MANAGEMENT OF BILE DUCT INJURIES AFTER LAPAROSCOPIC CHOLECYSTECTOMY: A RETROSPECTIVE SINGLE-CENTER STUDY

Muhammad Haroon, Ahmed Siddique Ammar✉, Muhammad Imran Khan, Albash Sarwar, Muhammad Atiq, Faisal Hanif

Department of Hepato-Pancreatico-Biliary and Liver Transplant Surgery of Bahria International Hospital Lahore.

Address for correspondence:
Ahmed Siddique Ammar
Department of Hepato-Pancreatico-Biliary and Liver Transplant Surgery of Bahria International Hospital Lahore.

E-mail:
asammar1912@gmail.com

Date Received:
7th July, 2022
Date Revised:
25th March, 2023
Date Accepted:
18th April, 2023

ABSTRACT

Objective: To monitor the management and outcomes of bile duct injuries following laparoscopic cholecystectomy.

Methodology: This retrospective case series study was conducted from June 2020 to October 2021 in the Department of Hepato-Pancreatico-Biliary and Liver Transplant Surgery, Bahria International Hospital Lahore. A non-probability convenient sample technique was used to include 11 patients referred to our center after iatrogenic bile duct injuries (BDI) during cholecystectomy.

Results: All 11 patients (100%) included in the study had iatrogenic extrahepatic biliary duct injuries during their primary surgery for symptomatic gall stones, with 4 patients (36%) having type E injury, 4 (36%) having type A leak, and 3 patients (27%) having type D leak according to the Strasberg classification. Endoscopic management was utilized in 6 patients (55%) with type A and D injuries, while the percutaneous intervention was used in 1 patient (9%), and hepaticojejunostomy was performed in 3 patients (27%). One patient (9%) developed secondary biliary cirrhosis and was advised for a liver transplant.

Conclusion: Laparoscopic cholecystectomy is a generally safe procedure, but it can result in bile duct injuries. Suspected or diagnosed cases of bile duct injuries require referral to a specialist center for proper management. The treatment of such injuries is complex, and inadequate management can lead to secondary biliary cirrhosis and liver failure.

Keywords: Bile Duct; Laparoscopic; Cholecystectomy; Iatrogenic; Injury; Strasberg

INTRODUCTION

Laparoscopic cholecystectomy (LC) was performed in 1985 by Erich Muhe.[1] In recent decades, LC is now one of the most common kinds of surgery done all over the world. A systematic review found that there is no big difference between laparoscopic and open cholecystectomy in terms of morbidity and death. One of the known problems that can happen after LC is bile duct injury, which happens in about 0.8 of every 1000 cases. Injury to the bile duct can be dangerous and lead to long-term problems like biliary strictures, bile leaks, cholangitis, and secondary biliary cirrhosis.[2] The major causes of bile duct injury following LC include misidentification of the common bile duct and common hepatic duct or aberrant hepatic duct. Poor surgical technique, anatomical variations, and poor visualization can also contribute to bile duct injury during LC. Several risk factors can increase the likelihood of bile duct injury during LC. Thermal damage to the bile duct can occur during dissection or electrocautery, which can lead to bile duct injury. Inadequate application of metal clips can also cause bile duct injury by causing ischemia or necrosis of the bile duct. Excessive traction on the cystic duct or gallbladder, and bleeding in the Calot's triangle are other factors that can contribute to bile duct injury. It is critical for surgeons to have a thorough understanding of the anatomy and exercise caution during the procedure to minimize the risk of bile duct injury. Proper identification of critical structures and careful dissection are crucial to prevent bile duct injury. Prompt recognition and appropriate management of bile duct injury can help minimize the long-term complications.[3] Various classifications have been developed to categorize bile duct injuries (BDI) before and after the laparoscopic era. However, the Strasberg classification of BDI is considered the most complete and user-friendly. This classification system provides a standardized framework for the assessment and management of BDI, based on the level and extent of the injury.

This article may be cited as
Haroon M, Siddique AA, Khan IM, Sarwar A, Atiq M, Hanif F. Management of bile duct injuries after laparoscopic cholecystectomy: a retrospective single-center study. J Postgrad Med Inst 2023;37(2): 103-108. http://doi.org/10.54079/jpmi.37.2.3127

The management of BDI requires a multidisciplinary approach involving gastroenterologists, radiologists, and surgeons. Treating complicated cases of BDI can be a real challenge for the surgeon. Early recognition and appropriate management of BDI are crucial to prevent long-term complications such as cholangitis, biliary cirrhosis, and end-stage liver disease. The treatment approach for BDI depends on the type and severity of the injury, as well as the patient's overall health status.

