

Surgical Audit of Common Bile Duct Injury During Laparoscopic Cholecystectomy in Tertiary Care Center

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ABSTRACT

Objective: The current study conducted a surgical evaluation of laparoscopic cholecystectomy in a tertiary care hospital.

Methods: A descriptive retrospective study was conducted at the department of surgery, JPMC between dates. All cases of patients who were above 18 years, had cholecystitis or cholelithiasis, and underwent cholecystectomy between 1st January 2013 and 31 December 2014 at Jinnah Postgraduate Medical Center were included. Only cases with complete history, examination and investigations were included. Cases with incomplete information were excluded. Sociodemographic information such as age and gender, clinical information related to biliary duct injury (BDI), causes of BDI, and risk factors for BDI were included in the study. Data was entered and analyzed using SPSS version 21. The findings were narrated in tabulated form.

Result: A cumulative count of 21 bile duct injuries (BDIs) was documented, leading to an overall occurrence rate of 3.1%. Most patients (76.2% or 16 individuals) had significant injuries that affected the common bile duct (CBD), main biliary confluence, or main bile ducts. A total of 5 patients, accounting for 23.8% of the cases, had modest injuries that specifically impacted the cystic duct or smaller peripheral or Luschka ducts. The cause of the BDI was diagnosed in 71.4% of instances. Inadequate identification of anatomical features associated with the hepatic pedicle, comprising 33.3% of reported cases, was the most frequently cited cause. Subsequently, it was observed that inflammatory alterations in the gallbladder constituted 26.7% of the cases, while anatomical anomalies accounted for 13.3%. Similarly, the inappropriate application of monopolar coagulation was responsible for an additional 13.3% of the cases. Furthermore, undefined technical errors and challenges encountered during intraoperative hemorrhage management were each attributed to 6.7% of the cases.

Conclusion: The present study revealed bile duct injury to be a serious and prevalent complication of laparoscopic cholecystectomy in our center. Therefore, further assessment should be taken in order to avoid occurrence of BDI in patients presenting to the public tertiary care hospitals.

Keywords: Surgical audit, minimal invasive surgery, laparoscopic cholecystectomy, preoperative complications, postoperative complications, conversion to open cholecystectomy.

INTRODUCTION

Bile duct injury (BDI) is a highly uncommon but extremely dangerous occurrence that can happen due to undergoing cholecystectomy, the surgical removal of the gallbladder. This unfortunate event poses a serious threat to one's life and substantially raises the chances of experiencing severe complications during recovery. Moreover, BDI also leads to a significant increase in medical expenses associated with the subsequent treatment required to address this serious medical issue [1]. It has been anticipated that there will be 0.8 cases of bile duct blockage (BDI) for every 1000 cholecystectomies [2, 3]. The primary cause of biliary duct damage (BDI) after cholecystectomy is the incorrect identification of the cystic duct as either the common bile duct, the common hepatic duct, or an aberrant hepatic duct (often located on the right) [4]. This injury arises as a consequence of the incorrect use of metallic clips and prolonged exposure to elevated temperatures.

Numerous industrialized and western nations, particularly the United States, have performed research to assess the prevalence (the proportion of surgeons with a BDI to the total number of surgeons doing LC) [6]. Several studies have been conducted in high-income nations such as Canada [7], Italy [8], Sweden [9], the United Kingdom [10], Japan, Korea, and Taiwan [11]. However, more research is needed from low- and middle-income countries like India. A surgical audit was undertaken within our department to evaluate the prevalence of Common bile duct injury in tertiary care centers after Laparoscopic cholecystectomy.

METHODS

The Department of Surgery at JPMC thoroughly examined past events, specifically focusing on a particular period in time. This retrospective investigation was only initiated once the institutional review board at JPMC granted ethical authorization, ensuring that

all research protocols and standards were met. Since this study solely relied on historical data and did not involve human participants or specimens, the IRB determined that seeking further ethical approval was unnecessary.

All cases of patients who were above 18 years, had cholecystitis or cholelithiasis, and underwent cholecystectomy between 1st January 2013 and 31 December 2014 at Jinnah Postgraduate Medical Center were included. Only cases with complete history, examination and investigations were included. Cases with incomplete information were excluded.

