The Egyptian Journal of Hospital Medicine (July 2023) Vol. 92, Page 6607- 6611

Management of Iatrogenic Bile Duct Injuries Following Cholecystectomy

Ayman AbdelHady Alkhalegy, Abdelrahman Kamal
Department of General Surgery, El-Sahel Teaching Hospital, Cairo, Egypt
Corresponding author: Ayman AbdelHady Alkhalegy, Email: aymanalkhalegy@gmail.com, **Mobile:** +20 111 969 9126

ABSTRACT

Background: The most significant side effects of open cholecystectomy, which is currently thought to be the preferred treatment for symptomatic gall stones, are bile duct damage and bile leaks. An iatrogenic catastrophe known as major bile duct injury after cholecystectomy is linked to high rates of post-litigation, worse long-term survival and quality of life, and considerable mortality. Any patient who experiences an unusual course after having their cholecyst removed should be worked up for a bile duct injury.

Aim of the study: To provide light on post-cholecystectomy biliary complications.

Patients and Methods: 14 patients with biliary damage complicating cholecystectomy were treated using different procedures. Two patients who were discovered during surgery were treated right away; one patient has partial common bile duct (CBD) injury at the site of junction with the cystic duct was fixed using a T-tube, and one case had an urgent hepaticojejunostomy. The other 12 patients had postoperative diagnoses.

Results: Three patients were treated non-surgically; an intra-abdominal bile collection was drained under the guidance of an ultrasound. Nine patients had elective surgery to correct bile duct damage; Roux-en-Y hepaticojejunostomies were performed in 8 cases of the patients in this cohort. Choledechodoudenostomy was utilised to manage one case.

Conclusion: Because patients who undergo laparoscopic procedure are typically sent home earlier, frequently before the appearance of the clinical signs of biliary damage, early diagnosis is crucial for preventing as many consequences as possible. Bile duct damage greatly raise the patient's morbidity.

Keywords: Bile duct damage, Cholecystectomy, Choledechodoudenostomy, Hepaticojejunostomies.

INTRODUCTION

Injuries to the bile duct are usually iatrogenic, primarily linked to surgery for gallbladder stones [(1)]. The preferred method for treating symptomatic gall stones is currently laparoscopic cholecystectomy, however the most significant side effects include bile duct damage and bile leakage [(2)].

Laparoscopic cholecystectomy is the commonest performed abdominal surgical procedure in the US, which is expected to be performed more than 750,000 times a year. Before laparoscopic cholecystectomy became a common form of therapy for gall bladder problems, the US experienced around 700 000 open cholecystectomy cases annually, 0.2% of which involved biliary duct injury [(3)]. Numerous studies have shown that the incidence of bile duct damage raised from 0.1%-0.2% to 0.4%-0.7%, since the time of open cholecystectomy to the time of laparoscopic cholecystectomy. Major injury of bile duct after cholecystectomy is a major problem linked to high rates of subsequent lawsuits, severe morbidity and mortality, and affecting long-term quality of life and survival [(4)].

Many reasons, such as excessive manipulation in an obscured Calot's triangle, the application of an energy device near bile ducts, local difficulties due to acute and ongoing inflammation with fibrosis of the gallbladder, and excessive traction on the gall bladder are hypothesised to cause biliary damage [(5)].

Laboratory markers such as serum bilirubin, alkaline phosphatase, gamma glutamyl transferase, and leucocytic count are to be measured in order to investigate biliary leakage [(6)].

Surgery may be the best course of action in some situations, whereas intervention endoscopically may be a safe as well as successful means of management in others. Individual care should be determined by circumstances like the presence of a stone, a stricture, a ligature, or coagulopathy [(7)].

So, our aim from this study is to spotlight on post cholecystectomy biliary injuries.

PATIENTS AND METHODS

14 patients with biliary injuries complicating cholecystectomy were included in the study; 9 received open surgery and 5 underwent laparoscopic surgery. Their mean age was 40.25, with ages ranging from 30 to 65.