In cases of mild BDI, conservative management with close monitoring may be sufficient. However, more severe cases may require surgical intervention such as a biliary-enteric anastomosis, bile duct reconstruction, or liver transplantation. Treatment may also involve the use of percutaneous drainage, endoscopic retrograde cholangiopancreatography (ERCP), and stenting.[4] Endoscopic management of bile duct injuries (BDI) typically involves endoscopic retrograde cholangiopancreatography (ERCP) and stenting. During ERCP, a flexible endoscope is used to access the bile ducts, and a contrast agent is injected to identify the site and extent of the injury. Stents can then be placed to maintain bile flow and promote healing of the injured duct. The choice of endoscopic management technique depends on the location and severity of the BDI, as well as the patient's overall health status. ERCP is typically preferred for injuries located in the common bile duct or proximal hepatic ducts, while PTC is preferred for injuries located more distally in the intrahepatic bile ducts.[5] If endoscopic management of bile duct injuries (BDI) fails or is not suitable, surgical intervention may be necessary. One common surgical intervention for BDI is hepaticojejunostomy, which involves the creation of a new connection between the injured bile duct and the jejunum (part of the small intestine). This allows bile to flow directly into the small intestine, bypassing the site of the injury.[6]

In cases where patients develop recurrent secondary biliary cirrhosis due to long-standing recurrent biliary obstruction and sepsis, liver transplantation may be necessary. Liver transplantation can provide a definitive treatment for patients with end-stage liver disease and can improve their quality of life. However, it is a complex procedure and should only be considered after a thorough evaluation by a transplant team. Early identification and prompt treatment of bile duct injuries can help prevent the development of such complications and the need for liver transplantation.[7]

This study aims to discuss the clinical manifestations following BDI and our strategy of management.

METHODOLOGY

This case series was carried out in Department of Hepato-Pancreatico-Biliary and Liver Transplant Surgery, Bahria International Hospital Lahore from June 2020 to October 2021 after obtaining ethical approval from Institutional review board. We collected the data of patients who had iatrogenic BDI following LC from June 2020 to October 2021, and were referred to us as a specialist Hepato-Pancreato-biliary (HPB) and liver transplant (LT) unit. The ethical approval was sought from Institutional Review Board (IRB) of our institute. Using consecutive sample technique, 11 patients were selected for this study who were referred to our center after iatrogenic bile duct injuries (BDI) during cholecystectomy. Included criteria include all those bile duct injuries who had history of laparoscopic bile duct injury done outside our hospital and were referred to us. All those patients on presentation to our hospital had sign and symptoms of local of generalized peritonitis (abdominal tenderness, vomiting, rebound tenderness, fever, leukocytosis, vomiting).On performing Magnetic Resonance Cholangio Pancreaticgram (MRCP) we found any bile duct injury according to Strasberg classification.[8] All other patients referred to us with suspicion of bile duct injury but we observed no bile duct injury were excluded from the study. Patients with age more than 13 years and less than 60 years were included in this study. Data was collected from hospital record and documented and analyzed in SPSS version 22. Variables recorded were age, gender, duration of presentation after injury, post-operative complications, clinical manifestations after BDI, management plans and further follow up.

RESULTS

In this study, 11 patients with the history of iatrogenic bile duct injury following Laparoscopic cholecystectomy were included . All of these patients had iatrogenic extra hepatic biliary tree ducts injury during their primary surgery for symptomatic gall stones. Seven (64%) patients were less than 40 years of age and the median age was 38 years (28 to 56). Six (55%) patients were females. All eleven patients underwent LC for gall stones disease at first, while conversion from laparoscopy to open was performed in four (36%) patients. Most of the patients presented early with in four weeks of primary surgery (n=9, 82%). All of the LCs during which injuries took place were performed outside our hospital. Injury were identified in two patients within 1 week after index operation and patient presented to us in same week s hepaticojejunostomy was performed in the same week by our team. The most common clinical manifestation was jaundice (n=6, 54%), followed by bile leak (n=3, 27%) and recurrent cholangitis (n=2, 18%). As per the Strasberg classification, four patients (36%) had type E leak, while four (36%) had type A leak and three patients had type D (27%) leak.

