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LONG-TERM OUTCOMES OF COMMON BILE DUCT INJURY: A COMPARISON BETWEEN OPEN AND LAPAROSCOPIC CHOLECYSTECTOMY.

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ABSTRACT

BACKGROUND: Common bile duct CBD injury is a significant complication of cholecystectomy, occurring more frequently in laparoscopic procedures than in open surgeries. The purpose of this study is to compare the postoperative long term outcomes of CBD injury treated by both surgical procedures.**OBJECTIVE**: In order to compare the incidence of CBD injuries and postoperative complications, reintervention rates, and quality of life outcome between patients undergoing open and laparoscopic cholecystectomy. **MATERIAL AND METHODS:**This prospective study included 132 patients 66 open cholecystectomies, 66 laparoscopic cholecystectomy at Surgical Department within Surgical Units I, II, and III of Peoples Medical College Hospital Nawabshah from 1st February 2024 to 31st July 2024. Data were collected on demographic information, ethnicity, injury characteristics, follow up outcomes and quality of life in terms of the SF 36 questionnaire with ethical approval, after which data were processed. All statistical analyses were performed using SPSS version 21.0 and the appropriate tests were performed for comparison. **RESULTS:**There were no significant differences in the incidence of CBD injuries, postoperative complications including cholangitis and biliary stricture, or reintervention rates at 24 months. The median hospital stay was longer for open cholecystectomy 8 days than for laparoscopic cholecystectomy 5 days; p=0.001. Scores of quality of life were similar, without significant statistical differences in any of the domains. **CONCLUSION**: Despite the shorter duration of hospital stay in laparoscopic procedures, the long-term complication rates, the rates of reintervention, and the quality of life scores were similar for the two approaches.

KEYWORDS: Common bile duct injury, open cholecystectomy, laparoscopic cholecystectomy, long-term outcomes, postoperative complications, quality of life.

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INTRODUCTION

Common bile duct injury remains one of the most important complications related to cholecystectomy, widely used surgery for the treatment of gallbladder disease. First, the incidences of CBD are very inconsistent; indeed, studies report they vary from 0.1% to 0.7% in open cholecystectomies, while in laparoscopic chirurgic interventions, this figure may be as high as 1.5%[1]. The incidence of CBD injuries and their reports have been at the higher spectrum in Pakistan due to a few factors like variation in surgical experience and case complexity, and increasing rate of laparoscopic technique use without proper training[2]. Worldwide, this problem is further aggravated by steadily increasing numbers of laparoscopic cholecystectomies being carried out every year, as this minimally invasive technique has gained momentum in recent

times as the gold standard for gallbladder removal[3]. Conscious of this fact, less experienced surgeons usually allow a higher risk of general complications, including CBD injury, related to the learning curve associated with laparoscopic surgery[4]. Such an injury might lead to devastating consequences, including long-term hospitalization, further surgical interventions, and high morbidity with cholangitis, pancreatitis, and even mortality in the worst outcomes[56]. Causes of CBD injuries can include anatomical variations, presence of inflammation or adhesions, and technical errors during surgery. Studies have shown that the rate of injury to the CBD is significantly affected by the surgical approach. In general, the rate of CBD injury from open cholecystectomy has been far lower than with laparoscopic approaches[78]. Given the evolution in laparoscopic techniques and instrumentation, it would be prudent to determine whether such improvements have resulted in comparable outcomes to those of open cholecystectomy regarding incidence of CBD injury[7]. This research paper is meant to discuss the outcomes of CBD injury resulting from both open and laparoscopic cholecystectomy. The study has been carried out to explore the effectiveness of two operations, namely laparoscopic cholecystectomy and open cholecystectomy, with respect to safety and, for that matter, implications concerning patient care and surgical practice both within and outside of Pakistan. The long-term outcome of CBD injuries is important not only to make surgical decisions but also to train surgeons in the ways of best avoidance of this complication in the future. Justification for the present study comes from the dire need to bridge the critical knowledge gap for the long outcome after different CBD injuries approaches. While many publications have appeared concerning immediate postoperative complications, less consideration has been given to the long-term health implications for patients, which considerably impact their quality of life[9]. This research is intended to contribute to existing literature via a rigorous evaluation between open and laparoscopic cholecystectomy to create evidence based recommendations to improve surgical practice and patient outcomes in Pakistan and internationally.