The following criteria were used to identify 2 cases of biliary injury during surgery:

1-The presence of chronic bile in the surgical area without knowledge of its source. The use of bile-stained toilet paper, towels, and sponges, as well as irrigation and aspiration during laparoscopic cholecystectomy, draw attention to the wound.

2- Visualization of the bile duct damage by examining the leakage site. In another case the CBD was completely transected but the ease of dissection of both ends without affection of its blood supply gave us the decision of end-to-end anastomosis without tension. The anastomosis was made by 4/0 Vicryl interrupted suture over T tube that was taken out through another incision in CBD.

The remaining twelve cases were managed by Roux-en-Y hepaticojejunostomy because the inflammation of previous attack of acute cholecystitis made the situation difficult for primary anastomosis

Received: 02/03/2023
Accepted: 01/05/2023

(end to end) and the injury was high up reached the common hepatic duct. Tube stent was placed at the site of anastomosis and get o01017391005hrough the jejunum to the exterior and removed after 10 days.

Assessment of the Patients: The 12 postoperative patients were evaluated in accordance with:

- **Thorough history taking**, **physical examination**.
- **Laboratory investigations**.
- **Radiological investigations:** Abdominal Ultrasonography, Percutaneous Trans-hepatic cholangiography (PTC) , Endoscopic Retrograde Cholangiopancreatography (ERCP), and Magnetic Resonance Cholangiopancreatography (MRCP).

Managing patients with postoperative diagnoses:

- Treatment options ranged from surgical to nonsurgical.
- 9 cases required surgical intervention, whereas 3 cases required none.

1) These were the non-surgical treatment options:

- Ultrasound guided drainage: 3 cases of biliary leakage were managed with drainage under ultrasound guidance using Nelaton tubes (20 Fr.) under local anesthesia. The abdominal wall was punctured four fingers under the right costal margin, in the midclavicular line.

2) Surgery was performed as follows:

- Hepaticojejunostomy (Roux-en-Y): Was used in eight cases.
- A choledochoduodonostomy was done in a case where the CBD was more than 2 cm dilated.

Postoperative follow up:

1. Parenteral fluid, which was discontinued after the patients began using oral fluid.
2. An antibiotic that primarily targets gram-negative and anaerobic bacteria for 5-7 days.
3. Drains were taken care of, and they were removed after the discharge stopped.

Monitoring of each patient: After discharge, it was done monthly for the first six months, then biweekly. It was including:

1- Clinical assessment:

2-Laboratory: It included (CBC) blood picture, coagulation profile, bilirubin (total and direct), liver enzymes (ALT, AST), alkaline phosphatase (ALP), urea and creatinine.

3- Radiological investigations:

- **Contrast study (T-tube cholangiography)** was done 10 days postoperatively to cases with intraoperatively diagnosed bile duct injury and immediate repair over T-tube.
- **Ultrasound:** to assess any bile collection and also to measure the diameter of intrahepatic biliary radicals to exclude restricture.

Ethical consent:

The Ethical Committee of El-Sahel Teaching Hospital, Department of General Surgery approved the study considering that it was a randomized controlled trial with a single-blind design. The study's quality was ensured by a Research Ethics Committee that reviewed and approved it.

All participants received a thorough and understandable explanation of the study. and Approval consent was taken from every participant for sharing in this research. The trial coordinator routinely checked the quality of screening, data management, and protocol adherence. All procedures involving human participants in this study were conducted in accordance with the standards indicated in the World Medical Association's Declaration of Helsinki on the conduct of research involving human participants.

Statistical methods

Qualitative data are presented as frequency and percentage and quantitative data are presented as mean and range.

RESULTS

In this study, 14 patients with post-cholecystectomy biliary damage who underwent open or laparoscopic surgery. Age of the patients ranged from 30 to 65 years, (mean age of 40.25). Obstructive jaundice was the most prevalent postoperative complication, appearing in 8 patients (Table 1).

Table (1): Varieties of presentations of the patients

PRESENTATION	Number	%
During the original procedure (intraoperative)	2	14.29 %
Peritonitis (biliary)	1	7.14 %
External biliary leak	2	14.29 %
Internal bile collection (biloma)	1	7.14 %
Jaundice (obstructive type)	6	42.86 %
Obstructive jaundice + cholangitis	2	14.29 %
Total	14	100 %

From the operation time to the time of presentation, the diagnosis took a variety of times. In 2 cases, the damage was treated during the initial procedure (immediate repair). The remaining 12 cases showed up at various times (Table 2).