The commonest intervention was ERCP done in nine patients. Six patients (55%) were managed successfully with ERCP who had type A and D injuries. Those patients who

Table 1: Overall management plan of all patients

Age (Years)	Gender	Symptoms	Conversion to open*	Type of Injury	Management Planed
38	Male	Bile Leak	No	Type-A	ERCP Stenting
56	Female	Recurrent Cholangitis	Yes	Type-E	PTC
35	Female	Stricture/Jaundice	Yes	Type-E	Hepaticojejunostomy
28	Female	Bile Leak	No	Type-A	ERCP Stenting
39	Female	Stricture/Jaundice	Yes	Type-E	Hepaticojejunostomy
52	Female	Recurrent Cholangitis	Yes	Type-D	Liver Transplant
45	Male	Stricture/Jaundice	No	Type-A	ERCP Stenting
55	Male	Stricture/Jaundice	No	Type-E	Hepaticojejunostomy
30	Female	Stricture/Jaundice	No	Type-D	ERCP Stenting
35	Male	Bile Leak	No	Type-A	ERCP Stenting
38	Male	Stricture/Jaundice	No	Type-D	ERCP Stenting

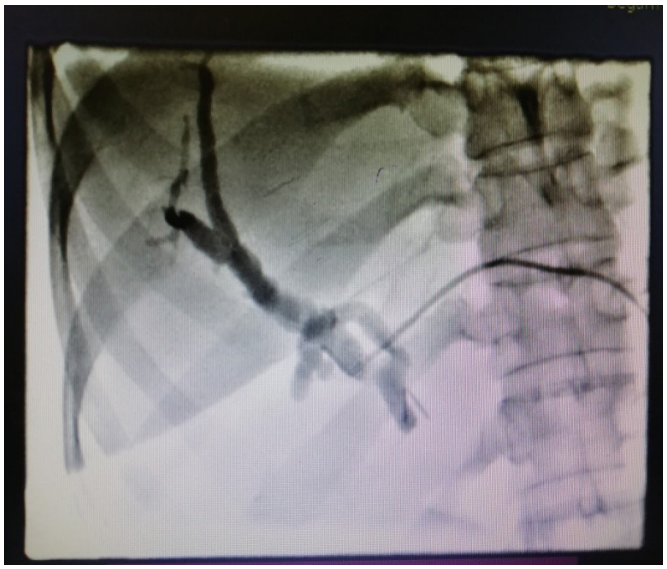

Figure 1: Complete transaction of Common Hepatic Duct

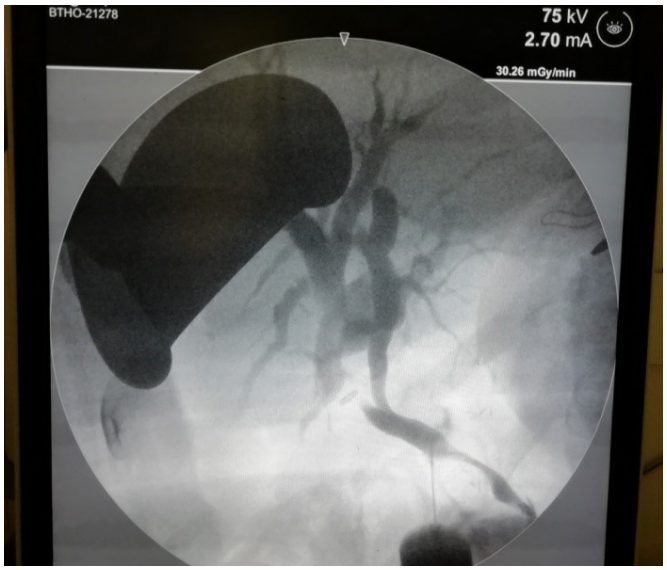

Figure 2: Complete transaction of Right Hepatic Duct

had failed ERCPs were subjected to PTC. One patient (9%) was successfully managed with the help of percutaneous transhepatic biliary stenting (PTBS) as she had recurrent cholangitis due to biliary stricture at previously made hepatico-jejunostomy. Surgical management including hepaticojejunostomy was performed in 3 patients (27%). One patient had complete transaction of bile duct after laparoscopic cholecystectomy. Hepatico-jejunostomy was performed within first week of injury. Second patient had complete transaction of Common Hepatic Duct as shown in percutaneous transhepatic cholangiography (PTC) in Figure 1. ERCP was not successful in this patient. PTC drainage was done initially followed by surgery for this patient. Figure 2 is intra operative cholangiogram of third patient showing complete transaction of right hepatic duct (RHD) during LC while CBD and Left Hepatic duct (LHD) was intact in continuity.