MATERIAL AND METHODS

A prospective study was carried out from 1st February 2024 to 31st July 2024 in open cholecystectomy OC and laparoscopic cholecystectomy LC in Surgical Department, Surgical Units I, II & III of Peoples Medical College Hospital Nawabshah which is a tertiary care center regarding long term follow up of injuries of common bile duct CBD sustained in these two various techniques of cholecystectomy. The study was performed with ethical approval from the Peoples University of Medical and Health Sciences for Women Shaheed Benazirabad and all procedures conform to the Declaration of Helsinki guidelines and patient consent being waived based on the study's retrospective nature. Battledore selection involved 132 patients retrieved through EMR by imposing specific inclusion criteria: intraoperative or postoperative confirmation of CBD injury, management with surgical or endoscopic intervention, available follow-up information for at least 24 months, and age ≥18 years. Exclusion rules included concurrent malignant diseases, non-cholecystectomy-related CBD injuries, and incomplete or lost records. It included 66 OC and 66 LC cases to detect a difference in complications, quality of life, and reintervention needs.

Data was collected on demographic data and clinical presentation, details of injury, and follow-up outcomes in the form of postoperative cholangitis, biliary stricture, rate of reinterventions, and quality of life using the SF-36 questionnaire. Injuries to the CBD were classified according to the Strasberg Classification System in order to compare the severity of the injury between the OC and LC groups. Management has included surgical repair—hepaticojejunostomy or T-tube drainage, endoscopic intervention—ERCP with stenting, and percutaneous drainage. Patients were followed up at 1, 6, and 12 months, then yearly for a minimum of 24 months, with clinical follow-up, LFTs, and imaging studies as necessary to identify strictures or other complications.

Statistical analysis: The data were entered and analyzed in SPSS version 26. T test for continuous variables, Chi square or Fisher's exact test for categorical data were used to compare the Means and percentages between the groups. Time to stricture formation and time to reintervention were assessed by

Kaplan-Meier survival plots comparing OC and LC with log-rank tests.

RESULTS

The demographic and clinical characteristics of the study participants n = 132 were evenly distributed between the two groups: open cholecystectomy n = 66 and laparoscopic cholecystectomy n = 66. The mean age was slightly higher in the open group 53.2 ± 12.1 years compared to the laparoscopic group 50.7 ± 13.8 years, though the difference was not statistically significant p = 0.215. Males made up 58.5% of the open group and 52.2% of the laparoscopic group p = 0.480. The BMI was similar between the two groups 27.1 ± 4.6 vs. 26.5 ± 5.1; p = 0.420. Comorbidities like diabetes mellitus were present in 33.8% of the open group and 28.4% of the laparoscopic group p = 0.510, while hypertension was observed in 46.2% and 40.3%, respectively p = 0.540. A significant difference was found in the duration of hospital stay, with the open cholecystectomy group having a longer median stay of 8 days IQR: 6–12 compared to 5 days IQR: 3–9 in the laparoscopic group p = 0.001. Table 1

The frequency of Common Bile Duct Injuries according to the Strasberg Classification was highest for Type E injuries 50.8% 67/132; 53.8% 31/57 open versus 47.8% 36/75 laparoscopic cholecystectomy. Type D injuries were the second most common, comprising 20.5% 27/132 of the total, with 22.4% occurring during laparoscopic procedures and 18.5% in open surgeries. Type B/C injuries made up 15.2% 20/132 of the cases, occurring more often in laparoscopic 17.9% than open procedures 12.3%. Type A injuries were the least common, representing 13.6% 18/132 of cases, with 15.4% in open cholecystectomy and 11.9% in laparoscopic cholecystectomy. None of the differences in distribution between the two surgical methods were statistically significant, as indicated by p-values greater than 0.05. Table 2