Table (2): Time of diagnosis from the original cholecystectomy till the patients' presentation

Time of presentation	**No. patients**	%
During the original op.	2	14.29%
< 1 week	4	28.57%
1 week - 1 month	6	42.86%
1 month - 3 months	2	14.29%
Total	14	100%

According to the severity of the distal obstruction and the amount of time since the diagnosis, the degree of intrahepatic biliary dilatation found on sonographic examination ranged from mild in 2 patients to moderate in 3 patients to marked in 2 patients. The ultrasonography of the two patients who had biliary peritonitis and bilomas revealed abdominal collections. When patients presented postoperatively, endoscopic retrograde cholangiopancreatography was performed in 8 cases. In 7 cases, it provided a diagnosis (93.3%). Four instances were given an MRC. In terms of determining the kind and severity of injury, it was 100 percent correct (Table 3).

Table (3): Results of abdominal ultrasonography, ERCP and MRCP

Ultrasonography	No	%
Dilated intrahepatic biliary radicles	7	58.33%
Intraperitoneal collection	2	16.67 %
Negative	3	25.00%
ERCP		
Diagnostic	7	77.78%
Failed procedure	2	22.22%
Total	9	100%
MRC		
8	8	100

ERCP: endoscopic retrograde cholangio pancreatogtaphy, MRCP: magnetic resonance cholangio pancreatography.

As shown from the **table 4, h**epaticojejunostomy (Roux-en-Y) was the commonest performed surgical procedure. Wound seroma and infection were the most frequent early consequence, occurring in 2 individuals, and was managed according to standard procedures (removal of stitches to facilitate proper wound drainage and antibiotic prescription according to culture and sensitivity together with daily dressing). One patient required catheter drainage under CT guidance after developing a subphrenic collection under U/S guidance. Despite early ambulation, one patient experienced deep vein thrombosis. Two years ago, the patient had a history of DVT and was obese. Without any follow-ups, this was handled in the customary manners (Bed rest with leg elevation 45° and clexane (enoxaparin sodium) 60 mg S.C. B.D. for 7 days and patient was discharged on marevan (warfarin) 5 mg oral tablets for six months) **(Table 5)**.

Table (4): Varieties of surgical operations perforated for the patients.

Procedure	No	% of operative patients.	% of total patients.
HJ (Roux-en-Y)	8	73%	57%
Choledechoduodonostomy	2	18%	14.2%
Total	11	100%	78.5%

Table (5) Postoperative complications observed

postoperative complications	**Number of patients**
Surgical site infection	2 (18%)
Collection (subphrenic)	1 (9%)
Collection (pelvic)	1 (9%)
DVT	1 (9%)
Totals	5 (45%)

DISCUSSION

Damage of the bile duct during surgery is a fearful issue that is simpler to avoid than to treat. These injuries are challenging to treat, and results aren't always satisfactory. Even for seasoned biliary surgeons, the management of these issues is a significant difficulty [(8)]. 14 individuals with post-cholecystectomy bile duct damage were examined in this study. It is difficult to diagnose and easy to overlook the injury during the cholecystectomy surgery, particularly in incomplete duct injuries because the injured duct will eventually leak or develop a stricture. In our study, 2 cases (14.29%) had an intraoperative diagnosis, while 12 patients (85.71%) had a postoperative diagnosis.

Agabiti *et al.* found that about 33% of the injuries were found intraoperatively after 200 patients of biliary injury following cholecystectomy (open or laparoscopic) were examined. Only 5% of the lesions were found during surgery, according to I A **Salama *et al.***'s analysis of 472 patients of biliary injury following cholecystectomy (open or laparoscopic, 24 out of 472). Shorter hospital stays, single anesthesia for the patient, and single surgical operation are benefits of quick on-table treatment of biliary damage. As well as the benefit of a better surgical outcome when an expert surgeon (hepatobiliary) offers the on-table repair (outreach service) [(9,10)].

