International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Management of Bile Duct Injury Complicating Cholecystectomy: Experience of the General Surgery Department of Avicenne Military Hospital in Marrakesh

Mohamed Jawad Fassi Fihri[1], Mohammed Lahkim[2]

[1,2]General surgery department, Hôpital Militaire Avicenne, Marrakesh

Abstract

Bile duct injuries are the most feared complication of a commonly performed cholecystectomy, which is generally considered as a safe and benign intervention.

Eighteen cases of bile duct injuries were collected through a retrospective study conducted between January 2019 and December 2023 in the general surgery department of the Military Hospital Avicenne in Marrakesh.

The average age was 53 years old, sex ratio M/F was 0.38.

Acute cholecystitis, acute pancreatitis, obesity and anatomical variations were the main risk factors found in our patients.

For 13 patients, the iatrogenic injury had occurred in our department. For the remaining 5 patients, they were referred from peripheral hospitals.

Intraoperative diagnosis was made in five cases. In the postoperative period, 6 patients had bile leakage from the drain, 5 patients had abdominal pain, one patient presented incisional bile leakage and one patient had a jaundice.

The repair consisted mostly on Roux-en-Y hepaticojejunostomy which was performed in 9 cases. Cystic duct ligation was performed in five cases. Two patients underwent primary repair on common bile duct with T-tube insertion. Two cases were treated by endoscopically. The six months' follow up was favorable for 66,7% of the cases.

The prevention and the respect of surgical rules and recommendations (critical view of safety) during cholecystectomy are the best means to avoid these lesions.

Keywords: Bile Duct Injury, Repair, Strasberg Classification

1. Introduction

Operative bile duct injury (BDI) is a dreaded complication of biliary surgery associated with significant morbidity and mortality. Complications of bile duct injuries during laparoscopic cholecystectomy (LC) are likely to be more proximal localized and more complicated such as the presence of accompanying vascular injury [1].

Iatrogenic bile duct injuries are complications seen between 0.2% and 0.3% during open cholecystectomy [2], whereas this percentage is slightly higher between 0.3% and 1.4% with LC. Biliary duct injuries may

lead to morbidities such as biliary leak, peritonitis, and biliary stenosis and mortality [3].
While advancements in surgical techniques and technology have reduced the incidence, it continues to occur. Approximately 20% of bile duct injuries are recognized during the operation [2].
The aim of this study evaluates the experience of bile duct injuries at the Avicenne military hospital in Marrakesh, Morocco, to identify trends, risk factors, and outcomes and compare it to data of literature.

2. Materials and methods

This is a retrospective study conducted in the general surgery department of Avicenne military Hospital in Marrakesh. The study reviewed all patients who underwent cholecystectomy at this department, between January 2019 and December 2023.
It was found that 1,093 operations were performed and 13 iatrogenic bile duct injuries occurred during this period. Another 5 patients were also included in the study. They were referred to our facility from peripheral hospitals with iatrogenic bile duct injury after cholecystectomy.
Thus, a total of 18 patients with bile duct injury, treated and followed up in our department, were included in the study.
Patients' age, gender, a medical history and comorbidities were recorded. Clinical and imaging diagnosis investigations were also recorded. Operative variables like previous emergency or elective surgery, drain insertion, time of BDI diagnosis (intra- or post-operative) and other variables were noted.
Classification of bile duct injuries was made using the Strasberg classification [4]. Finally, repair strategies and outcomes of the treatments were also analyzed.