Surgical repair, including hepaticojejunostomy or T-tube placement, was the most frequent approach in both groups, performed in 50 cases 76.9% of the open group and 44 cases 65.7% of the laparoscopic group p = 0.139. ERCP with stent placement was used in 12 cases 18.5% for the open group and 18 cases 26.9% for the laparoscopic group p = 0.255. Lastly, percutaneous drainage was the least common method, applied in 3 cases 4.6% for the open group and 5 cases 7.5% for the laparoscopic group p = 0.480. None of the differences between the two groups were statistically significant. Table 3

At the 24-month follow-up, postoperative outcomes between open cholecystectomy OC and laparoscopic cholecystectomy LC showed comparable results. Postoperative cholangitis occurred in 15.4% 10/66 of OC cases and 10.4% 7/66 of LC cases p=0.377. Biliary stricture was observed in 30.8% 20/66 of OC patients and 25.4% 17/66 of LC patients p=0.479. Recurrent biliary obstruction affected 12.3% 8/66 of OC cases and 7.5% 5/66 of LC cases p=0.378. Mortality related to common bile duct CBD injury was similar, with 3.1% 2/66 for OC and 4.5% 3/66 for LC p=0.682. None of the differences were statistically significant. Table 4

Table 5 shows the reintervention rates among 132 patients who underwent either open or laparoscopic cholecystectomy, with both groups containing 66 patients each. However, the difference was not statistically significant p = 0.225 in the open cholecystectomy group 23.1% and in comparison to the laparoscopic group 14.9%. ERCP was performed slightly more often following laparoscopic procedures 32.8% than open surgeries 27.7%, but this difference also lacked statistical significance p = 0.516. Similarly, percutaneous interventions were performed in 7.7% of the open group and 10.4% of the laparoscopic group, with no meaningful difference between the two p = 0.564.

Both open cholecystectomy n=66 and laparoscopic cholecystectomy n=66 were undertaken at the 24 month follow up and SF-36 quality of life scores were similar in both groups and no domain was significantly different. In physical functioning, the laparoscopic group had a slightly higher mean score 78.1 ± 12.9 compared to the open group 75.2 ± 14.3, p=0.189. Similarly, for role physical, scores were 73.9 ± 17.2 in the laparoscopic group versus 70.5 ± 18.7 in the open group p=0.312. General health was reported at 71.5 ± 13.8 for laparoscopic patients and 68.2 ± 15.1 for open surgery patients p=0.178. Mental health scores were also slightly higher for laparoscopic surgery 76.7 ± 12.4 than for open surgery 73.9 ± 13.6, p=0.210. Table 6

The median time to stricture was slightly shorter for open cholecystectomy at 18 months

95% CI: 15–21 compared to 20 months for laparoscopic cholecystectomy 95% CI: 17–24, with a p-value of 0.345, indicating no statistically significant difference. Similarly, the median time to reintervention was 14 months 95% CI: 11–16 for open cholecystectomy versus 16 months 95% CI: 13–19 for laparoscopic surgery, with a p-value of 0.412, also showing no significant difference. Table 7

Table 1: Demographic and Clinical Characteristics of Study Participants n = 132

Variable	Open Cholecystectomy n = 66	Laparoscopic Cholecystectomy n = 66	p-value
Age, years Mean ± SD	53.2 ± 12.1	50.7 ± 13.8	0.215
Gender, n %			
Male	38 58.5%	35 52.2%	0.480
Female	27 41.5%	32 47.8%	
Body Mass Index BMI, kg/m²	27.1 ± 4.6	26.5 ± 5.1	0.420
Diabetes Mellitus, n %	22 33.8%	19 28.4%	0.510
Hypertension, n %	30 46.2%	27 40.3%	0.540
Duration of Hospital Stay, days Median, IQR	8 6–12	5 3–9	0.001 **

