

Perforation and Spillage of Gallstone during Laparoscopic Cholecystectomy. A Single Center Study

Fatima Abdul Khaliq ¹; Brig Muhammad Mubeen ²; Arslan Saleem Chughtai ³; Aqil Hareem Butt ⁴

Abstract

Background:

Laparoscopic cholecystectomy (LC) is one of the most frequently performed abdominal procedures worldwide. Despite its minimally invasive nature and advantages such as reduced postoperative pain, shorter hospital stays, and faster recovery complications like gallbladder perforation (GP) and gallstone spillage remain clinically significant. Reported in up to 40% of cases, these events may prolong operative time, increase postoperative morbidity, and complicate recovery.

Aim:

This study aimed to determine the frequency of gallbladder perforation and gallstone spillage during LC and to analyze their association with operative factors and postoperative complications.

Methodology:

This retrospective audit was conducted at Shalamar Hospital, Lahore, including all patients (n=89) who underwent LC between 1st August to 28th October 2021. Data were analyzed using IBM SPSS Statistics version 27. Chi-square and Fisher's exact tests were applied, with $p < 0.05$ considered statistically significant. Ethical approval was obtained from the institutional review board.

Results:

Gallbladder perforation occurred in 21 cases (23.6%), and gallstone spillage in 15 cases (16.9%). The most frequent postoperative complications were bile leakage (6.7%) and intra-abdominal abscess (6.7%). Bleeding (2.2%) and trocar site infections (3.4%) were less common. No significant associations were identified between demographic variables (age, gender, diagnosis) and the risk of perforation ($p > 0.05$).

Conclusion:

Gallbladder perforation and stone spillage remain relatively common during LC, though no demographic or preoperative predictors were identified. The findings highlight the pivotal role of surgical technique, careful dissection, and prompt retrieval of spilled stones to minimize postoperative morbidity. Future large-scale prospective studies are needed to develop and validate standardized preventive protocols aimed at minimizing gallbladder perforation and stone spillage during laparoscopic cholecystectomy.

Keywords:

Laparoscopic cholecystectomy; Gallbladder perforation; Intraoperative complications; Gallstone spillage; Surgical outcomes.

Affiliations:

¹ Department of Dermatology, Mayo Hospital, Pakistan

² Department of Anesthesia, Shalamar Medical & Dental College, Lahore, Pakistan

³ Department of Biostatistics, Shalamar School of Allied Health Sciences, Lahore, Pakistan

⁴ General Operation Theater, Shalamar Hospital, Lahore, Pakistan

Email: buttaqil546@gmail.com

Corresponding Author: Aqil Hareem Butt

Introduction

Laparoscopic cholecystectomy (LC) is now widely accepted as the definitive surgical treatment for symptomatic gallbladder disease. Compared with open surgery, LC offers several well-established benefits, including less postoperative discomfort, quicker convalescence, shorter hospitalization, and fewer wound-related complications [1,2]. Despite these advantages,



the procedure carries a distinct set of technical challenges. Among the most frequent intraoperative issues are gallbladder perforation (GP) and inadvertent gallstone spillage, reported to occur in 6–40% of procedures [2,3].

Although often considered minor incidents, these complications can occasionally lead to significant postoperative consequences such as bile leakage, intra-abdominal infection, or abscess formation, and in rare circumstances may necessitate reoperation [4]. Certain pathological conditions such as acute inflammation, empyema, or cirrhotic changes may render the gallbladder wall more fragile and susceptible to iatrogenic injury [3,5]. Retained stones, particularly when contaminated with infected bile, can act as focal points for infection or abscess development if not completely retrieved [3,6].

Earlier surgical teachings viewed LC as relatively unsafe in cases of acute cholecystitis due to increased technical difficulty and risk of complications. However, with advancements in equipment, visualization, and perioperative management, LC is now routinely and safely performed even in acute settings. With evolving expertise and improved instrumentation, LC is now feasible even in emergency cases [1,4]. Interestingly, Haider et al. [6] reported that although conversion to open surgery was more frequent in acute cases (6.7% vs. 1.5%), gallbladder perforation paradoxically occurred more often in elective procedures, suggesting an interplay between operative technique and disease chronicity.

Despite widespread adoption of LC, local data on the incidence, risk factors, and consequences of gallbladder perforation and stone spillage remain limited, particularly in tertiary centers of Pakistan. This audit aimed to determine the frequency of these events, explore their association with patient and operative parameters, and assess their short-term postoperative outcomes. Identifying such patterns may guide refinements in surgical protocols and intraoperative practices to mitigate preventable complications.

