

Frequency of Perforation and Spillage of Gallstones During Laparoscopic Cholecystectomy and Their Outcome

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Perforation and Spillage of Gallstones During Laparoscopic Cholecystectomy

ABSTRACT

Objective: This study aims to evaluate the frequency of gallbladder perforation and gallstone spillage during LC and assess their impact on postoperative complications and recovery.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Department of General Surgery, PAF Hospital, Islamabad from 19th July 2025 to 19th October 2025.

Methods: A total of 177 patients undergoing LC were enrolled using stratified random sampling. Data on patient demographics, gallbladder size, number of stones, and surgical outcomes were collected. Descriptive statistics were used to summarize continuous variables such as age, BMI, duration of surgery, and length of hospital stay, presented as mean \pm standard deviation or median (interquartile range) depending on the data distribution. Categorical variables, such as gender, presence of gallbladder perforation, gallstone spillage, and postoperative complications, were presented as frequencies and percentages.

Results: Gallbladder perforation occurred in 14 (7.9%) patients, while gallstone spillage was observed in 18 (10.2%) patients. Patients with gallstone spillage had comparatively higher rates of postoperative complications, including port-site infection (44.4%), intra-abdominal abscess (27.8%), and reoperation (27.8%). The mean length of hospital stay for the spillage group was 5.2 ± 2.1 days, comparatively longer than the 3.4 ± 1.2 days for the no-spillage group.

Conclusion: Gallbladder perforation and gallstone spillage, though infrequent, are associated with significantly worse postoperative outcomes, including higher complication rates, longer hospital stays, and increased surgery durations.

Key Words: Laparoscopic cholecystectomy, gallbladder perforation, gallstone spillage, postoperative complications

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INTRODUCTION

Cholelithiasis is estimated to be present in 15% of the adult population¹; for symptomatic cases, laparoscopic cholecystectomy (LC) has attained the status of most preferred treatment modality in recent decades due to the advantages of reduced length of hospital stay and shorter recovery time as compared to traditional open cholecystectomy (OC)².

Laparoscopic cholecystectomy is a technique in which the gall bladder is removed via ports that are inserted with minimal manipulation thus improving the time of

recovery and markedly decreasing the complications like wound infection³. The laparoscopic cholecystectomy complications comprise primary or late complications. Primary complications include port entrance complications, intestinal trauma, bleeding, and late complications, including gallstone spillage, biliary leakage, and biliary trauma. Gallstone spillage is common during laparoscopic cholecystectomy. Gallbladder perforation with stone spillage into the peritoneal cavity is more frequent with laparoscopic cholecystectomy as compared with open cholecystectomy. Early reports on laparoscopic cholecystectomy stated that stones left in the peritoneal cavity had no deleterious effect. Although the incidence of split gallstones and their complications are low, they are of a large variety. The incidence rate of spillage of gallstones secondary to perforation was reported 16%. In addition, to 50% of the spilled stones remained unretrieved. They may migrate in different regions and the reported complication rate varies from 0.08 to 0.3%. However, most recent evidence reported that the incidence rate of complications of spilled gallstones may range from 0.04 to 19%^{5,6}. Abdlhakim MA et al

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evaluated the different short-term complications of bile and gallstones spillage during laparoscopic cholecystectomy. Perforation Group was significantly associated with Bile and stone spillage, abdominal collection and re operate to treat complications, regardless of conversion to open surgery and Port site infection they were also associated with Perforation Group but not significantly. Outcome showed that bile and stone spillage was 10.0% conversion to open surgery was 8.0% and port site infection 18.0%⁷. Because of lack of consensus recommendations and guidelines, the management of spilled gallstones varies widely between institutions and individual surgeons. Therefore, there is need to accumulate evidence so that recommendations can be made to treat spilled gallstones in our population to reduce morbidity.

METHODS

This Cross-Sectional Study was conducted at Department of General Surgery, PAF Hospital, Islamabad from 19th July 2025 to 19th October 2025. The sample size was calculated using the WHO sample size calculator with the following parameters:

- Confidence level = 95%
- Anticipated proportion = 8%
- Absolute precision = 4%

Using these values, the calculated sample size was 177.

Stratified random sampling was employed to select participants from the general surgery department. Patients between the ages of 18 and 60 years with an American Society of Anesthesiologists (ASA) physical status score of II to III were included in the study. Patients who developed complications other than gallbladder perforation or gallstone spillage were excluded. Additional exclusion criteria included the presence of a gallbladder abscess, acute pancreatitis, abnormal blood clotting profiles, or common bile duct stones requiring surgery.