Remnant stump of RHD was necrosed, parenchymal transaction of the liver was done to expose intrahepatic part of RHD where hepatico-jejunostomy was performed. One patient had Bile Duct Injury for which hepatico-jejunostomy was made by primary surgeon. Later on she developed anastomotic stricture leading to recurrent cholangitis. She had multiple PTC attempts but failed. By the time she reached our center, she

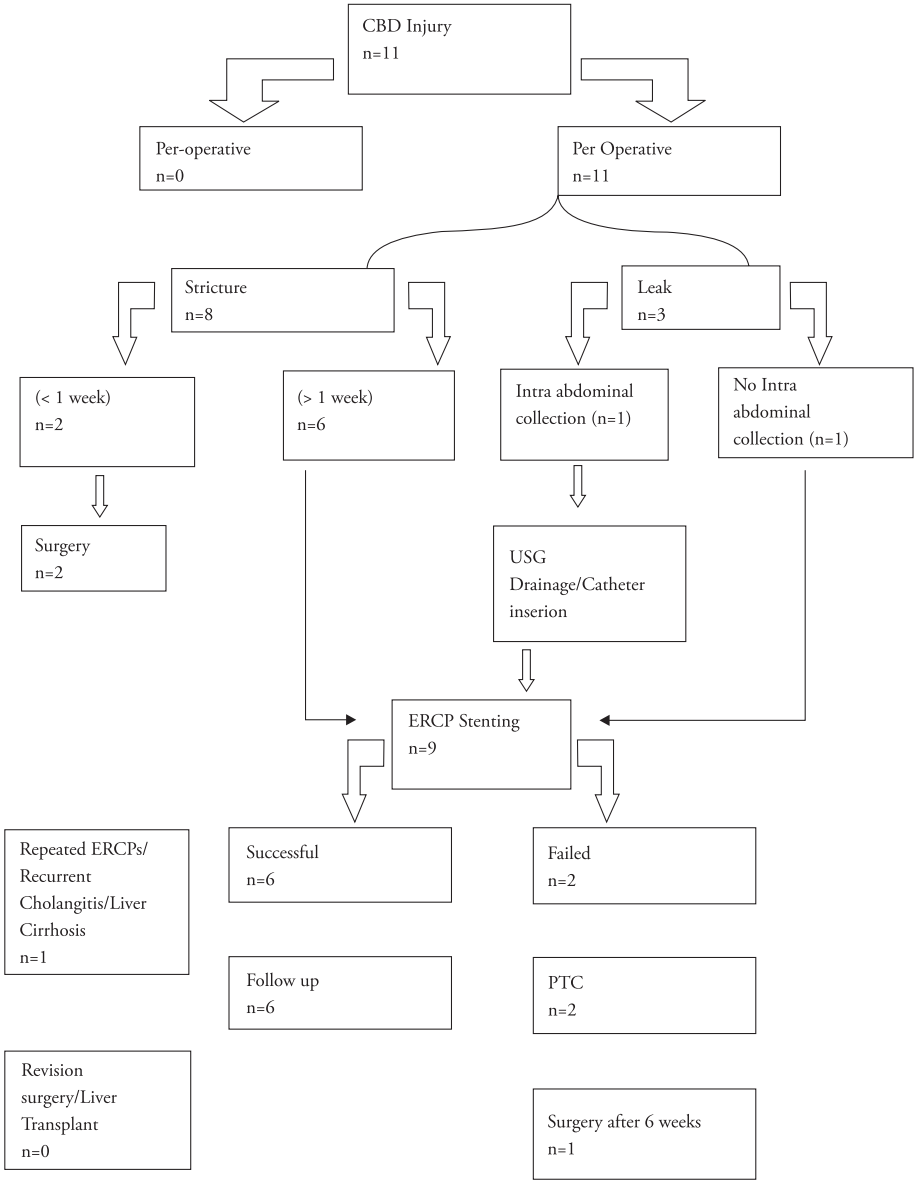

Figure 3: Management Protocol for Bile duct injuries

had developed secondary biliary cirrhosis. She was advised liver transplant surgery. On three months follow up, all patients are satisfactory with their health and have no abnormalities in their liver functions. Table 1 is showing overall outcomes of all the patients. Our center management protocol is shown in Figure 3.