In our study, patients presented between a few days and three months after their initial cholecystectomies. Eighty seven percent of our postoperatively identified cases showed up during the first month following surgery, whereas 13 percent did so after. Because of the varieties of clinical presentations according to the mechanism of injuries,

there was such a large range. Major bile leak injuries caused the majority of the patients who arrived before one month to have biliary peritonitis, whereas patients who presented after one month had external biliary fistulas and delayed strictures of the bile ducts. Schmidt S **and his coworkers** discovered that 54% of their patients presented within one month of having cholecystectomies, compared to 36% who did after one month [(11)].

Regular abdominal ultrasonography was part of the study's main investigation. Although it was able to distinguish reliably bile from other fluid collections such as serous fluid, pus or blood due to alike densities and was negative in 27% of patients, it was able to confirm the presence of peritoneal collections in 17% of cases (those who presented with biliary peritonitis or biloma) and found dilated intrahepatic biliary radicles in 56% of patients (The sensitivity of ultrasonography in our experiment was 74%).

In a study by **Donatelli *et al*** abdominal collection was seen in 40% of patients, biliary dilation was present in 50% of cases, and the test was negative in 10% of cases with a sensitivity of 65% [(12)].

65.2% of the patients in our study successfully underwent ERCP as a preoperative diagnostic test. 88% of the patients in the **Martin *et al 1992*** trial successfully underwent preoperative diagnostic ERCP. Due to considerable fibrosis and large bile duct stricture, which pulled the distal stump and raised the proximal stump to a much higher level, it was demonstrated in this study that 1 patient's ERCP failed to assess the biliary tree. In one of the cases, they looked into, ERCP didn't work because the duodenal papilla couldn't be cannulated [(8)].

Four patients had MRCP procedures. In our investigation, it exhibited 100% sensitivity and 100% specificity, with 100% diagnostic accuracy. MRCP overall sensitivity 93%, specificity 99%, and accuracy 97% in the diagnosis of bile duct injuries post-cholecystectomy. In a study conducted by **Waleed *et al 2005*** revealed sensitivity and specificity to be 87% and 80%, respectively [(10,13)].

For their bile duct damage in our study, 82% of the cases had corrective surgical operations. In contrast, 96% of the patients in **Li *et al.2010*** [(14)] study received various surgical methods for repair, as hepaticojejunostomy (Roux-en-Y) in 72% of cases, choledochojejunostomy (Roux-en-Y) in 18% of cases, and in 6 % of cases choledochoduodenostomy. In another study by **Martin *et al.*** [(8)], every single one of the 22 patients who participated underwent a Roux-en-Y hepaticojejunostomy.

MRCP procedures were performed on four patients. In our analysis, it showed 100% diagnostic accuracy, 100% sensitivity, and 100% specificity. According to research by **Waleed *et al.*** [(13)] that MRCP had an overall sensitivity of 93%, specificity of 99%, and accuracy of 97% in identifying bile duct lesions in post-cholecystectomy injuries. Sensitivity and specificity were observed at 87% and 80%, respectively also in another research[(10)].

Since the bulk of the injuries in our cases were proximal, hepaticojejunostomies were performed in the majority of them. This might be the result of the damaged duct's expanding ischemia as well as proximal traction from the developed fibrosis on the upper stump. In every case, it is essential to take the anastomosis high up in a healthy proximal duct away from any adhesions or fibrosis (high approach) **Salama I, *et al.* (2014)**.

Correct hilar plate dissections and a robust mucosa to mucosa anastomosis are essential for a good repair. Stenting is no longer as common if an adequate anastomosis is created. Trans anastomotic stenting must be utilised according to each patient's health, the surgeon's experience, and the duct diameter [(12)].

The technique was considered a success if the patient had no postoperative symptoms and didn't require additional surgery. Patients were considered to have succeeded if they only had minimal side effects, such as a rare case of cholangitis. and did not need additional surgery [(15)].

