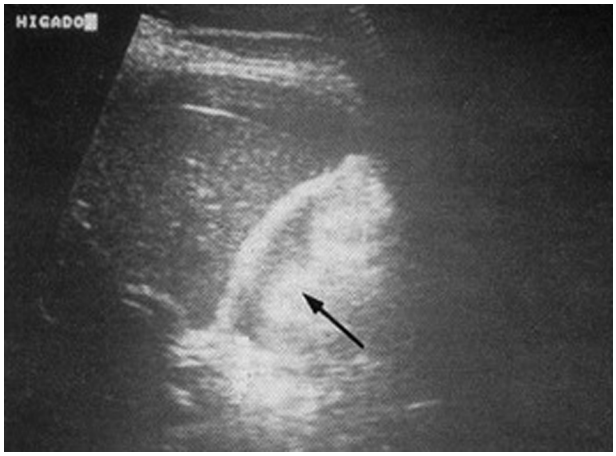
As this study shows, when ultrasonography is repeated or performed later than 5 days after surgery, confirmation of an intra-abdominal bile collection is the rule, an observation in agreement with Braghetto *et al.* [14]. Other diagnostic tools such as ERCP and CAT scan provide more specific information about the location and cause of bile leaks; such finding is nearly the same with that of Walke *et al.* [11]. ERCP gives the most definitive information on the status of the biliary system and allows visualization of retained common duct stones. It also allows therapeutic intervention in the form of sphincterotomy, clearance of stones, and stenting to

Table 2 Causes of postoperative bile leak

Causes of postoperative bile leak	*n* (%)
Undetermined	15 (25)
Cystic perforation	14 (31)
Misapplication to clips	20 (49)
Minimal perforation of the CBD	11 (20)

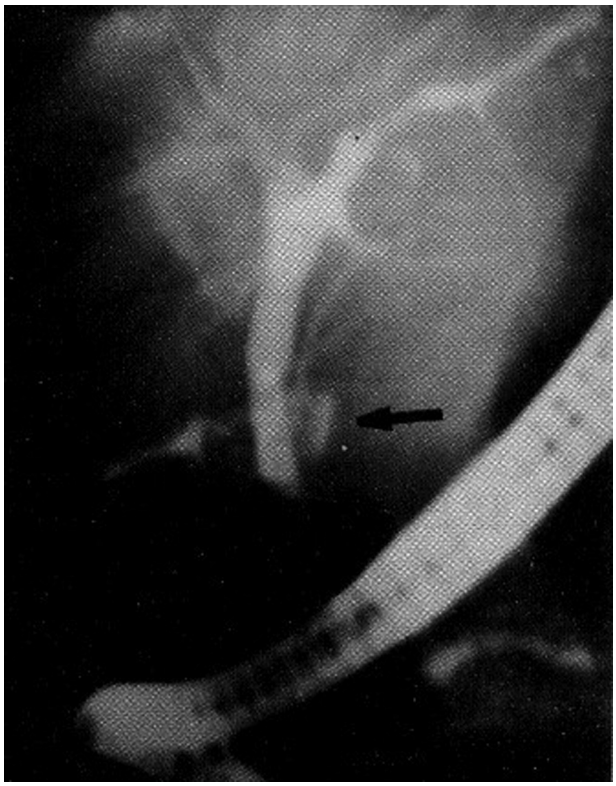
CBD, common bile duct.

Figure 1



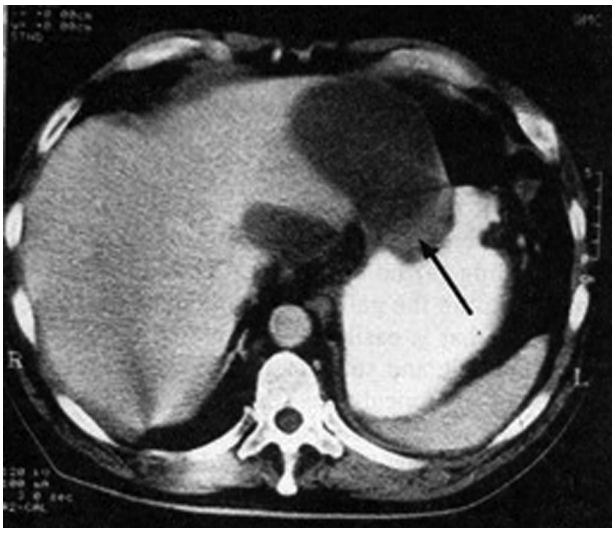
Diffuse collection postoperative.

Figure 2



Bile leak.

Figure 3



Bile collection and diffuse collection postoperative.

prevent build up of biliary pressure, causing the leak to heal [12]. In this study, the causes of leakage from bile ducts or radicles in the parenchymal liver bed that remain open after the gallbladder dissection in nearly 20%, particularly in patients with acute cholecystitis, in agreement with Soper *et al.* [13]. Misapplication of clips occur in 49%, minimal perforation of the CBD occur in 20%, such finding is the same with that of Braghetto *et al.* [14]. Major duct injuries most commonly are not recognized at the time of surgery. Only very favorable circumstances mitigate for primary repair of such injuries (sharp injury, without crunch, partial injury); primary repair over a T-tube may be attempted, but there is a 40–50% failure rate. The preferred treatment is Roux-Y choledochojejunostomy [12].

Conclusion

BIs are more common after LC than open surgery. Bile leakage is a major complication that is associated with potential for higher morbidity. It requires prolonged hospital stay, and sepsis may lead to several complementary procedures, even reoperations. Patients with BI symptoms and signs presented from the third to 21st postoperative days (mean: 5 days). The clinical presentation is in accordance with the magnitude of the bile leak and the time of the diagnosis. Optimal treatment depends on the cause, time of diagnosis, and the amount of bile leak. ERCP with an internal stent has become the treatment of choice.

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Conflicts of interest

There are no conflicts of interest.

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