3. Results

Of the operated 1,625 patients who underwent cholecystectomy from January 2019 to December 2023 in our department, 1,170 were female and 455 were male. Iatrogenic bile duct injury was found in 13 (0.8%) of these patients. Five other patients included in the study were referred from other hospitals. A total of 18 bile duct injuries were evaluated in this study.
The age of the patients ranged between 34 and 72 years old with an average of 53 ± 19. The gender was distributed between 13 (72,2%) female patients and 5 (27,8%) male patients for a sex ratio of 0,38. Demographic data is resumed in Table 1.
Of the 18 patients, 11 (61,1%) had a history of previous acute cholecystitis, 2 (11,1%) acute biliary pancreatitis, 2 (11,1%) Jaundice/acute cholangitis, 7 (38,9%) previous abdominal operation. Concerning comorbidities, 10 patients (55,6%) had obesity (IMC>30) and 10 patients (55,6%) were treated for type 2 diabetes and 8 (44,4%) for high blood pressure. All patients underwent cholecystectomy for symptomatic cholelithiasis.
Of the patients, 13 (72,2%) underwent elective and 5 (27,8%) emergency surgeries.
Of the 5 patients who underwent emergency surgery, 3 were operated during the day and 2 patients at night.
Five (27,8%) of the BDI cases were diagnosed during the initial cholecystectomy procedure, two of them were emergency surgery, operated for emphysematous cholecystitis. Fourteen cases (77,8%) occurred in laparoscopy and 4 (22,2%) in open surgery by subcostal incision.
Postoperatively, the main clinical complaints of patients included bile leakage from the drain in 6 patients (33,3%), abdominal pain in 5 patients (27,8%), bile leakage from the subcostal incision site in 1 (5,6%), and jaundice in 1 (5,6%).

In our study, a cavity drain was inserted in 10 (55,6%) patients.
Abdominal ultrasound was done in 5 patients to identify the biloma. Computed tomography was performed in 2 patients presenting signs of peritonitis. MRCP was realized in 9 cases.
The average of time from initial operation to BDI diagnosis was 2,4 (0 - 6) days. The delay between BDI recognition and the repair was in average 2,9 (0 – 7) days.
Types of injuries were determined in the patients based on the Strasberg classification.
The repartition was: 7 cases of Strasberg type A injury, 5 of type C, 3 of type D, 2 of type E3 and one of type E2. No case presented type B, E1, E4 or E5 injuries.
Distribution of the types of injury and their management is given in Table 2.
The repair consisted mostly on Roux-en-Y hepaticojejunostomy which was performed in 9 cases. Cystic duct ligation was realized in 5 cases having a ligature leakage or a cystic duct lesion. Two patients underwent primary repair on common bile duct with T-tube insertion. Two cases were treated by endoscopic stenting. The outcome was favorable for 12 patients (66,7%). On 6 months follow up, 6 patients had benign complications: 2 patients had recurrent cholangitis and 4 had superficial surgical site infection. No in-hospital deaths were reported and the average length of stay was 11,5 (7–20) days.

Table 1: Demographic data

Male/Female (n)	5/13
Age (average)	53
Laparoscopy/open (previous surgical approach)	14/4
Diagnosis peroperative/postoperative	5/13
Time between previous surgery – BDI diagnosis (median)	2,4 days
Time between BDI diagnosis – repair (median)	2,9 days
Symptoms	
Bile leakage	7
Abdominal pain	5
Jaundice	1
Length of stay (average)	
Follow-up Morbidity	11,5 days
Recurrent cholangitis	
Surgical site infection	2
	4

BDI: Bile duct injury

Table 2: Distribution of the types of injuries and their management

Types of injury	n	%	Treatment	n
Strasberg A	7	38.9	Cystic duct ligation	5
			Endoscopic treatment	2
Strasberg B	0	0		
Strasberg C	5	27.8	Roux-en-Y hepaticojejunostomy	5
Strasberg D	3	16.7	Primary repair + T-Tube	2
			Roux-en-Y hepaticojejunostomy	1

Strasberg E1	0	0		
Strasberg E2	1	5.6	Roux-en-Y hepaticojejunostomy	1
Strasberg E3	2	11.1	Roux-en-Y hepaticojejunostomy	2
Strasberg E4	0	0		
Strasberg E5	0	0		

4. Discussion

LC is the gold standard operation for patients with gallstone disease and represents one of the most common routine interventions performed worldwide in both elective and emergency settings [5, 6].

Bile duct injuries (BDIs) are dangerous complications of cholecystectomy, occurring more often since the introduction and widespread adoption of laparoscopy (0.4–1.5% of cases) compared to open cholecystectomy (0.2 – 0.3% of cases) [7-10].

In our study, the rate of BDI after cholecystectomy in our institution was 0,8% and is within the limits reported in the literature.