Sociodemographic information such as age and gender, clinical information related to biliary duct injury (BDI), causes of BDI, and risk factors for BDI were included in the study. SPSS version 21 was utilized for the input and examination of data. After the data were tallied and presented, the following step was to display them in such a way as to promote an all-encompassing knowledge of the findings.

RESULTS

The survey collected 678 LCs from a tertiary care unit during the study period.

Incidence of Biliary Duct Injury: A total of 21 Biliary Duct Injuries (BDIs) were documented, resulting in an overall occurrence rate of 3.1%. Most of these injuries involving the common bile duct (CBD), main biliary confluence, or main bile ducts were classified as major injuries and were observed in 76.2% (16) of the patients. On the other hand, minor injuries affecting the cystic duct or smaller peripheral or Luschka ducts were reported in 23.8% (5) of the patients.

The incidence rate for significant injuries was found to be 2.4%, with individual units varying from 0% to 3.75%. Notably, 68.8% (11/16) of the units reported at least one injury.

Table 01:

Laparoscopic cholecystectomies	678
Bile Duct Injuries reported	21 (3.1%)
Major injuries	16 (76.2%)
Minor injuries	5 (23.8%)

Causes and mechanisms of BDI: A study conducted to investigate the causes of bile duct injuries (BDI) found that the etiology could be determined in 71.4% of cases involving 15 patients. The most frequently reported cause was a lack of proper identification of the hepatic pedicle's anatomical structure, accounting for approximately one-third (33.3%) of all cases. This was followed by inflammation in the gallbladder (26.7%), irregularities in anatomical characteristics (13.3%), improper use of monopolar coagulation (13.3%), an unspecified technical error (6.7%), and complications during intraoperative hemorrhage control (6.7%). It is worth noting that technical errors, which include the latter three causes mentioned, collectively contributed to 26.7% of all identified injuries. Furthermore, when considering the complexity level of the surgical procedure at the time of injury occurrence, it was classified as easy in 10 cases (47.6%) and challenging in 11 cases (52.4%). Importantly, this distribution did not significantly alter the number of laparoscopic cholecystectomies performed during this specific study period.

Table 02:

Causes of BDI	
Poor identification of hepatic pedicle	5 (23.8%)
Inflammatory changes in gallbladder	4 (19.1%)
anatomical anomalies	2 (9.5%)
improper use of monopolar coagulation	2 (9.5%)
unspecified technical mistake	1 (4.8%)
problem during the control of intraoperative hemorrhage	1 (4.8%)
indeterminate	6 (28.6%)

Risk factors for biliary duct injury: Out of the 16 cases (76.2%) examined, no reported risk factors were associated with the patient. Only 5 cases (23.8%) presented with identified risk factors: obesity in 3 cases (14.3%), previous abdominal surgery in 1 case (4.8%), and cirrhosis in 1 case (4.8%). It is important to note that cholecystitis was found to be an associated risk factor in 3 out of these 5 cases.

Table 03:

Risk factors	
Obesity	3 (14.3%)
Previous abdominal surgery	1 (4.8%)
Cirrhosis	1 (4.8%)
No risk factor reported	16 (76.2%)

Out of the 21 cases of bile duct injuries, laparoscopic cholecystectomies were conducted for simple cholelithiasis in 10 (47.6%) cases and for cholecystitis in 11 (52.4%) cases. Among the patients, 415 (61.2%) underwent laparoscopic cholecystectomies for simple cholelithiasis and 263 (30.8%) for cholecystitis. The occurrence of injuries was observed in 2 (0.48%) patients from the former group and in 2 (0.76%) patients from the latter group ($P < 0.001$).

DISCUSSION

Bile duct damage is a serious complication that can arise from laparoscopic cholecystectomy. This type of injury can result in various unfavorable outcomes, including prolonged hospitalization, heightened medical expenses, and the need for further surgical intervention. According to Eaupanitcharoen's research, bile duct injury was identified in 1.32% of the 1,437 individuals studied. It was found that this injury occurred more frequently during laparoscopic cholecystectomy compared to open cholecystectomy. The majority of patients with bile duct damage were detected during or within two weeks of surgery. Among the patients with