DISCUSSION

The most vulnerable period in a person's life during which bacterial meningitis manifests and causes serious consequences is during infancy. Since sepsis and meningitis are the most common causes of neonatal mortality, doctors must have a high index of suspicion while treating newborns who exhibit vague clinical symptoms. On how to categorize meningitis and neonatal sepsis in the postpartum period, there is no agreement. According to the current study, the majority of the participants in the study were male (64.6 percent). According to Bhagat R et al., 2015[14], the majority of the individuals in their study on late-onset meningitis were male as opposed to female. In contrast to the current findings, Fredrick et al. claimed that male is a minority group that was based on the study (51 %).

According to earlier studies, sepsis affected 36.4 percent of preterm infants and 49.2 percent of LBW newborns. Meningitis, however, was noted in an earlier study in 63.3 percent of LBW infants and 61.7 percent of preterm neonates[14]. The findings of the present investigation are further supported by a study by Anjos da Silva et al.,[15] Among their investigation, Jiang et al[16] found a strong correlation between meningitis in newborns and low birth weight.

Clinical signs and symptoms indicated that 51.2% of newborns had poor feeding, 54.9% were lethargic, 42.7% had hypothermia, and 53% had hyperthermia. The findings of Bhagat R, et al[14], were used to corroborate these findings, which showed that lethargy and decreased oral feed were present in 100% and 46.4% of the subjects, respectively. In accordance with the current findings, Laving et al[17]identified feed intolerance and lethargy as the two most prevalent clinical characteristics of meningitis, both of which were present in 73.3 percent and 60 percent of cases, respectively.

The current study found no significant association between meningitis and gestational age. The results of Fredrick et al[3], were in support of the observation that there was no statistically significant difference in gestational age. Mean gestational age was 38.8 weeks was (28-42 weeks). According to a study conducted by Thomas E. et al[18], 16 percent of the pregnancies were under 36 weeks.

Out of total sample 57.3% had negative blood culture. Blood culture was positive in 42.6 percent and 7.04 percent of patients with meningitis and sepsis, respectively, according to a prior study by Bhagat R et al[14], and was found to be statistically substantially linked with both conditions.

The results of earlier research on meningitis prevalence in neonates by Visser et al[19], and Tisukumara et al[20], supported the 52.4 percent meningitis prevalence found in the current study. In another investigation, meningitis incidence in was found to be 16 percent (Bhagat R et al[14], Laving et al[17]and Anjos De Silva et al[15], both made a similar observation. Biochemical data revealed that 64% of patients had elevated CRP levels and 61% had elevated total leukocyte counts. CRP was not substantially linked with meningitis. The results of earlier research by Fredrick DS et al[3], showed that the mean CRP was 54.4±38.6 and that meningitis was not substantially associated with it.

CONCLUSION

LC is a considered as gold standard treatment for gall stones however, it is associated with complications like BDI. All patients with suspicion or with diagnosis of BDI must be referred to a specialist center for appropriate management. The treatment of BDI is complex and failure of treatment may cause secondary biliary cirrhosis and liver failure.