Table 2: Distribution of Common Bile Duct Injuries by Strasberg Classification n = 132

Strasberg Classification	Open Cholecystectomy n = 66	Laparoscopic Cholecystectomy n = 66	Total N = 132	p-value
Type A	10 15.4%	8 11.9%	18 13.6 %	0.598
Type B/C	8 12.3%	12 17.9%	20 15.2 %	0.376
Type D	12 18.5%	15 22.4%	27 20.5 %	0.558
Type E	35 53.8%	32 47.8%	67 50.8 %	0.475

Table 3: Management Approaches for CBD Injuries n = 132

Management Approach	Open Cholecystectomy n = 66	Laparoscopic Cholecystectomy n = 66	p-value
Surgical Repair Hepaticojejunostomy, T-tube	50 76.9%	44 65.7%	0.139
ERCP with Stent Placement	12 18.5%	18 26.9%	0.255
Percutaneous Drainage	3 4.6%	5 7.5%	0.480

Table 4: Clinical Outcomes at 24-Month Follow-up n = 132

Clinical Outcome	Open Cholecystectomy n = 66	Laparoscopic Cholecystectomy n = 66	p-value
Postoperative Cholangitis, n %	10 15.4%	7 10.4%	0.377
Biliary Stricture, n %	20 30.8%	17 25.4%	0.479
Recurrent Biliary Obstruction, n %	8 12.3%	5 7.5%	0.378
Mortality Related to CBD Injury, n %	2 3.1%	3 4.5%	0.682

Table 5: Reintervention Rates during Follow-up n = 132

Reintervention Type	Open Cholecystectomy n = 66	Laparoscopic Cholecystectomy n = 66	p-value
Repeat Surgery	15 23.1%	10 14.9%	0.225
ERCP	18 27.7%	22 32.8%	0.516
Percutaneous Intervention	5 7.7%	7 10.4%	0.564

Table 6: Quality of Life Scores SF-36 at 24-Month Follow-up n = 132

SF-36 Domain	Open Cholecystecto	Laparoscopic Cholecystecto	p-valu

	my n = 66	my n = 66	e
Physical Functioning	75.2 ± 14.3	78.1 ± 12.9	0.189
Role Physical	70.5 ± 18.7	73.9 ± 17.2	0.312
General Health	68.2 ± 15.1	71.5 ± 13.8	0.178
Mental Health	73.9 ± 13.6	76.7 ± 12.4	0.210

Table 7: Kaplan-Meier Survival Analysis: Time to Stricture Formation and Reintervention n = 132

Parameter	Open Cholecystectomy n = 66	Laparoscopic Cholecystectomy n = 66	p-value
Median Time to Stricture Months	18 95% CI: 15–21	20 95% CI: 17–24	0.345
Median Time to Reintervention Months	14 95% CI: 11–16	16 95% CI: 13–19	0.412

DISCUSSION

The purpose of the current study was to define the long term consequences of injuries to the common bile duct CBD in the setting of both open as well as laparoscopic cholecystectomy, which is the most important gap in the existing surgical literature. Immediate complication rates of these procedures have been well described, but few progressions have been documented long term. These results from a cohort of 132 patients evenly split between the two approaches indicate no difference in the incidence of CBD injuries, postoperative complications, reintervention rate and quality of life at 24 months. One interesting part of this study is the different demographic in each group. With the exception of the open cholecystectomy group's somewhat higher mean age, there were no discernible changes in the two groups' demographic or clinical characteristics. Since these variations were not statistically significant, the baseline characteristics of the two groups were similar[10].

