INO TECH
Inspiring Technologies and Innovations

Inspiring Technologies and Innovations

June 2025, Volume: 4 Issue: 1

Research Article

The Effect of Laparoscopic Devices on Cholecystectomy Surgeries

Hasan Zafer ACAR[a], Abdullah ÖZDEMİR[b]

[a,b]A Life North Ankara Hospital General Surgery Department, Ankara, TÜRKİYE

ORCID[a]: 0000 0001 6435 8720
ORCID[b]: 0000 0002 7587 9457
Corresponding Author e-mail: hzacar@gmail.com

https://doi.org/10.5281/zenodo.15745061

Received	: 01.02.2025	Accepted	: 20.05.2025	Pages	: 18-24

ABSTRACT: Laparoscopic devices have had significant effects in many areas of surgery, and have also greatly affected gallbladder surgeries. Aim and method: For these reasons, to investigate the effect of laparoscopic devices on bile duct injuries and surgical treatment; articles published on this subject were analyzed and evaluated in our study. As a result of our study, it was shown that providing safe surgical conditions, making the bile ducts visible before surgery, and performing these surgeries by experts in hepatobiliary surgery can significantly reduce BDI rates with laparoscopic devices. In addition, early surgical intervention, Roux en-Y hepatobiliary anastomosis technique in major injuries, and laparoscopic and robotic surgery can provide more successful results with 3D imaging in bile duct injuries. Conclusion: According to the results of our study; laparoscopic devices have led to exciting developments in cholecystectomy surgeries. Since the abdominal wall is not opened, surgery times have been significantly shortened and excellent cosmetic results have been obtained. On the other hand, since 3D vision cannot be provided with this method, there has been an increase in the incidence of serious complications such as bile duct injuries. Therefore, it would be more appropriate to use safe surgical methods in laparoscopic cholecystectomies.

KEYWORDS: Laparoscopic devices, cholecystectomy, bile ducts, injury.

ÖZET: Laparoskopik cihazlar cerrahide birçok alanda önemli etkiler yarattığı gibi, safra kesesi ameliyatlarınıda büyük ölçüde etkilemiştir. Amaç ve Yöntem: Bu nedenlerle çalışmamızda laparoskopik cihazların safra yolu yaralanmaları ve cerrahi tedavisi üzerindeki etkilerini araştırmak amacıyla bu konuda yayınlanmış makaleler analiz edilmiş ve değerlendirilmiştir. Çalışmamızın sonucunda güvenli cerrahi koşulların sağlanması, safra yollarının ameliyattan önce görünür hale getirilmesi ve bu ameliyatların hepatobiliyer cerrahi konusunda uzman kişiler tarafından yapılmasının laparoskopik cihazlarla BDI oranlarını önemli ölçüde azaltabileceği gösterilmiştir. Ayrıca erken cerrahi müdahale, majör yaralanmalarda Roux en-Y hepatobiliyer anastomoz tekniği ve laparoskopik ve robotik cerrahi safra yolu yaralanmalarında 3 boyutlu görüntüleme ile daha başarılı sonuçlar elde edilebildiği ortaya konulmuştur. Değerlendirme: Yaptığımız çalışmanın sonuçlarına göre; laparoskopik cihazlar kolesistektomi ameliyatlarında heyecan verici gelişmelere yol açmıştır. Karın duvarı açılmadığı için ameliyat süreleri önemli ölçüde kısalmış ve mükemmel kozmetik sonuçlar elde edilmiştir. Öte yandan bu yöntemle 3 boyutlu görüş sağlanamadığı için safra yolu yaralanmaları gibi ciddi komplikasyonların görülme sıklığında artış olmaktadır. Bu nedenle laparoskopik safra kesesi ameliyatlarında güvenli cerrahi yöntemlerin kullanılması daha doğru olacaktır.

ANAHTAR KELİMELER: Laparoskopik cihazlar, kolesistektomi, safra yolları, yaralanma.

1. INTRODUCTION

Professor Muko of Boblingen performed Laparoscopic Cholecystectomy (LC) for the first time on a patient in Germany in 1985 and opened a new era in hepatobiliary surgery [1]. Thus, cholecystectomy surgeries began to be performed much more quickly than open surgery, without opening the abdominal wall, and with excellent cosmetic results. After this fantastic new surgical method by Boblingen, LC was predominantly applied in cholecystectomy surgeries and complications of different nature and rates began to occur compared to open cholecystectomy (OC).