Concerning risk factors, a meta-analysis in China including 19 case–control studies with a total of 458 patients presenting BDI, revealed that age (≥ 40 years), abnormal preoperative liver function, gallbladder wall thickening, acute and subacute inflammation of the gallbladder, cholelithiasis complicated with effusion, and anatomic variations of the gallbladder triangle were found to be closely associated with bile duct injury in LC [11].

In our study, the average age was 53 years old. The history of previous cholecystitis was found in 61.1%, and history of cholangitis and acute biliary pancreatitis in 22.2% of the patients.

Five cases of BDI (27.8%) were recognized during the initial cholecystectomy, which falls within the range (27%-73%) observed in previous multicenter surveys [12-15].

The timing of surgery was another factor analyzed in our study. The rate of emergency/elective surgery leading to BDI was 5/13. In the literature, emergency cholecystectomy has three times more likelihood of causing biliary injury than elective surgery [12].

The presence of a drain is of paramount importance in providing biliary drainage and in the prevention of sepsis. This can significantly reduce the time to diagnosis and initiation of the treatment especially when biliary leakage is exteriorized outside peritoneal cavity [16].

Ten (55.6%) of our patients had a subhepatic drain inserted and biliary leakage from the drain had led to diagnosis of BDI in 6 cases (33.3%).

The time between initial procedure and the repair after cholecystectomy, excluding the intraoperative recognition, was meanly 7.3 days in our study, which is considered as an early timing. According to a review and meta-analysis of 32 studies by Wang et al. [17], repair failure is more frequent after early repair (< 6weeks) than after delayed repair (31.9% vs. 17.1%, $p < 0.001$).

The Strasberg classification was used in our study for classification of bile duct injuries, because it is a classification involving all injuries including biliary leakage, it can be readily used in multidisciplinary treatment management in clinical practice, and due to its advantages of facilitating comparison between different centers.

Strasberg type A injuries are biliary leakages seen from a minor duct, with continuing association with bile ducts. These are biliary leakages usually resulting from cystic stump due to the failure of appropriate clipping of the cystic duct or from an injury to a peripheral hepatic duct (Luschka), which ends in the liver bed [4].

Endoscopic treatment in which bile duct pressures obtained by the sphincter of Oddi are decreased with sphincterotomy has almost completely eliminated the need for surgery in these injuries [2]. Endoscopic treatment has a success rate between 66% and 100% in major bile duct-related injuries, especially in type A injuries and type D injuries where injury area is not wide [19].

A type A lesion was detected in 7 of our patients, of whom 2 underwent endoscopic treatment and 5 underwent cystic duct ligation, which presented a leak or an injury.

Strasberg type B injuries are the injuries with an occlusion occurring with ligation and cut of the right aberrant duct. In our study, no type B injury was found.

Strasberg type C injuries are the injuries with biliary leakage occurring due to transection of the right aberrant duct without occlusion. This type of injury may cause local intraperitoneal bile collections, biliary acid, and peritonitis, and almost always require treatment [20]. In such case, surgical treatment should be preferred in cases of failed endoscopic treatment or as the first choice [21]. Type C injury was detected in five of our patients, 2 in peroperative time and 3 in postoperative. They all have been treated surgically by Roux-en-Y hepaticojejunostomy. It should be kept in mind that the clinical picture may worsen within days and sepsis may occur in patients with bile duct injury [22].

Strasberg type D injuries are the injuries in which major bile ducts are partially transected (<50%). The most important late complication in these injuries are the development of stenosis secondary to biliary leakage [19]. In our department, three type D injuries were diagnosed and treated by primary repair and T-tube insertion for two patients and Roux-en-Y hepaticojejunostomy for one patient. A success rate has been reported as 85% in surgical repair of major bile duct injury in an experienced center where biliary tree is completely viewed [23].