REFERENCES

1. 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(9):786-94. DOI:10.1016/j.hpb.2018.03.004.
2. Balla A, Quaresima S, Corona M, Lucatelli P, Fiocca F, Rossi M, et al. ATOM Classification of Bile Duct Injuries During Laparoscopic Cholecystectomy: Analysis of a Single Institution Experience. J Laparoendosc Adv Surg Tech A. 2019;29(2):206-12.DOI:10.1089/lap.2018.0413.
3. Barazanchi AWH, MacFater WS, Rahiri JL, Tutone S, Hill AG, Joshi GP, et al. Evidence-based management of pain after laparoscopic cholecystectomy: a PROSPECT review update. Br J Anaesth. 2018;121(4):787-803. DOI:10.1016/j.bja.2018.06.023.
4. Booij KAC, Coelen RJ, de Reuver PR, Besselink MG, van Delden OM, Rauws EA, et al. Long-term follow-up and risk factors for strictures after hepaticojejunostomy for bile duct injury: An analysis of surgical and percutaneous treatment in a tertiary center. Surgery. 2018;163(5):1121-27. DOI:10.1016/j.surg.2018.01.003.
5. Cheng K, You J, Wu S, Chen Z, Zhou Z, Guan J, et al. Artificial intelligence-based automated laparoscopic cholecystectomy surgical phase recognition and analysis. Surg Endosc. 2022;36(5):3160-68. DOI:10.1007/s00464-021-08619-3.
6. Dip F, Lo Menzo E, White KP, Rosenthal RJ. Does near-infrared fluorescent cholangiography with indocyanine green reduce bile duct injuries and conversions to open surgery during laparoscopic or robotic cholecystectomy? - A meta-analysis. Surgery. 2021;169(4):859-867. DOI:10.1016/j.surg.2020.12.008.
7. Loozen CS, van Santvoort HC, van Duijvendijk P, Besselink MG, Gouma DJ, Nieuwenhuijzen GA, et al. Laparoscopic cholecystectomy versus percutaneous catheter drainage for acute cholecystitis in high risk patients (CHOCOLATE): multicentre randomised clinical trial. BMJ. 2018;363:k3965. DOI:10.1136/bmj.k3965.
8. Lyu Y, Cheng Y, Li T, Cheng B, Jin X. Laparoscopic common bile duct exploration plus cholecystectomy versus endoscopic retrograde cholangiopancreatography plus laparoscopic cholecystectomy for cholecystocholedocholithiasis: a meta-analysis. Surg Endosc. 2019;33(10):3275-86. DOI:10.1007/s00464-018-06613-w.
9. Madani A, Namazi B, Altieri MS, Hashimoto DA, Rivera AM, Pucher PH, et al. Artificial Intelligence for Intraoperative Guidance: Using Semantic Segmentation to Identify Surgical Anatomy During Laparoscopic Cholecystectomy. Ann Surg. 2022;276(2):363-69. DOI:10.1097/SLA.0000000000004594.
10. Mangieri CW, Hendren BP, Strode MA, Bandera BC, Faler BJ. Bile duct injuries (BDI) in the advanced laparoscopic cholecystectomy era. Surg Endosc. 2019;33(3):724-730. DOI:10.1007/s00464-018-6333-7.
11. Mascagni P, Alapatt D, Urade T, Var-

dazaryan A, Mutter D, Marescaux J, et al. A Computer Vision Platform to Automatically Locate Critical Events in Surgical Videos: Documenting Safety in Laparoscopic Cholecystectomy. Ann Surg. 2021;274(1):e93-e95. DOI:10.1097/SLA.0000000000004736.

12. Michael Brunt L, 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. Surg Endosc. 2020;34(7):2827-55. DOI:10.1007/s00464-020-07568-7.
13. Zhong FP, Wang K, Tan XQ, Nie J, Huang WF, Wang XF. The optimal timing of laparoscopic cholecystectomy in patients with mild gallstone pancreatitis: A meta-analysis. Medicine (Baltimore). 2019;98(40):e17429. DOI:10.1097/MD.0000000000017429.
14. Wang X, Yu WL, Fu XH, Zhu B, Zhao T, Zhang YJ. Early Versus Delayed Surgical Repair and Referral for Patients With Bile Duct Injury: A Systematic Review and Meta-analysis. Ann Surg. 2020;271(3):449-59. DOI:10.1097/SLA.0000000000003448.
15. Schreuder AM, Busch OR, Besselink MG, Ignatavicius P, Gulbinas A, Barauskas G, et al. Long-Term Impact of Iatrogenic Bile Duct Injury. Dig Surg. 2020;37(1):10-21. DOI:10.1159/000496432.

Author's Contribution

MH, MI and FH conceived the idea, designed the study and wrote the manuscript and gave final approval. AAM, AS and MA contributed in data collection and drafted the manuscript. Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

Authors declared no conflict of interest

Grant Support and Financial Disclosure

None

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.