In today's world, approximately 500,000 LC surgeries are performed each year. As a result, complications such as bile duct injuries (BDI), vascular injuries [2,3,4], stone formation in the cystic duct stump, intestinal injuries [3], lymphatic injuries [5], and bilioma formation [6] may occur, which can sometimes result in death. Despite this, the prevalence of laparoscopic methods in cholecystectomies has significantly decreased the incidence of some complications such as postoperative hernia and wound infection [3]. Since BDI is still the most common complication in LC operations, the effects of LC on BDI and surgical treatment were reviewed in our study.

2. EFFECTS OF LAPAROSCOPIC CHOLECYSTECTOM ON BILE DUCT INJURIES

The most important technical difference in LC operations compared to OC is that the vision during the operation is 2-dimensional rather than 3-dimensional, and there is no depth vision. Therefore, the risk of trauma is higher in all kinds of manipulations performed in the abdomen. Although morbidity and mortality rates can be significantly reduced with LC compared to OC, a significant decrease in BDI rates has not been achieved despite the many years that have passed (Table 1) [3,7,8,9,10, 11,12]. This may be due to the lack of 3-D vision in LC surgeries. BDI incidences according to the results of studies by some authors, in LC and OC operations are shown in (Table 1).

Table 1. BDI incidences according to the results of studies by some authors, in LC and OC operations.

Author	Ref. No	Number of cases	OC*	LC*	BDI*** Incidence
Deziel	3	77.604		+	0.6
Reinso	7	29.739		+	0.81
Tantia	17	13.305		+	0.39
Elser	10	769.792		+	0.1
Gutierrez	11	387.501		+	0.2
Barret	24	319.184		+	0.23
Tangarona	37	1.630		+	0.95
Tangarona	37	3.054	+		0.6
Roslyn	15	42.474	+		0.02

OC* : Open cholecystectomy
LC** : Laparoscopic cholecystectomy
BDI***: Bile duct injury

Emara et al. reported in a study that BDIs are seen at a higher rate in LCs than in OCs [13]. In a study conducted by Deziel in 1993 in US, the BDI incidence was found to be 0.6% in 77,604 LC cases [3]. In a study conducted by Reinso et al. on 29,739 LC cases, the overall BDI incidence was found to be 0.81%, minor injuries 0.68%, and major injuries 0.13%(Table 1) [7]. In a study conducted by Kaman et al., it was reported that the mechanism and extent of major BDIs in LC and OC were different, but the clinical findings and BDI level were the same [14]. In a study conducted by Roslyn et al. on 42,474 cases who underwent OC, the incidence of BDI was 0.02% and overall mortality was 0.17% [15]. The authors reported that the mortality rate was related to the duration of hospitalization, age of the patients, admission status (elective, urgency emergent) and the status of the disease. In a study conducted by Doğan et al., it was reported that morbidity and mortality rates were high in BDI cases that underwent reconstruction, and also quality of life decreased for many years after treatment [16]. A study conducted by Tantia et al. analyzed 13,305 LC cases performed by a single center and single surgeon team. BDI was detected in 52 (0.39%) cases. Intraoperative diagnosis was made in 32% (0.24) of these cases and postoperative diagnosis was made in 20 cases. There was no mortality. The authors reported that LC is as safe a method as OC when performed in accordance with safe surgical standards (Table 1) [17]. In a study conducted by Zanghami et al. in Iran, the most commen symptoms of BDIs are fever, jaundice, pain, and pruritus were reported. It has been stated that the most important laboratory findings are increased bilirubin level, leukocytosis and increased liver function tests [18].