Strasberg type E injuries (1–5) are the injuries occurring with complete incision of the major bile ducts. Type E injuries are defined by a complete loss of common and/or hepatic bile duct continuity. Devascularization and loss of bile duct tissue obliges the surgeon to perform a high-quality hepatojejunal anastomosis. The latter procedure guarantees well-perfused bile ducts and a low tension anastomosis. The opposite is obtained when choledoco-choledoco or hepato-duodenum anastomosis are performed as devascularized ducts are used for the reconstruction and the duodenum tends to move downwards, increasing anastomotic tension, even if a Kocher maneuver is performed well in advance [24]. Roux-en-Y hepaticojejunostomy was performed for three patients of our study with type E injury.

BDIs are a surgical challenge associated with significant postoperative sequelae for the patient in terms of morbidity, mortality (up to 3.5%), and long-term quality
of life [25-27]. In our study, the mortality rate was zero and morbidity was represented by 4 mild cases of surgical site infection and 2 cases of recurrent cholangitis.

5. Conclusion

Iatrogenic BDIs are among the most serious complications of cholecystectomy. LC is a safe procedure owing to the adaptation of critical view of safety principles and protocols [28]. However, the risks of BDI cannot be eliminated. The multidisciplinary approach is of paramount importance both in diagnosis and treatment of iatrogenic bile duct injuries. Reconstruction of Roux-en-Y hepaticojejunostomy results in a good outcome and is recommended to be performed in selected cases by trained surgeons.

6. Conflict of Interest

Authors declare no conflict of interest.

7. References

1. Machado NO. Biliary complications post laparoscopic cholecystectomy: mechanism, preventive measures and approach to management: a review. Diagn Ther Endosc 2011; 2011:967017. DOI: 10.1155/2011/967017.
2. Salama IA, Shoreem HA, Saleh SM, et al. Iatrogenic biliary injuries: multidisciplinary management in a major tertiary referral center. HPB Surg 2014; 2014::575136. DOI: 10.1155/2014/575136.
3. Abbasoglu O, Tekant Y, Alper A, et al. Prevention and acute management of biliary injuries during laparoscopic cholecystectomy: expert consensus statement. Ulus Cerrahi Derg 2016;32(4):300–305. DOI: 10.5152/UCD.2016.3683
4. Strasberg SM. Laparoscopic biliary injuries. diseases of the gallbladder and bile ducts: diagnosis and treatment. HPB Surg 2008. 182.
5. Alexander HC, Bartlett AS, Wells CI, Hannam JA, Moore MR, Poole GH, et al. Reporting of complications after laparoscopic cholecystectomy: a systematic review. HPB (Oxford). 2018;20:786–94. https://doi.org/10.1016/j.hpb.2018.03.004.
6. Brunt LM, Deziel DJ, Telem DA, Strasberg SM, Aggarwal R, Asbun H, et al. Safe cholecystectomy multi-society practice guideline and state of the art consensus conference on prevention of bile duct injury during cholecystectomy. Ann Surg. 2020;272(1):3–23. https://doi.org/10.1097/SLA.0000000000003791.
7. Kapoor VK. In: Kapoor V, editor. Epidemiology of bile duct injury., in postcholecystectomy bile duct injury. Singapore: Springer; 2020. p. 109–25.
8. Hogan NM, Dorcaratto D, Hogan AM, Nasirawan F, McEntee P, Maguire D, et al. Iatrogenic common bile duct injuries: increasing complexity in the laparoscopic era: a prospective cohort study. Int J Surg. 2016;33(Pt A):151–6. https://doi.org/10.1016/j.ijsu.2016.08.004.
9. Pulvirenti E, Toro A, Gagner M, Mannino M, Di Carlo I. Increased rate of cholecystectomies performed with doubtful or no indications after laparoscopy introduction: a single center experience. BMC Surg. 2013;13(1):17. https://doi.org/10.1186/1471-2482-13-17.
10. Fletcher R, Cortina CS, Kornfield H, Varelas A, Li R, Veenstra B, et al. Bile duct injuries: a contemporary survey of surgeon attitudes and experiences. Surg Endosc. 2019;34(7):3079–84. https://doi.org/10.1007/s00464-019-07056-7
11. Yang S, Hu S, Gu X, Zhang X. Analysis of risk factors for bile duct injury in laparoscopic cholecystectomy in China: A systematic review and meta-analysis. Medicine 2022; 101:37(e30365). http://dx.doi.org/10.1097/MD.0000000000030365
12. Russell JC, Walsh SJ, Mattie AS, Lynch JT. Bile duct injuries, 1989-1993. A statewide experience. Connecticut Laparoscopic Cholecystectomy Registry. Arch Surg 1996;131(4):382–388
13. Gigot J, Etienne J, Aerts R et al. The dramatic reality of biliary tract injury during laparoscopic cholecystectomy: an anonymous multicenter Belgian survey of 65 patients. Surg Endosc 1997;111171- 1178
14. Archer SB, Brown DW, Smith D et al. Bile duct injury during laparoscopic cholecystectomy. Ann Surg 2001; 234549- 559
15. Olsen D. Bile duct injuries during laparoscopic cholecystectomy. Surg Endosc 1997; 11133- 138
16. Jarnagin WR, Blumgart L. Blumgart's surgery of the liver, biliary tract, and pancreas. Elsevier Saunders; 2012.