CONCLUSION

From this research, the following conclusions were made: Because patients who undergo laparoscopic cholecystectomy are typically sent home earlier, frequently before the appearance of the clinical manifestations of biliary damage, early diagnosis is crucial for preventing as many consequences as possible. Bile duct damage greatly raise the patient's morbidity.

DECLARATIONS

- **Consent for publication:** I confirm that all authors accept the manuscript for submission
- **Availability of data and material:** Available
- **Competing interests:** None
- **Funding:** No fund
- **Conflicts of interest:** The authors declare no conflicts of interest regarding the publication of this paper.

REFERENCES

1. **Kang D, Kim T, You S *et al.* (2008):** Successful endoscopic treatment of biliary stricture following mesenteric tear caused by blunt abdominal trauma. World J Gastroenterol., 14(14):2277-9. doi: 10.3748/wjg.14.2277.
2. **Balakrishnan V, Kumar R, Dhanpathi H *et al.* (2008):** Hepatobiliary scintigraphy in detecting lesser sac bile leak in postcholecystectomy patients: the need to recognize as a separate entity. Clin Nucl Med., 33(3):161-7. doi: 10.1097/RLU.0b013e318162eb08.
3. **Thomson B, Parks R, Madhavan K *et al.* (2006):** Early specialist repair of biliary injury. Br J Surg., 93(2):216-20. doi: 10.1002/bjs.5194.

4. **Lai E, Lau W (2006):** Mirrizi syndrome: history, present and future development. ANZ J Surg., 76(4):251-7. doi: 10.1111/j.1445-2197.2006.03690.x.
5. **Bhattacharjee P (2005):** Review Article-Bile duct injuries: Mechanism and prevention. Indian Journal of Surgery , 67: 67.
6. **Weber A, Feussner H, Winkelmann F *et al.* (2009):** Long-term outcome of endoscopic therapy in patients with bile duct injury after cholecystectomy. J Gastroenterol Hepatol., 24(5):762-9. doi: 10.1111/j.1440-1746.2008.05713.x.
7. **Hirano Y, Tatsuzawa Y, Shimizu J (2006):** Efficacy of multi-slice computed tomography cholangiography before laparoscopic cholecystectomy. ANZ J Surg., 76(8):693-5. doi: 10.1111/j.1445-2197.2006.03833.x.
8. **Martin I, Holdsworth P, Asker J (1992):** Laparoscopic cholecystectomy as a routine procedure for gallstones: results of an 'all-comers' policy. Br J Surg., 79(8):807-10.doi: 10.1002/bjs.1800790833.
9. **Agabiti, N, Stafoggia M, Davoli M (2013).** Thirty-day complications after laparoscopic or open cholecystectomy: a population-based cohort study in Italy. BMJ Open,3(2):e001943. doi: 10.1136/bmjopen-2012-001943.
10. **Salama I, Shoreem H, Saleh S *et al.* (2014):** Iatrogenic biliary injuries: multidisciplinary management in a major tertiary referral center. HPB Surg., 2014:575136. doi: 10.1155/2014/575136.
11. **Schmidt S, Settmacher U, Langrehr J *et al.* (2004):** Management and outcome of patients with combined bile duct and hepatic arterial injuries after laparoscopic cholecystectomy. Surgery, 135(6):613-8. doi: 10.1016/j.surg.2003.11.018.
12. **Donatelli G, Vergeau B, Derhy S *et al.* (2014):** Combined endoscopic and radiologic approach for complex bile duct injuries (with video). Gastrointest Endosc.,79(5):855-64.doi: 10.1016/j.gie.2013.12.034.
13. **Waleed S, Mahafza M, Azmi M *et al.* (2005):** Magnetic resonance cholangiopancreatography in post laparoscopic cholecystectomy patients. JMJ., 39 (1): 23-29.
14. **Li J, Frilling A, Nadalin S (2010):** Surgical management of segmental and sectoral bile duct injury after laparoscopic cholecystectomy: a challenging situation. J Gastrointest Surg.,14(2):344-51. doi: 10.1007/s11605-009-1087-0.
15. **Bittner, R. (2006):** Laparoscopic surgery--15 years after clinical introduction. World J Surg., 30(7):1190-203. doi: 10.1007/s00268-005-0644-2.