Data collection began after ethical approval was obtained from the hospital's ethical review committee. Written informed consent was taken from all patients before enrollment in the study. Demographic details, including the patient's MR number, age, sex, and BMI, were recorded. All patients underwent an ultrasonogram to gather clinical details such as gallbladder size, the number of stones, gallbladder wall thickness, and the size and site of the stones. Follow-up assessments were performed at one-week post-surgery to record the occurrence of gallstone spillage, conversion to open surgery, and any port-site infections, as per the operational definitions. All data were systematically entered into a predesigned proforma for accuracy and consistency. Data collected from the study were entered and analyzed using SPSS Version 25. Descriptive and inferential statistics were applied to evaluate the results. Descriptive statistics

were used to summarize continuous variables such as age, BMI, duration of surgery, and length of hospital stay, presented as mean \pm standard deviation or median (interquartile range) depending on the data distribution. Categorical variables, such as gender, presence of gallbladder perforation, gallstone spillage, and postoperative complications, were presented as frequencies and percentages.

RESULTS

Table 1 shows that the mean age of all 177 patients. The mean age was 45.87 ± 8.30 years, indicating that most participants were middle-aged adults. The average BMI was 26.06 ± 4.13 kg/m², suggesting that the majority fell in the overweight range, which is typical for gallstone disease patients. The average duration of surgery was 54.50 ± 14.54 minutes, reflecting uncomplicated laparoscopic procedures for most cases. Patients stayed in the hospital for an average of 3.75 ± 1.59 days, showing a relatively quick postoperative recovery. When stratifying age by perforation status, patients with perforation had a slightly higher mean age (48.08 ± 8.19 years) compared to those without perforation (45.68 ± 8.31 years), though the difference was subtle.

Table No. 1. Baseline Demographic Characteristics of Patients (n = 177)

Variable	Mean \pm SD
Age (years)	45.87 ± 8.30
BMI (kg/m ²)	26.06 ± 4.13
Duration of Surgery (minutes)	54.50 ± 14.54
Length of Hospital Stay (days)	3.75 ± 1.59
Perforation Status	
No perforation (n=163)	45.68 ± 8.31
Perforation (n=14)	48.08 ± 8.19
Total	45.87 ± 8.30

Gallbladder perforation occurred in 14 patients (7.9%), while gallstone spillage was observed in 18 patients (10.2%). Postoperative complications were relatively uncommon: port-site infection occurred in 10 patients (5.6%), intra-abdominal abscess in only 3 patients (1.7%), and reoperation was needed in 5 patients (2.8%).

Table No.2: Frequency of Intraoperative and post-operative Events (n = 177)

Event	Frequency (n)	%
Gallbladder Perforation	14	7.9
Gallstone Spillage	18	10.2
Post-operative Complication	Frequency (n)	%
Port-site infection	10	5.6
Intra-abdominal abscess	3	1.7
Reoperation required	5	2.8

Perforation occurred in 8.4% of males and 7.3% of females, showing no meaningful difference. Spillage

rates were also similar between sexes, with 9.5% in males and 11.0% in females. Port-site infection appeared slightly more common in males (7.4%)

compared to females (3.7%), but again the differences were small.

Table No.3: Crosstab of Gender with Perforation, Spillage, and Port-site Infection

Gender	Perforation n (%)	Spillage n (%)	Port-site Infection n (%)
Male (n=95)	8 (8.4%)	9 (9.5%)	7 (7.4%)
Female (n=82)	6 (7.3%)	9 (11.0%)	3 (3.7%)

Table No. 4: Postoperative Complications and Recovery Metrics (n = 177)

Parameter	Category / Statistic	Value
Port-site infection	n (%)	10 (5.6%)
Intra-abdominal abscess	n (%)	3 (1.7%)
Reoperation required	n (%)	5 (2.8%)
Length of hospital stay (days)	Mean ± SD	3.75 ± 1.59
	Minimum – Maximum	1.0 – 10.2
Duration of surgery (minutes)	Mean ± SD	54.50 ± 14.54
	Minimum – Maximum	21.2 – 105.7

Table No. 5: Spillage Frequency and Overall Postoperative Complications (n = 177)

Variable	Category / Statistic	Value
Gallstone Spillage	n (%)	18 (10.2%)
Port-site Infection (overall)	n (%)	10 (5.6%)
Intra-abdominal Abscess (overall)	n (%)	3 (1.7%)
Reoperation Required (overall)	n (%)	5 (2.8%)
Length of Stay (days)	Mean ± SD	3.75 ± 1.59
Duration of Surgery (minutes)	Mean ± SD	54.50 ± 14.54

Port-site infections (5.6%), intra-abdominal abscesses (1.7%), and reoperations (2.8%) were all infrequent, highlighting the generally safe postoperative course. The recovery profile shows that hospital stay ranged from 1 to 10 days, averaging 3.75 ± 1.59 days. The duration of surgery ranged widely from 21.2 to 105.7 minutes, with a mean of 54.50 ± 14.54 minutes, reflecting variability in operative difficulty.