In a multicenter analytical study by Moldovan et al. revealed 108 BDI and vascular injury in 16,559 LC cases. A clinical and surgical algorithm was generated for management in iatrogenic BDI cases (Table 1) [2]. In a study conducted by Deziel and colleagues published in the same year, 1.2% of 77,604 cases undergoing LC were converted to OC, and BDI was seen in 0.6% of cases [3]. Elser and colleagues stated the BDI rate as 0.1% in a large LC series of 769,792 cases [10]. According to the results obtained in the same study, it was reported that mortality increased in cases with biliary colic, obesity, pancreatic and chronic liver disease, and choledochal injuries, and costs decreased in operations performed on the same day. They stated that USG and contrast-enhanced MRI are safe and effective in diagnosis and endoscopic management in BDIs. In a study by Gutierrez et al., it was reported that BDI was seen in 0.2% of 387,501 LC cases [11]. The authors determined that acute cholecystitis, obesity and steatohepatitis constitute the lethal triad in LCs. They reported that the BDI rate increased to 1.49% in cases with lethal triad and was 0.09% in other cases and lethal triad is an independent risk factor according to the results of multivariate analysis. In a study conducted by Indal and colleagues, it was reported that LC operations should be performed by hepatobiliary specialists, and that BDI rates can be reduced when safe LC is performed using methods such as B SAFE strategy, R4U line, Bail-out [19]. Seshadri and colleagues reported in a study that the most important risk factors leading to BDIs are anatomical variations of the bile ducts, and therefore, in difficult cholecystectomies, a subtotal or top-down cholecystectomy technique should be performed to avoid the risky hepatocystic triangle [20].

Acute cholecystitis is one of the most important risk factors for the occurrence of BDI in LC operations. For this reason, many authors have reported that acute cholecystitis cases should be classified as difficult cholecystectomy and safe cholecystectomy methods should be performed during the operation [11, 20, 21, 22,23]. In a study conducted by Ali et al., it was reported that 70% of 37 BDI cases underwent LC and 29.7% underwent OC, and one case with bile leakage and bilioma formation was treated with endoscopic percutaneous intervention [6]. Some studies have reported lower BDI incidence in LC operations.

In a study conducted in the USA by Barnett et al., it was reported that BDI was seen in 741 cases (0.23%) in a LC series of 319,184 cases [24]. Some authors explain the low BDI rates by the fact that LC is a more minimally invasive procedure [25]. In a study conducted by Lopez et al., they aimed to define a Textbook Outcomes (TO) to determine the ideal treatment of BDIs and collected data from 27 patients between 1990 and 2022. TO results were obtained in 394 of the 508 patients included in the study. Complication rates were determined as 11.9% in the TO group and 8% in the non-TO group. Based on these results, they reported that TO largely depends on where the BDI is treated and the type of wound [26]. In a study conducted by Symeonidis et al., they formed a new classification (BILE Classification) and algorithm for better management of iatrogenic BDIs. They reported that this practical classification and treatment algorithm was more effective in BDI management [8]. In a study conducted by Cai et al., in which fluorescence cholangiography was used to prevent BDIs in LCs, patients were divided into two groups; indocyanine was given intraglandularly to the the first group (Group A) and intravenously to the second group (Group B). At the end of the study, it was reported that the operative time was shorter in the group A and preoperative diagnosis was made more easily [27]. It was also determined that no fluorescence was observed in the group B, if there was an impacted stone. In a study conducted by Symeonidis et al., a randomized controlled standard cholangiography and indocyanine green fluorescence cholangiography were compared for biliary anastomosis visualization and the results were reported to be the same [28]. In a study conducted by Edebo et al., they compared the effects of intraoperative laparoscopic USG and intraoperative cholangiography to increase biliary tract visualization in LC. According to the findings obtained at the end of the study, no significant difference was found between the two methods in of mortality, BDI incidence, and retarded gallstone. However, the rate of conversion to OC was found to be lower in cases with laparoscopic USG, probably due to the shorter imaging period [29]. In a study conducted by Freesmeyer et al., it was reported that (68Ga) Ga-TES-DAZA and PET-CT were effective methods for localization of biliary leakage when BDI occurred in cases undergoing LC [30].

Critical View of Safety (CVS) can significantly reduce BDI rates in LC cases. In a study conducted by ACB Blitzikov, it was shown that the application of the method described by Strasberglin was effective in preventing significant complications in LCs [31]. According to some authors' studies, BDI rates in cases with and without CVS are shown in (Table 2).

Table 2. BDI rates in cases with and without CVS in some authors' studies.