Methodology

Study Design and Setting

This retrospective audit was conducted at the Operation Theatre Complex of Shalamar Hospital, a tertiary care teaching hospital in Lahore, Pakistan. The study included all patients who underwent laparoscopic cholecystectomy (LC) between 1st August and 28th October 2021 in the Department of General Surgery. A total of 89 consecutive cases were reviewed.

Inclusion Criteria

Patients were included if they met any of the following criteria:

- Diagnosed with acute or chronic cholecystitis
- Presenting with symptomatic cholelithiasis
- Diagnosed with gallstone pancreatitis
- Identified gallbladder polyps or masses requiring LC
- Diagnosed with acalculous cholecystitis

Exclusion Criteria

Patients were excluded if they had:

- Perforated or gangrenous gallbladders at presentation
- Cholecystoenteric fistulae or other complex biliary fistulous disease

Data Collection Procedure

Data were collected prospectively during each operative procedure using a structured proforma. Intraoperative details such as gallbladder perforation, stone spillage, and retrieval efforts were documented by the surgical team. Postoperative outcomes, including bile leakage, bleeding, intra-abdominal abscess, and wound infection, were monitored during the hospital stay and recorded prior to discharge.

Sample Size Calculation

The sample size was calculated using a one-proportion formula based on an anticipated prevalence of gallbladder perforation of 36.1%, drawn from published literature [6]. With a 95%

confidence level and 10% margin of error, the minimum required sample size was determined as 89 patients, which formed the study cohort.

Data Management and Statistical Analysis

Data were initially organized using Microsoft Excel and subsequently analyzed with IBM SPSS Statistics version 27. Descriptive statistics were used to summarize patient demographics, intraoperative findings, and postoperative complications. Associations between categorical variables were evaluated using Chi-square or Fisher's exact test, as appropriate. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

This study adhered to the ethical standards outlined in the Declaration of Helsinki. Approval was obtained [Dated: 02-12-2021] from the Institutional Review Board (IRB) [Ref# SMDC-IRB/AL/164/2021] of Shalamar Hospital, Lahore. Patient confidentiality and data anonymity were maintained throughout.

Results

A total of 89 patients underwent laparoscopic cholecystectomy (LC) during the study period. The mean age was 42.5 ± 8.0 years, with 21 males (23.6%) and 68 females (76.4%). Gallbladder perforation occurred in 21 patients (23.6%), while stone or bile spillage was observed in 15 patients (16.9%).

Statistical Associations

No statistically significant association was found between gallbladder perforation and analyzed risk factors, including age ($\chi^2=0.13$, $p=0.94$), gender ($\chi^2=0.42$, $p=0.52$), or medical history ($\chi^2=1.89$, $p=0.76$). Similarly, the occurrence of gallstone or bile spillage showed no significant correlation with age ($\chi^2=0.41$, $p=0.81$), gender ($\chi^2=1.09$, $p=0.30$), or duration of hospital stay ($\chi^2=2.27$, $p=0.32$).

Patient Demographics

Most patients were between 35–50 years (40.4%), followed by those under 35 years (33.7%) and above 50 years (25.8%). The mean hospital stay was 2.6 ± 1.1 days, with 44.9% of patients staying between 48–72 hours.

Clinical Characteristics

The most common preoperative diagnosis was chronic cholelithiasis (65.2%), followed by acute cholecystitis (22.5%) and gallstone pancreatitis (10.1%). Single cases of cirrhosis (1.1%), empyema (1.1%), and vomiting (1.1%) were also recorded. No patient presented with right upper quadrant adhesions at the time of surgery.

Intraoperative and Postoperative Findings

Intraoperative and postoperative findings are summarized in Table 1. Gallbladder perforation occurred in 21 patients (23.6%), with stone spillage documented in 15 of these cases (71.4%). Postoperative complications included bile leakage in 5 patients (5.6%), abdominal abscess formation in 6 (6.7%), bleeding in 2 (2.2%), trocar-site infection in 3 (3.4%), and conversion to open surgery in 3 (3.4%).

No cases of postoperative mortality were reported. The majority of complications occurred among patients with intraoperative gallbladder perforation or spillage.

Although statistically non-significant, female patients and those with acute cholecystitis exhibited a relatively higher frequency of perforation and spillage, suggesting a potential trend warranting further study. Table 2 summarizes the frequency of gallbladder perforation and stone spillage according to patient demographics, underlying diagnosis, intraoperative complications, and hospital stay.