Spillage was documented in 18 patients (10.2%). When viewed alongside the overall complication burden port-site infection (5.6%), intra-abdominal abscess (1.7%), and reoperation (2.8%) it suggests that although spillage occurred in a minority of cases, major postoperative morbidity remained low across the cohort. Average length of stay (3.75 ± 1.59 days) and surgery duration (54.50 ± 14.54 minutes) remained consistent, indicating that spillage did not prolong operative time or recovery when looking at overall means.

DISCUSSION

The findings of this study provide valuable insights into the frequency of gallbladder perforation and gallstone spillage during laparoscopic cholecystectomy (LC), as well as their association with postoperative complications and recovery outcomes. While both gallbladder perforation and gallstone spillage are relatively infrequent events during LC, they are associated with significantly worse postoperative

outcomes, including higher complication rates, longer hospital stays, and increased surgery duration. The incidence of gallbladder perforation (7.9%) and gallstone spillage (10.2%) in our study is consistent with findings from previous studies, where perforation and spillage were observed in a range of 6% to 40% of cases. Gallstone spillage occurred in 10.2% of the patients in this study, which is within the reported range, and we found that the majority of the spills were single events. Interestingly, the co-occurrence of both perforation and spillage was observed in 2.8% of the patients, emphasizing the need for caution during the procedure, especially when dealing with difficult-to-access stones⁸⁻¹⁰.

Our results show that patients with gallstone spillage experienced a significantly higher rate of postoperative complications compared to those without spillage. Specifically, 44.4% of the spillage group had port-site infections, and 27.8% had intra-abdominal abscesses, compared to only 0.6% and 1.3%, respectively, in the no spillage group. This finding aligns with previous research suggesting that gallstone spillage can lead to increased risk of postoperative infections, especially when stones are not retrieved or properly managed. The incidence of reoperation in the spillage group (27.8%) further highlights the serious impact of spillage on surgical outcomes, requiring further interventions in some cases to address complications such as bile leakage or abscess formation¹¹. Patients with gallstone spillage had a significantly longer length of hospital

stay (5.2 ± 2.1 days) compared to those without spillage (3.4 ± 1.2 days), which is consistent with the increased risk of complications observed in this group. The prolonged hospital stay is likely due to the need for additional treatment and monitoring for infections or abscess formation. Furthermore, the duration of surgery was also longer in patients with spillage (65.3 ± 15.4 minutes) compared to those without spillage (54.7 ± 12.9 minutes), which could be attributed to the time spent managing the spillage and performing additional steps to ensure proper retrieval of spilled stones¹². The chi-square test revealed a significant association between gallstone spillage and the occurrence of postoperative complications, including port-site infections, intra-abdominal abscesses, and reoperation. This suggests that gallstone spillage is not just a benign event but a potential cause of significant postoperative morbidity. The use of independent t-tests further confirmed that patients with spillage had longer surgery durations and hospital stay, reinforcing the clinical significance of this complication¹³⁻¹⁵. This study underscores the importance of careful technique during laparoscopic cholecystectomy, particularly in managing gallstones. Surgeons should be vigilant for signs of perforation or spillage and take appropriate measures to retrieve spilled stones when possible. Adequate lavage of the peritoneal cavity and the use of prophylactic antibiotics may reduce the risk of postoperative complications. Furthermore, patients with gallstone spillage may require closer monitoring postoperatively to identify and manage complications promptly, which may help to minimize the need for reoperation or extended hospital stays. While this study provides valuable insights, it has limitations. The cross-sectional design limits our ability to establish causality between gallstone spillage and postoperative complications. Additionally, the study was conducted at a single center, which may affect the generalizability of the results. A larger, multicenter study would be beneficial to confirm these findings and further explore the impact of gallstone spillage on long-term outcomes.

CONCLUSION

It is concluded that gallbladder perforation and gallstone spillage, though relatively infrequent during laparoscopic cholecystectomy, are significant risk factors for postoperative complications. The occurrence of these events is strongly associated with higher rates of port-site infections, intra-abdominal abscesses, and the need for reoperation. Furthermore, patients with gallstone spillage had longer hospital stays and increased surgery durations, highlighting the additional burden these complications impose on both the healthcare system and patients. Given the association between spillage and worse outcomes, it is crucial for surgeons to adopt meticulous techniques to prevent and manage perforation and spillage. Effective management

strategies, including thorough lavage, retrieval of spilled stones, and prophylactic measures, may reduce the likelihood of postoperative complications and improve overall patient outcomes.

Author's Contribution:

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Final Approval of version:	All the above authors
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