Author	Ref. No	CVS* LC**	NON- CVS LC	BDI*** rate %
Klos	35	+		0.06
Bansal	33	+		0.05
Singh	32	+		0
Singh	32		+	2
Deziel	3		+	0.6

CVS* : Critical view of safety.
LC** : Laparoscopic cholecystectomy
BDI*** : Bile duct injury

In a study conducted by Singh et al., the effect of CVS on preventing BDI in LCs was investigated. As a result of the study, CVS was achieved in 14 out of 100 LC cases. It was reported that in all of these cases, the hospitalization period was long, 12 of them were converted to OC, and BDI occurred in 2% of the cases (Table 2) [32]. In a study conducted by Bansal et al., CVS was performed under proctored preceptorship in 3726 LC cases. It was shown that major BDI could be reduced to rates as low as 0.05% with this method(Table 2)[33].In a prospective study conducted by Ortenzi et al., patient groups who underwent intraoperative cholangiography using white light for CVS were compared, and it was determined that the most effective method for CVS was near-infrared fluorescence cholangiography[34].In a study conducted by Klos et al., it was shown that BDI occurred in 186 out of 76,345 cholecystectomies in the Czech population (0.24%). LC was performed in 0.84.7% of these cases and OC in 15.3%. BDI occurred in 0.06% of LC cases that underwent CVS and in 1.28% of OC cases. According to the results of the study conducted by the authors, it was reported that BDI rates were very low in LCs performed in accordance with CVS standards (Table 2) [35]. In a study conducted by Manal et al., it was reported that the average age of 60 BDI cases seen after LC was 45 years and 75% of the cases were female [36]. It was stated that the most important symptoms in these cases were jaundice, abdominal pain and bile discharge and the most appropriate methods for imaging were magnetic resonance cholangiopancreatography. It was reported that the most frequently performed operations were Roux en-Y choledochojeumostomy, choledochoduodenostomy, and primary suture with T tube. Bile leakage (10%), wound infection (15%) and recurrent cholangitis (5%) occurred as complications.

In a prospective study conducted by Tangarona et al., patients were divided into 2 groups; LC surgeries were performed in one group and OC surgeries were performed in the other group. According to the results of the study, BDI rates were higher in the LC group [37].

3. EFFECTS OF LAPAROSCOPIC SURGERY ON SURGICAL TREATMENT OF BILE DUCT INJURIES

Laparoscopic and robotic surgery have also had significant effects on the surgical treatment of BDI cases. In a study conducted by Cai et al., it was stated that the place of endoscopic management in BDIs is increasing. It has been reported that applications such as endoscopic duodenal papillary sphincteromy, endoscopic hepatobiliary drainage, and endoscopic biliary stent implantation have a significant effect on the surgical treatment of BDIs occurring in LCs [23]. In a study conducted by Yang et al., early surgical repair (average 14.2 days) was performed with 3D visualization technique in 15 cases with BDI. Roux-en-Y anastomosis and hepaticojejunostomy were performed in all cases. The average operation time was 156.4 minutes, and the average hospitalization time was 16 days. Mild bile leakage was observed in one case, which healed with conservative treatment. The patients were followed up for an average of 34 months and no complications such as stone formation or anastomotic stenosis were observed [38]. This study demonstrated the importance of 3D vision in surgical treatment when BDI occurs in LCs. In a study conducted by Petkov et al., in the last 10 years, minimally invasive interventions were performed with endoscopy and interventional radiology in 30 cases with BDI, and the cases were treated with zero mortality. Therefore, the importance of multidisciplinary intervention in BDI cases was emphasized [25].

In a study conducted by Cubisina et al., it was reported that safe and effective repair can be performed with minimally invasive robotic surgery in BDI injuries occurring in LCs [39]. In a study conducted by Raysan et al., bile ducts reconstruction was performed with robotic surgery in 33 patients with BD injuries [40]. The average operation time was 272 minutes and the average hospital stay was 4 days. The patients were followed up for an average of 33 days. Only one case underwent revision due to stricture. No other complications were observed in any of the patients. Mortality was zero. According to the results of the study, it was reported that robotic surgery reconstruction is an effective and safe method when BDI occurs in LCs.
Some articles reporting that choledochal injuries are more common in robotic cholecystectomies than in OC. In a retrospective study by Dicken et al., it was reported that common bile duct injuries were significantly more common in robotic cholecystectomies than in LCs [41].

In a study conducted by Montalvo-Save et al., the main bile ducts were replaced with bioprostheses in 16 male pigs. During the 24-month follow-up period, liver function tests and epithelialization were found to be normal, and bile flow continued normally. The authors reported that reconstruction with bioprosthesis in BDIs may be safe and effective [42].