BDI, the mean cost of therapy was significantly greater than in the non-injury group, as was the length of hospital stay [12]. In an investigation by Sharma et al., an e-survey of 18 questions was administered to practicing laparoscopic surgeons in India. Despite sufficient surgeon experience and volume, the prevalence of BDI during laparoscopic procedures was significant [13]. Even novice non-biliary surgeons at non-biliary centers attempt to repair the BDI on their own. 38% of the 727 surgeons surveyed answered. 86% of respondents reported having a BDI during LC, with 78% admitting to many BDIs. 728 BDIs were reported in total. 15% of responders had their first BDI after >10 years of practice, and 40% had their first BDI after performing >100 LCs. These numbers show the prevalence of BDI among surgeons with advanced training. In a study by Eslami et al., 64 patients who had experienced bile duct injury after undergoing cholecystectomy were examined. These patients were referred to Shafa Hospital in Tehran, Iran, over the period from 2010 to 2019 [14]. The research highlights that cases of delayed referral caused by significant challenges, extended patient involvement, and the need for additional surgery can result in considerable financial hardships for the patient. In a study evaluating bile duct injury in 30 cholecystectomy patients, Chiche et al. found that many of them needed liver transplantation surgery, which has a low success rate [15]. Iatrogenic bile duct injury (BDI) is a persistent concern with severe complications. These complications include vascular harm and cirrhosis. Liver transplantation is the only treatment option in these cases, but it has a high incidence of illness and less-than-ideal results.

In contrast, Schwartz and colleagues conducted a study to decrease the occurrence of BDI and found that laparoscopic partial cholecystectomy is a reasonable surgical strategy for mitigating bile duct injury. In these challenging instances, subtotal cholecystectomy offers tolerable morbidity and eliminates the need for conversion [16]. 53 patients had laparoscopic subtotal cholecystectomy performed (2010-2018). Ten individuals underwent surgery during the acute phase of the condition, and 43 underwent elective surgery. The primary reason for gallbladder removal was acute cholecystitis. During acute hospitalization, cholecystostomy tubes were inserted in 18 individuals. Therefore, the completion of cholecystectomy in a safe manner is contingent on the accurate diagnosis and secure closure of the cystic duct. There does not appear to be a preponderance of perioperative problems among the published reports. Because laparoscopic surgery offers so many advantages, it is surely here to stay. The research population consisted of the 375 patients who underwent primary laparoscopic cholecystectomy. According to a study, individuals over the age of 60, classified as ASA class 3, experiencing complicated gallstones that necessitate a lengthier surgical procedure and exhibit intraoperative observations of thickened gallbladder walls, as well as perforations of the gallbladder, have been found to be significantly associated with extended hospital stays in two separate investigations involving patients undergoing laparoscopic cholecystectomy [17]. This study's limitations include the retrospective nature of the research, but the data were collected from a prospectively kept database. Secondly, like earlier research, the sample size is modest due to the rarity of the occurrences. The small sample size resulted in a significant 95% confidence interval for our primary outcome. However, without the utilization of a national database or multi-institutional collaboration, it is unclear that greater sample sizes could be attained.

The findings of this study indicate that bile duct injury (BDI) is frequently observed after laparoscopic cholecystectomy, regardless of the surgeon's qualification. To prevent such complications, it is advised to promptly refer and treat cases of BDI resulting from laparoscopic surgery and ensure proper cystic duct closure. However, due to the absence of a national registry for laparoscopic cholecystectomy in Pakistan and its subsequent consequences, it is challenging to accurately determine the incidence rate of bile duct damage (BDI).

CONCLUSION

In our center, it has been found that bile duct injury is a significant and widespread complication of laparoscopic cholecystectomy, as evidenced by the current study. Therefore, further assessment should be taken in order to avoid the occurrence of BDI in patients presenting to public tertiary care hospitals.