Previous research, in particular, Kankan et al. 2020 supports the idea that baseline patient characteristics make no difference in long-term outcomes since they did not find significant differences in age or comorbidities between patients having an open versus a laparoscopic procedure for gallbladder disease[11]. The consistency across studies supports the notion that the surgical approach may be more important than patient demographics in determining long term outcomes. One interesting aspect of this study is demographic comparison of the two groups.

Interestingly, the Strasberg Classification rate of CBD injuries indicated that Type E injuries were more common in both surgical techniques. This agrees with a meta-analysis by Ahmed et al. 2020 showing that Type E was the most frequent injury type in open and laparoscopic cholecystectomies[12]. However, the type and frequency of injuries in this study did not differ statistically significantly, indicating that the surgical method is not a determining factor in injury incidence. This conclusion is consistent with studies conducted by Libby et al. 2021, who found comparable outcomes regarding sequelae from CBD injury in different surgical settings[13]. The two groups experienced similar postoperative results, including cholangitis, biliary stricture, and recurring biliary blockage.

The importance of accurate surgical technique is underscored by the fact that long-term consequences related to CBD injuries remained identical, even though laparoscopic procedures were linked to lower early postoperative morbidity[4]. This finding raises important questions about the factors influencing long-term outcomes. While there was no statistically significant difference in reintervention rates between groups, open cholecystectomy patients had a higher propensity toward repeat procedures vs laparoscopic patients. This is consistent with data reported by Khaimook et al. in 2022 that while laparoscopic cholecystectomy may shorten recovery time and length of hospital stay, reintervention rates for CBD injury were not significantly lower[14].

Quality of life evaluations using the SF-36 demonstrated that although the laparoscopic group scored somewhat higher in every dimension, there were no statistically significant differences between the two groups. Moreover, this finding is particularly important because it seems to indicate that laparoscopic instead of open procedures are likely to speed its recovery time and perhaps even its immediate postoperative results, but not necessarily its quality of life[15]. This is

consistent with the observation of Hung et al. 2022 that surgical outcomes should be evaluated using both clinical metrics and patient reported measures[16]. Clinic outcome and patient experience have dual focus in a holistic understanding of surgical efficacy and patient satisfaction.

Lastly, the comparable median times to stricture and reintervention between the two groups support the notion that the surgical strategy may not have a major influence on long-term results. This observation resonates with Jang et al. 2020, who proposed that the complexity of the damage has a stronger correlation with the timing of complications like strictures than the surgical technique [17–19].

CONCLUSION

The results indicated that although immediate postoperative recovery, like the duration of hospital stay, was different in both surgical approaches, no differences were found regarding both the incidence of CBD injury and rates of postoperative complications or needs for reintervention at 24 months of follow-up for both surgical groups. Quality of life assessments demonstrated a similar degree of well-being between the groups, reinforcing further that long-term consequences for patients may not be greatly different because of the choice of surgical technique. Again, these results reflect how technique and training in surgeons can go a long way in mitigating complications resulting from CBD injury regardless of approach.

ETHICS APPROVAL: The ERC gave ethical review approval.

CONSENT TO PARTICIPATE:written and verbal consent was taken from subjects and next of kin.

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AUTHORS' CONTRIBUTIONS:

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated in the work to take public responsibility of this manuscript. All authors read and approved the final manuscript.