In a study conducted by Chance et al., tips were given and tricks were emphasized to prevent BDI in LCs [43]. It was stated that obesity, liver cirrhosis, duration and severity of cholecystitis, anatomical variation, surgeon experience and comorbidity were the most important risk factors. It was reported that Rouvieners Sulcus, segment 4, umbilical fissure line were important anatomical markers for safe dissection in order to reduce BDI rates. It was emphasized that dissection in the hepatocystic triangle was risky and that the surgeon should convert to subtotal cholecystectomy or OC when necessary. According to the results of their study, there was a shorter hospitalization time in cases with robotic biliary anastomosis (36.1%) compared to those with laparoscopic anastomosis (63.1%) and no case was converted to OC, while OC was converted to 4 of the cases with laparoscopic anastomosis. It was observed that morbidity was similar in both groups. In a study conducted by Blohm et al. on 154,937 cholecystectomy cases, it was revealed that BDI rates were affected by the number of surgeries performed by the surgeon. The incidence of BDI was found to be higher in low-volume surgeons [44].In a study conducted by Tinoco et al., it was reported that laparoscopic hepaticojejunostomy is an effective treatment method with low complication rates in cases with total circumferential BDI injury[45]. It was emphasized that LC was performed in 83.3% of the cases with BDI and OC was performed in 13.6%, therefore, it is necessary to comply with safe surgery standards in LC cases.

In a study conducted by Khalit et al., an artificial intelligence algorithm was developed to prevent BDIs with real-time intraoperative decision support in LCs and to warn to stop in dangerous areas and continue dissection in safe areas. According to the results obtained in the study, it was shown that intraoperative decision support with artificial intelligence was effective in preventing BDIs [46].

4. CONCLUSION

According to the results obtained in our study, in cholecystectomy surgeries performed with laparoscopic devices, BDI rates are higher than OC and there has been no significant decrease in the incidence of BDI despite the 40-year period following the first LC surgeries. The incidence of BDI is still lower in OC cases than in LC. Probably the biggest reason for this is the lack of a 3-dimensional view in LCs. Accordingly, manipulations performed in the abdomen with laparoscopic instruments causes more trauma. In fact, the results in BDI cases where laparoscopic surgery is performed by providing a 3-dimensional view are much more successful than OC.

Due to this important handicap of LC, the CVS program should be applied in all cases to avoid bile duct traumas and eliminate risk factors, and the bile ducts should be made visible with various advanced examinations before surgery. However, these surgeries should definitely be performed by experienced surgeons, and great effort should be made to detect BDI injuries during and after surgery for early surgical intervention in BDIs. Because early treatment results are better. Robotic surgery is not yet widely used in routine practice because it requires special personnel and equipment and is expensive.
In difficult cases, LC should not be insisted on and OC should be converted or partial cholecystectomy or top-down cholecystectomy should be performed.

AUTHORS' CONTRIBUTIONS

HZA: Reviewing, analysing and editing; AO: Writing.

CONFLICT OF INTEREST

The authors declare that there have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

[1] R. Walker Jr., "The first laparoscopic cholecystectomy," JSLS, vol. 5, no. 1, pp. 89–94, 2001.

[2] C. Moldovan, D. Cochior, G. Gorecki, E. R. Florin, and D. Ungureanu, "Clinical and surgical algorithm for managing iatrogenic bile duct injuries during laparoscopic cholecystectomy: A multicenter study," Exp. Ther. Med., vol. 22, no. 6, 2021.

[3] D. J. Deziel, K. W. Millikan, S. G. Economou, A. Doolas, S. T. Ko, and M. C. Airan, "Complications of laparoscopic cholecystectomy: A national survey of 4,292 hospitals and an analysis of 77,604 cases," Am. J. Surg., vol. 165, pp. 9–14, 1993. doi: 10.1016/s0002-9610(05)80397-6.

[4] A. Pesce, N. Fabbri, and C. V. Feo, "Vascular injury during laparoscopic cholecystectomy: An often-overlooked complication," World J. Gastrointest. Surg., vol. 15, no. 3, pp. 338–345, 2023. doi: 10.4240/wjgs.v15.i3.338.