Table 1. Intraoperative and Postoperative Findings (n = 89)

Variable	Category / Finding	n (%)
Gallbladder perforation	Total cases	21 (23.6%)
Stone spillage	Among perforation cases	15 (71.4%)
Postoperative complications	Bile leakage	5 (5.6%)
	Abdominal abscess formation	6 (6.7%)
	Bleeding	2 (2.2%)
	Trocar-site infection	3 (3.4%)
	Conversion to open surgery	3 (3.4%)

Table 2. Frequency of Gallbladder Perforation and Spillage According to Clinical Variables (n=89)

Variable	Category	n	Gallbladder Perforation n (%)	Spillage n (%)
Gender	Male	21	4 (19.0)	2 (9.5)
	Female	68	17 (25.0)	13 (19.1)
Age Group (years)	<35	30	7 (23.3)	6 (20.0)
	35–50	36	9 (25.0)	5 (13.9)
	>50	23	5 (21.7)	4 (17.4)
Medical Diagnosis	Cholelithiasis	58	12 (20.7)	8 (13.8)
	Acute cholecystitis	20	7 (35.0)	6 (30.0)
	Gallstone pancreatitis	9	2 (22.2)	1 (11.1)
	Cirrhosis / Empyema / Vomiting	3	1 (33.3)	1 (33.3)
Complications	Bleeding	2	0	0
	Bile leak	5	1 (20.0)	1 (20.0)
	Abdominal abscess	6	3 (50.0)	2 (33.3)
	Trocar-site infection	3	1 (33.3)	1 (33.3)
	Conversion to open surgery	3	3 (100)	3 (100)
Hospital Stay (hours)	≤24	23	4 (17.4)	3 (13.0)
	48–72	40	13 (32.5)	11 (27.5)
	>72	26	4 (15.4)	1 (3.9)

Discussion

This study evaluated intraoperative complications of laparoscopic cholecystectomy (LC), particularly gallbladder perforation (GP) and gallstone spillage. The mean patient age was 42.5 ± 8.01 years, with a predominance of females (76.4%), aligning with previous studies

that attribute higher gallbladder disease prevalence in women to hormonal and genetic influences [1,7,8].

The incidence of GP (23.6%) and stone spillage (16.85%) in this cohort falls within the reported global range of 10–30% [2,3,6]. Although female patients showed slightly higher complication

rates, these differences were not statistically significant, suggesting gender alone is not an independent predictor. Similarly, age did not significantly correlate with either GP or spillage, though middle-aged patients (35–50 years) demonstrated a mild numerical trend toward higher rates.

The highest complication frequency was noted in patients with acute cholecystitis (35% for perforation; 30% for spillage), reinforcing the established link between inflammation and surgical difficulty [3,9]. Interestingly, patients with non-inflammatory gallbladder disease also experienced perforations, indicating that intraoperative factors such as poor visualization, excessive traction, and anatomic variations may contribute substantially to these events.

Postoperative abdominal abscesses occurred more frequently among cases with intraoperative spillage (33%) or perforation (50%). Moreover, all patients converted to open surgery had both events, underscoring their procedural significance [10,11]. Although extended hospital stays were more frequent among these patients, the association was not statistically significant, likely due to limited sample size.

Despite examining multiple patient-related variables, no specific demographic or clinical predictors of GP or spillage were identified. This suggests that operator-dependent factors such as surgical technique, intraoperative judgment, and case experience may be more critical determinants of outcome [4,7,12]. Future multicenter prospective studies incorporating surgeon experience, case complexity, and intraoperative grading systems could provide more definitive insights.

Strengths include the provision of local data on an underreported complication of LC, a defined

methodology, and consistent statistical analysis, enhancing internal validity. The study also integrates clinical data with existing literature to produce contextually relevant insights.

Limitations include its retrospective single-center design, limited sample size, and omission of certain intraoperative parameters such as gallbladder wall thickness and surgeon experience. The lack of confidence intervals and effect sizes further limits interpretative depth. Potential documentation bias cannot be excluded.

Conclusion

Gallbladder perforation remains a frequent intraoperative event during LC, occurring in nearly one-quarter of cases, though postoperative complications remain infrequent. No patient-related risk factors were identified, highlighting the predominant influence of surgical technique and intraoperative management. Vigilant operative dissection, meticulous retrieval of spilled stones, and proper documentation are essential to minimize morbidity and ensure optimal outcomes.