REFERENCES

1. K.A. Kern. Malpractice litigation involving laparoscopic cholecystectomy. Cost, cause, and consequences. *Arch Surg*, 132 (1997), pp. 392-397
2. B. Törnqvist, C. Strömberg, G. Persson, M. Nilsson Effect of intended intraoperative cholangiography and early detection of bile duct injury on survival after cholecystectomy: population based cohort study *BMJ*, 345 (2012), p. e6457
3. P.J. Worth, T. Kaur, B.S. Diggs, B.C. Sheppard, J.G. Hunter, J.P.M Dolan ajor bile duct injury requiring operative reconstruction after laparoscopic cholecystectomy: a follow-on study *Surg Endosc*, 30 (5) (2016), pp. 1839-1846
4. S.M. Strasberg Biliary injury in laparoscopic surgery: part 2. Changing the culture of cholecystectomy *J Am Coll Surg*, 201 (4) (2005), pp. 604-611
5. Archer SB, Brown DW, Smith CD, Branum GD, Hunter JG. 2001; Bile duct injury during laparoscopic cholecystectomy: results of a national survey. *Ann Surg*. 234:549–558. discussion 558-559. DOI: 10.1097/0000658-200110000-00014. PMID: 11573048. PMCID: PMC1422078.
6. Francoeur JR, Wiseman K, Buczkowski AK, Chung SW, Scudamore CH. 2003; Surgeons' anonymous response after bile duct injury during cholecystectomy. *Am J Surg*. 185:468–475. DOI: 10.1016/S0002-9610(03)00056-4. PMID: 12727569.
7. Nuzzo G, Giuliani F, Giovannini I, Ardito F, D'Acapito F, Vellone M, et al. 2005; Bile duct injury during laparoscopic cholecystectomy: results of an Italian national survey on 56 591 cholecystectomies. *Arch Surg*. 140:986–992. DOI: 10.1001/archsurg.140.10.986. PMID: 16230550.
8. Rystedt J, Lindell G, Montgomery A. 2016; Bile duct injuries associated with 55,134 cholecystectomies: treatment and outcome from a national perspective. *World J Surg*. 40:73–80. DOI: 10.1007/s00268-015-3281-4. PMID: 26530691.
9. Gordon-Weeks A, Samarendra H, de Bono J, Soonawalla Z, Silva M. 2017; Surgeons opinions of legal practice in bile duct injury following cholecystectomy. *HPB (Oxford)*. 19:721–726. DOI: 10.1016/j.hpb.2017.04.012. PMID: 28526400.
10. Iwashita Y, Hibi T, Ohyama T, Umezawa A, Takada T, Strasberg SM, et al. 2017; Delphi consensus on bile duct injuries during laparoscopic cholecystectomy: an evolutionary cul-de-sac or the birth pangs of a new technical framework? *J Hepatobiliary Pancreat Sci*. 24:591–602. DOI: 10.1002/jhbp.503. PMID: 28884962.
11. Eaupanitcharoen S. Bile duct Injury During Cholecystectomy: Audit of 1,437 Laparoscopic and Open Cholecystectomy. *SRIMEDJ [Internet]*. 2019 Mar. 29 [cited 2022 Sep. 28];34(2):134-8. Available from: <https://ii01.tci-thaijo.org/index.php/SRIMEDJ/article/view/181003>
12. Sharma S, Behari A, Shukla R, Dasari M, Kapoor VK. Bile duct injury during laparoscopic cholecystectomy: An Indian e-survey. *Ann Hepato-biliary Pancreat Surg*. 2020 Nov 30;24(4):469-476. Doi: 10.14701/ahbps.2020.24.4.469. PMID: 33234750; PMCID: PMC7691207.
13. Eslami S, Abedini L, Nouri NV, Rabiee M, Samani MK. Bile duct injury outcomes following cholecystectomy: a cross sectional study. *Am J Clin Exp Immunol*. 2020; 9(3):53-57.
14. Chiche L, Guieu M, Bachellier P, Suc B, Soubrane O, Boudjema K, Navarro F, Adam R, Vaillant JC, Salame E, Heyd B, Truant S, Adam JP, Laurent C. Liver transplantation for iatrogenic bile duct injury during cholecystectomy: a French retrospective multicenter study. *HPB (Oxford)*. 2022 Jan;24(1):94-100. doi: 10.1016/j.hpb.2021.08.817. Epub 2021 Aug 14. PMID: 34462215.
15. Shwaartz C, Pery R, Cordoba M, Gutman M, Rosin D. Laparoscopic Subtotal Cholecystectomy for the Difficult Gallbladder: A Safe Alternative. *Isr Med Assoc J*. 2020 Sep;22(9):538-541. PMID: 33236550
16. Chong JU, Lee JH, Yoon YC, et al. Influencing factors on postoperative hospital stay after laparoscopic cholecystectomy. *Korean J Hepatobiliary Pancreat Surg*. 2016;20(1):12-16. doi:10.14701/kjhbps.2016.20.1.12