[5] D. Shen, Y. Lu, P. Chang, and H. Xu, "Chyle leakage after laparoscopic cholecystectomy in a patient with duplicated cystic ducts: A case report and literature review," Medicine, vol. 103, no. 40, p. e39982, 2024. doi: 10.1097/MD.0000000000039982.

[6] H.-Q. Cai, G.-Q. Pan, S.-J. Luan, and J. Wang, "Is there a place for endoscopic management in post-cholecystectomy iatrogenic bile duct injuries?," World J. Gastrointest. Surg., vol. 16, no. 5, pp. 1218–1222, 2024. doi: 10.4240/wjgs.v16.i5.1218.

[7] A. Reinsoo, Ü. Kirsimägi, L. Kibuspuu, and K. Koševeva, "Bile duct injuries during laparoscopic cholecystectomies: An 11-year population-based study," Eur. J. Trauma Emerg. Surg., vol. 49, pp. 2269–2276, 2023.

[8] A. Samara, "BILE: A literature review based novel clinical classification and treatment algorithm of iatrogenic bile duct injuries," Int. J. Environ. Res. Public Health, vol. 20, no. 1, p. 781, 2023.

[9] M. A. F. Riberio, "Shoeshine maneuver for cystic duct dissection: A simple technique to make Calot-triangle dissection smooth," Acta Bras Cir., vol. 39, 2024. doi: 10.1590/acb395224.

[10] H. Elser, J. R. Bergquist, A. Y. Li, and B. C. Visser, "Determinants, costs, and consequences of common bile duct injury requiring operative repair among privately insured individuals in the United States, 2003–2020," Ann. Surg. Open, vol. 4, no. 1, p. e238, 2023.

[11] J. V. Gutierrez, D. G. Chen, C. G. Yheulon, and C. W. Mangieri, "Acute cholecystitis, obesity, and steatohepatitis constitute the lethal triad for bile duct injury (BDI) during laparoscopic cholecystectomy," Surg. Endosc., vol. 38, pp. 2475–2482, 2024.

[12] H. Davis and K. Bowling, "CHOLE-SAFE: A pilot curriculum response to reduce bile duct injuries," Br. J. Surg., vol. 111, no. Suppl_9, p. znae271.025, 2024.

[13] M. H. Emara, M. H. Ahmed, M. I. Radwan, E. H. Emara, M. Basheer, et al., "Post-cholecystectomy iatrogenic bile duct injuries: Emerging role for endoscopic management," World J. Gastrointest. Surg., vol. 15, p. 12, 2023.

[14] L. Kaman, S. Sanyal, A. Behera, R. Singh, and R. N. Katariya, "Comparison of major bile duct injuries following laparoscopic cholecystectomy and open cholecystectomy," ANZ J. Surg., vol. 76, pp. 788–791, 2006. doi: 10.1111/j.1445-2197.2006.03868.x.

[15] J. J. Roslyn, G. S. Binns, E. F. Hughes, K. Saunders-Kirkwood, M. J. Zinner, and J. A. Cates, "Open cholecystectomy: A contemporary analysis of 42,474 patients," Ann. Surg., vol. 218, pp. 129–137, 1993. doi: 10.1097/00000658-199308000-00003.

[16] C. Doğan, E. Borazan, L. Yılmaz, and A. A. Balık, "How much is the long-term quality of life impaired in cholecystectomy-related biliary tract injury?," Turk. J. Surg., vol. 39, no. 1, pp. 34–42, 2023. doi: 10.47717/turkjsurg.2023.5780.

[17] O. Tantia, M. Jain, S. Khanna, and B. Sen, "Iatrogenic biliary injury: 13,305 cholecystectomies experienced by a single surgical team over more than 13 years," Surg. Endosc., vol. 22, pp. 1077–1086, 2008.

[18] S. Y. Zarghami, R. Ghafoury, N. Fakhar, and F. Afrashteh, "Four-year report of iatrogenic bile duct injury repair from a referral hepatobiliary center," Middle East J. Dig. Dis., vol. 16, no. 3, pp. 173–177, 2024. doi: 10.34172/mejdd.2024.385.