17. Wang X, Yu WL, Fu XH, Zhu B, Zhao T, Zhang YJ (2020) Early versus delayed surgical repair and referral for patients with bile duct injury: a systematic review and meta-analysis. Ann Surg 271(3):449–459. https://doi.org/10.1097/SLA.0000000000003448
18. Mercado MA, Domínguez I. Classification and management of bile duct injuries. World J Gastrointest Surg 2011; 3(4): 43-48
DOI: http://dx.doi.org/10.4240/wjgs.v3.i4.43
19. Rauws E, Gouma D. Endoscopic and surgical management of bile duct injury after laparoscopic cholecystectomy. Best Practice & Research 2004;18(5):829–846.
DOI: 10.1016/j.bpg.2004.05.003.
20. Pucher PH, Brunt LM, Fanelli RD, et al. SAGES expert Delphi consensus: critical factors for safe surgical practice in laparoscopic cholecystectomy. Surg Endosc 2015;29(11):3074–3085. DOI: 10.1007/s00464-015-4079-z.
21. Sicklick JK, Camp MS, Lillemoe KD, et al. Surgical management of bile duct injuries sustained during laparoscopic cholecystectomy: perioperative results in 200 patients. Ann Surg 2005;241(5):786. DOI: 10.1097/01.sla.0000161029.27410.71.
22. Stewart L. Iatrogenic biliary injuries: identification, classification and management. Surgical Clinics 2014;94(2):297–310. DOI: 10.1016/j.suc.2014.01.008
23. Kapoor VK. Management of bile duct injuries: a practical approach. Am Surg 2009;75(12):1157–1160.
24. Mercado MA, Orozco H, de la Garza L, López-Martínez LM, Contreras A, Guillén-Navarro E. Biliary duct injury: partial segment IV resection for intrahepatic reconstruction of biliary lesions. Arch Surg 1999; 134: 1008-1010
25. Booij KAC, de Reuver PR, van Dieren S, van Delden OM, Rauws EA, Busch OR, et al. Long-term impact of bile duct injury on morbidity, mortality, quality of life, and work related limitations. Ann Surg. 2018;268(1):143–50. https://doi.org/10.1097/SLA.0000000000002258.
26. Fong ZV, Pitt HA, Strasberg SM, Loehrer AP, Sicklick JK, Talamini MA, et al. Diminished survival in patients with bile leak and ductal injury: management strategy and outcomes. J Am Coll Surg. 2018;226(4):568–76 e561. https://doi.org/10.1016/j.jamcollsurg.2017.12.023.
27. Koppatz H, Sallinen V, Mäkisalo H, Nordin A. Outcomes and quality of life after major bile duct injury in long-term follow-up. Surg Endosc. 2020;35(6): 2879–88. https://doi.org/10.1007/s00464-020-07726-x.
28. Manatakis DK, Antonopoulou MI, Tasis N, Agalianos C, Tsouknidas I, Korkolis DP, Dervenis C (2022) Critical view of safety in laparoscopic cholecystectomy: A systematic review of current evidence and future perspectives. World J Surg.
https://doi. org/10.1007/s00268-022-06842-0.