Funding

The authors did not receive any financial assistance, grants, or external funding for the design, execution, or publication of this study.

Conflict of Interest

All authors affirm that there are no financial or non-financial conflicts of interest that could have influenced the conduct or reporting of this study.

References

1. Taki-Eldin A, Badawy AE. Outcome of laparoscopic cholecystectomy in patients with gallstone disease at a secondary level care hospital. *Arq Bras Cir Dig*. 2018 Jun 21;31(1):e1347. doi:10.1590/0102-672020180001e1347. PMID: 29947681; PMCID: PMC6049991.
2. Altuntas YE, Oncel M, Haksal M, Kement M, Gundogdu E, Aksakal N, Gezen FC. Gallbladder perforation during elective laparoscopic cholecystectomy: incidence, risk factors, and outcomes. *North Clin Istanb*. 2018 Jan 12;5(1):47–53. doi:10.14744/nci.2017.88155. PMID: 29607432; PMCID: PMC5864707



3. Danhel L, Fritz A, Havranek L, Kratzer T, Punkenhofner P, Punzengruber A, et al. Lost gallstones during laparoscopic cholecystectomy as a common but underestimated complication: case report and review of the literature. *Front Surg*. 2024;11:1375502. doi:10.3389/fsurg.2024.1375502. Available from: <https://www.frontiersin.org/articles/10.3389/fsurg.2024.1375502>
4. Gavriilidis P, Catena F, de'Angelis G, de'Angelis N. Consequences of spilled gallstones during laparoscopic cholecystectomy: a systematic review. *World J Emerg Surg*. 2022 Nov 2;17(1):57. doi:10.1186/s13017-022-00456-6. PMID: 36324150; PMCID: PMC9632095.
5. Wang SY, Yeh CN, Jan YY, Chen MF. Management of gallstones and acute cholecystitis in patients with liver cirrhosis: what should we consider when performing surgery? *Gut Liver*. 2021 Jul 15;15(4):517–27. doi:10.5009/gnl20052. PMID: 32921635; PMCID: PMC8283297.
6. Naeem M, Waheed R, Maroof SA, Shah A. Frequency of conversion of lap chole to open cholecystectomy. *J Med Sci*. 2017;25(1):68–71. Available from: <https://jmedsci.com/index.php/Jmedsci/article/view/83>
7. Haider R, Butt MQ, Ullah JS, Azim MT, Akbar A. Early complications in acute versus elective cases of laparoscopic cholecystectomy in tertiary hospitals: a comparative study. *Pak Armed Forces Med J*. 2023 Oct 30;73(5):1338–41. Available from: <https://pafmj.org/PAFMJ/article/view/8968>
8. Evans L, Sams E, Naguib A, Hajibandeh S, Hajibandeh S. Iatrogenic gallbladder perforation during laparoscopic cholecystectomy and outcomes: a systematic review and meta-analysis. *Langenbecks Arch Surg*. 2022 May;407(3):937–46. doi:10.1007/s00423-022-02439-2. Epub 2022 Jan 17. PMID: 35039923.
9. Kamran K, Afridi ZU, Muqim RU, Khalil J. Does sex affect the outcome of laparoscopic cholecystectomy? A retrospective analysis of single center experience. *Asian J Endosc Surg*. 2013 Feb;6(1):21–5. doi:10.1111/j.1758-5910.2012.00152.x. Epub 2012 Sep 12. PMID: 22970993.
10. Abdhahakim MA, Zidan AM, Ibrahim SG, Ramadan OF. Short-term consequences of gallbladder perforation with bile and gallstones spillage during laparoscopic cholecystectomy. *Benha J Appl Sci*. 2021;6(2 Pt 1):79–82. Available from: https://bjas.journals.ekb.eg/article_167961_4f51361f8f48beefe326231fb5f7bb92.pdf
11. Ahmed Z, Khan NU, Ahmad J, Saeed S, Batool SF, Sami A, et al. Incidence, risk factors and outcome of gallbladder perforation during laparoscopic cholecystectomy. *Pak J Med Health Sci*. 2023;16(12):798. doi:10.53350/pjmhs20221612798.
12. Alfahaid M, Aljohani M, Salati SA, Alaodah S, Alresheedi W, Almarshud R. Practices and attitudes of surgeons with regard to spilled gallstones during laparoscopic cholecystectomy: a cross-sectional study from Saudi Arabia. *Cureus*. 2024 Jan 28;16(1):e53115. doi:10.7759/cureus.53115. PMID: 38283781; PMCID: PMC10822716.