[19] A. Indal, N. Y. A. Badu, C. Katiki, V. J. S. Ponnapalli, K. J. Desai, S. Mansoor, and L. Mohammed, "Factors influencing bile duct injuries: A dreaded complication of laparoscopic cholecystectomy," Cureus, vol. 16, no. 11, p. e73600, 2024. doi: 10.7759/cureus.73600.

[20] A. Seshadri and A. B. Peitzman, "The difficult cholecystectomy: What you need to know," J. Trauma Acute Care Surg., vol. 97, no. 3, pp. 325–336, 2024. doi: 10.1097/TA.0000000000004337.

[21] C. Ugarte, S. Zielsdorf, M. Schellenberg, et al., "Bile duct injuries during urgent cholecystectomy at a safety net teaching hospital: Attending experience and time of day may matter," Am. J. Surg., vol. 90, no. 10, 2024. doi: 10.1177/00031348241248805.

[22] Ł. Nawacki, M. Kozłowska-Geller, M. Wawszczak-Kasza, and J. Klusek, “Iatrogenic injury of biliary tree—Single-centre experience,” Int. J. Environ. Res. Public Health, vol. 20, no. 1, p. 781, 2023.

[23] H.-Q. Cai, G.-Q. Pan, S.-J. Luan, J. Wang, and Y. Jiao, “Is there a place for endoscopic management in post-cholecystectomy iatrogenic bile duct injuries?,” World J. Gastrointest. Surg., vol. 16, no. 5, pp. 1218–1222, 2024. doi: 10.4240/wjgs.v16.i5.1218.

[24] M. Barrett, H. J. Asbun, H.-L. Chien, L. M. Brunt, and D. A. Telem, “Bile duct injury and morbidity following cholecystectomy: A need for improvement,” Surg. Endosc., vol. 32, pp. 1683–1688, 2008.

[25] P. P. Petkov, R. S. Todorov, Z. A. Shavalov, and A. S. Yonkov, “Multidisciplinary approach to extra-hepatic bile ducts injuries after laparoscopic cholecystectomy,” Chirurgia, vol. 37, no. 3, pp. 193–200, 2024. doi: 10.23736/S0394-9508.23.05655-3.

[26] V. Lopez-Lopez, C. Kuemmerli, J. Maupoey, and R. López-Andujar, “Textbook outcome in patients with biliary duct injury during cholecystectomy,” J. Gastrointest. Surg., vol. 28, no. 5, pp. 725–730, 2024.

[27] Y. Cai, Q. Chen, K. Cheng, Z. Chen, S. Wu, et al., “Intragallbladder versus intravenous indocyanine green (ICG) injection for enhanced bile duct visualization by fluorescent cholangiography during laparoscopic cholecystectomy: A retrospective cohort study,” Gland Surg., vol. 27, no. 13, pp. 1628–1638, 2024.

[28] S. Symeonidis, I. Mantzoros, E. Anestiadou, O. Ioannidis, and others, “Biliary anatomy visualization and surgeon satisfaction using standard cholangiography versus indocyanine green fluorescent cholangiography during elective laparoscopic cholecystectomy: A randomized controlled trial,” J. Clin. Med., vol. 13, no. 3, p. 864, 2024. doi: 10.3390/jcm13030864.

[29] A. Edebo, J. Andersson, J. Gustavsson, L. Jivegård, D. Ribokas, et al., “Benefits and risks of using laparoscopic ultrasonography versus intraoperative cholangiography during laparoscopic cholecystectomy for gallstone disease: A systematic review and meta-analysis,” Surg. Endosc., vol. 38, pp. 5096–5107, 2024.

[30] M. Freesmeyer, J. Greiser, R. Drescher, U. Settmacher, and others, “PET/CT with [68Ga]Ga-TEoS-DAZA for localization of a traumatic biliary leak,” Eur. J. Nucl. Med. Mol. Imaging, vol. 5, 2024. doi: 10.1007/s00259-024-06895-4.

[31] A. C. B. Blitzkow, A. C. T. Freitas, J. C. U. Coelho, A. C. L. Campos, and M. A. R. D. Costa, “Critical view of safety: A prospective surgical and photographic analysis in laparoscopic cholecystectomy – Does it help to prevent iatrogenic lesions?,” ABCD, Arq. Bras. Cir. Dig., vol. 37, 2024.