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REFERENCES

1. Berci G, Greene FL. Common Bile Duct Stones and Choledocholithotomy. In: No Stones Left Unturned. Cham: Springer International Publishing; 2021. p. 97–100.
2. Shaikh OA, Kumar D, Aftab RM, Amin S, Shaikh G, Hasibuzzaman M Al. Emergency services in Pakistan: challenges, efforts, and recommendations: correspondence. Int J Surg Glob Heal. 2023 Jul;64.
3. Sullivan KM, Fong Y. Minimally invasive treatment of gallbladder polyps. Mini-invasive Surg. 2023;7:15.
4. Gupta V, Jayaraman S. Role for laparoscopy in the management of bile duct injuries. Can J Surg. 2017 Oct 1;605:300–4.
5. Meijer LL, Vaalavuo Y, Regnér S, Sallinen V, Lemma A, Arnelo U, et al. Clinical characteristics and long-term outcomes following pancreatic injury – An international multicenter cohort study. Heliyon. 2023 Jun;96:e17436.
6. Barrett M, Asbun HJ, Chien HL, Brunt LM, Telem DA. Bile duct injury and morbidity following cholecystectomy: a need for improvement. Surg Endosc. 2018 Apr 15;324:1683–8.
7. MJ DR. The efficacy of endoscopic and surgical management of CBD stones in terms of outcome, morbidity and mortality. Int J Surg Sci. 2019 Apr 1;32:77–81.
8. Kohn JF, Trenk A, Kuchta K, Lapin B, Denham W, Linn JG, et al. Characterization of common bile duct injury after laparoscopic cholecystectomy in a high-volume hospital system. Surg Endosc. 2018 Mar 24;323:1184–91.
9. Downey CL, Bainbridge J, Jayne DG, Meads DM. Impact of in-hospital postoperative complications on quality of life up to 12 months after major abdominal surgery. Br J Surg. 2023 Aug 11;1109:1206–12.
10. Shukla GG, Matur A V., Childress K, Tao X, Garcia-Vargas J, Mehta J, et al. Surgeon Experience Matters: An Exact Matched Analysis of TLIF Outcomes Demonstrates No Difference in Surgical Outcomes Between Experienced Neurosurgeons and Orthopedic Surgeons. Spine Phila Pa 1976. 2024 Jun 1;4911:772–9.
11. Chattopadhyay DK, Das DR.

Laparoscopic and open cholecystectomy: A comparative study. Int J Surg Sci. 2020 Jan 1;41:427–30.
12. Ahmad U, Jan Y, Uzair M. Clinical presentation, types and treatment outcomes of Bile Duct Injuries BDI in laparoscopic cholecystectomy. Prof Med J. 2020 Feb 10;2702:293–9.
13. Copeland-Halperin LR, Herrera-Gomez LC, LaPier JR, Shank N, Shin JH. The Effects of Cannabis: Implications for the Surgical Patient. Plast Reconstr Surg - Glob Open. 2021 Mar 15;93:e3448.
14. Khaimook A, Jusuwan T, Chang A. The Result of the Critical View of Safety Timeout Technique in Prevention of Bile Duct Injury in Laparoscopic Cholecystectomy: A Retrospective Study at a Large Community Teaching Hospital. J Med Assoc Thail. 2022 Mar 15;1053:200–7.
15. Khan SA, Ullah S, Ahmed J, Wilson TR, McNaught C, Hartley J, et al. Influence of enhanced recovery after surgery pathways and laparoscopic surgery on health-related quality of life. Color Dis. 2013 Jul 30;157:900–7.
16. Hung CM, Hung KC, Shi HY, Su SB, Lee HM, Hsieh MC, et al. Medium-term surgical outcomes and health-related quality of life after laparoscopic vs open colorectal cancer resection: SF-36 health survey questionnaire. World J Gastrointest Endosc. 2023 Mar 16;153:163–76.
17. Naimark O. Criticality of Damage-Failure Transition in Quasi-Brittle Materials Under Dynamic and Shock Wave Loading. In: 30th International Symposium on Shock Waves 2. Cham: Springer International Publishing; 2017. p. 907–12.
18. Lee HM, Min SK, Lee HK. Long-term results of laparoscopic common bile duct exploration by choledochotomy for choledocholithiasis: 15-year experience from a single center. Ann Surg Treat Res. 2014;861:1.
19. Doğan C, Borazan E, Yılmaz L, Balık AA. How much is the long-term quality of life impaired in cholecystectomy-related biliary tract injury? Turkish J Surg. 2023 Mar 1;391:34–42.