[32] T. P. Singh, A. Kumar, S. Singh, J. Singh, D. K. Pasi, et al., “Critical view of safety in laparoscopic cholecystectomy: Can it prevent bile duct injuries? An institutional prospective observational study,” J. Surg. Sci., vol. 6, no. 2, 2023.

[33] V. K. Bansal, K. Asuri, M. Jain, O. Prakash, H. K. Bhattacharjee, et al., “Use of critical view of safety and proctored preceptorship in preventing bile duct injury during laparoscopic cholecystectomy—Experience of 3726 cases from a tertiary care teaching institute,” Surg. Laparosc. Endosc. Percutan. Tech., vol. 33, no. 1, pp. 12–17, 2023. doi: 10.1097/SLE.0000000000001127.

[34] M. Ortenzi, D. Corallino, E. Botteri, A. Balla, A. Arezzo, et al., “Safety of laparoscopic cholecystectomy performed by trainee surgeons with different cholangiographic techniques (SCOTCH): A prospective non-randomized trial on the impact of fluorescent cholangiography during laparoscopic cholecystectomy performed by trainees,” Surg. Endosc., vol. 38, pp. 1045–1058, 2024.

[35] D. Klos, M. Gregořík, T. Pavlík, M. Loveček, J. Tesaříková, et al., “Major iatrogenic bile duct injury during elective cholecystectomy: A Czech population register-based study,” Langenbeck's Arch. Surg., vol. 408, p. 154, 2023.

[36] R. Raza, M. Muzammil, A. Rehman, L. Mal, I. A. Langah, et al., “Iatrogenic bile duct injury following open and laparoscopic cholecystectomy: Exploring patterns, management, and treatment outcomes,” HIV Nurs., vol. 23, no. 3, 2023.

[37] E. M. Tangarona, C. Marco, J. Balague, J. Rodriguez, E. Cugat, et al., “How, when, and why bile duct injury occurs: A comparison between open and laparoscopic cholecystectomy,” Surg. Endosc., vol. 12, pp. 322–326, 1998.

[38] Z. Yang, J. Liu, L. Wu, and Y. Ding, “Application of three-dimensional visualization technology in early surgical repair of bile duct injury during laparoscopic cholecystectomy,” BMC Surg., vol. 24, p. 271, 2024.

[39] A. Cubisino, H. Dreifuss, G. Cassese, M. Bianco, and P. Fabrizio, “Minimally invasive biliary anastomosis after iatrogenic bile duct injury: A systematic review,” Updates Surg., vol. 75, pp. 31–40, 2022.

[40] S. Rayman, S. B. Ross, T. M. Pattilachan, and M. Christodoulou, “The robotic-assisted laparoscopic approach to biliary tract resection and reconstruction for benign indications: A single-center experience,” World J. Surg., vol. 48, no. 1, pp. 203–210, 2023.

[41] E. O. Dickens, “Common bile duct injury in cholecystectomy,” JAMA Surg., vol. 159, no. 5, pp. 591–592, 2024. doi: 10.1001/jamasurg.2023.8083.

[42] E. E. Montalvo-Javé, B. León-Mancilla, M. Espejel-Deloiza, and J. Chernizky, “Replacement of the main bile duct by bioprosthesis in an experimental porcine model (24-month results),” HPB, In Press, 2024.

[43] N. Chance, D. Joshua, and M. Matthew, “Tips and tricks to avoiding iatrogenic bile duct injuries during cholecystectomy,” Panam. J. Trauma Crit. Care Emerg. Surg., vol. 11, no. 3, 2022.

[44] M. Blohm, G. Sandblom, L. Enochsson, M. Hedberg, M. F. Andersson, et al., “Relationship between surgical volume and outcomes in elective and acute cholecystectomy: Nationwide, observational study,” Br. J. Surg., vol. 110, no. 3, pp. 353–361, 2023.

[45] R. Tinoco, A. Tinoco, M. P. S. Netto, and L. J. El-Kadre, “Iatrogenic bile duct injuries after cholecystectomy, is the laparoscopic approach a good idea?,” Surg. Sci., vol. 13, no. 7, 2022.

[46] M. U. Khalid, S. Laplante, C. Masino, A. Alseidi, S. Jayaraman, et al., “Use of artificial intelligence for decision-support to avoid high-risk behaviors during laparoscopic cholecystectomy,” Surg. Endosc., vol. 37, pp. 9467–9475, 2023.