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Original Article

Effect of Bile Spillage during Laparoscopic Cholecystectomy on Post-Operative Infection

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Abstract

Objective: To determine the effects of bile spillage during laparoscopic cholecystectomy on post-operative infection.

Methodology: This Case-Control Study was conducted in the Department of General Surgery, Aziz Bhatti Shaheed Teaching Hospital, Gujrat, from January 2026 to March 2026. A total of 120 individuals undergoing laparoscopic cholecystectomy were included in this study. Participants were equally divided into two groups: Group A, comprising patients who experienced bile spillage during laparoscopic cholecystectomy, and Group B, comprising patients without bile spillage. Standard laparoscopic techniques were used for cholecystectomy. We assessed postoperative pain using the Numerical Rating Scale (NRS). We analyzed data using SPSS version 23.0.

Results: Among 120 patients, 60 experienced bile spillage and 60 did not. Mean age was comparable (41.3 vs. 40.2 years). Postoperative pain was greater initially with spillage but was not significantly different after 24 hours. Analgesic requirements were higher (59% vs. 34%), and hospital stay was longer, while postoperative fever and surgical-site infection showed no significant differences.

Conclusion: Our study concluded that Intraoperative bile spillage after laparoscopic cholecystectomy may increase rescue analgesic doses, a longer hospital stays, delayed ambulation, and increased early postoperative pain.

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Introduction

Cholelithiasis is the most common disease of the gallbladder and biliary tree. Gallstones form when the gallbladder concentrates bile, increasing solute concentration and causing stasis between meals. The prevalence of this disease among the adult population is 10-15%.¹ Cholecystectomy is a common procedure performed by general surgeons, with a symptomatic rate of 1% -4% per year [1]. Chronic cholecystitis is an ongoing or recurring inflammation of the gallbladder. Gallstones are the primary cause of cystic duct blockage in over 90% of patients, resulting in biliary discomfort or colic [2]. Laparoscopic cholecystectomy is the preferred treatment for symptomatic cholelithiasis [3]. Gallbladder perforation can occur during intraoperative retraction, dissection, and extraction, particularly if the gallbladder is inflamed and vulnerable, with perigallbladder omental adhesions [4]. The rise in laparoscopic surgeries has led to an increase in problems, including bile spillage into the peritoneal cavity, which can cause both acute and long-term issues [5]. Laparoscopic cholecystectomy (LC) has become a popular technique in general surgical departments. Symptomatic gallstone disease is the most prevalent reason for LC, and almost 90% of cholecystectomies are currently performed laparoscopically [6,7]. Minor problems (both biliary and non-biliary) are often managed conservatively. Converting to an open surgical technique is necessary to manage major problems (biliary and vascular), which can be life-threatening and increase mortality. Laparoscopic cholecystectomy complications range from 0.5 - 6% [8,9]. The most serious effects are linked to a high mortality rate: injury to the common bile duct (0.1-0.6%), injuries to major blood vessels. Depending on the study, the percentage ranged from 0.04 to 1.22% [10,11]. Gallbladder contents may be drained during open or laparoscopic cholecystectomy, but are typically removed by direct removal, extensive irrigation, and mopping during open surgeries. This study aimed to determine the effect of bile spillage during laparoscopic cholecystectomy on postoperative infection.

Materials and Method

This case-control study was conducted in the Department of General Surgery at Aziz Bhatti Shaheed Teaching Hospital, Gujrat, from January 2026 to March 2026, after approval from the hospital's ethics committee. A total of 120 individuals of both genders and different age groups (ranging from 15-80 years) undergoing laparoscopic cholecystectomy were included in this study, while individuals undergoing open

cholecystectomy, obstructive jaundice, and pancreatitis were excluded. We obtained written consent from each participant and randomly assigned them to group A or group B. Group A (60 participants) had bile spillage, and group B (control group) had no bile spillage during laparoscopic cholecystectomy. Standard laparoscopic techniques were used for cholecystectomy. Bile spillage into the peritoneal cavity due to gallbladder perforation was documented as intraoperative bile spillage. Participants were subsequently classified according to whether bile spillage occurred. Postoperative pain was measured using the Numerical Rating Scale (NRS), 0- 10, where 0 indicates no pain, 1- 3 indicates mild pain, 4-6 indicates moderate pain, and 7-10 indicates severe pain. We evaluated pain at predefined postoperative intervals. The study documented the need for rescue analgesia throughout the postoperative phase and identified diclofenac use as a significant outcome. We analyzed data using SPSS version 23. We expressed continuous variables as mean $\pm$ standard deviation and categorical variables as frequencies and percentages. We used the independent-samples t-test to compare normally distributed continuous variables, and the chi-square test for categorical data. We considered $p < 0.05$ statistically significant.

Results

A total of 120 individuals were randomly assigned to two equal groups: Group A (60 individuals) had an episode of bile spillage, and Group B (control group) had no bile spillage. The mean age in the bile-spillage group was 41.3 years, and in the non-spillage group, 40.2 years, with no statistically significant difference. The most significant finding was operative time. Patients who experienced bile spillage had a considerably longer mean operative time (97.3 vs. 90.6 minutes; $p=0.01$), as presented in Table 1. After surgery, mean pain scores were similar between the two groups; however, during the intermediate postoperative period, the bile-spillage group had more pronounced pain. In the spillage group, the mean NRS at 6 hours was 3.6 ± 1.8 , and in the non-spillage group it was 2.7 ± 1.4 ($p=0.004$). Similarly, the mean NRS at 12 hours was 3.1 ± 1.6 , compared with 2.3 ± 1.3 ($p=0.007$). The difference was no longer statistically significant after 24 hours, as shown in Table 2. In the spillage group, analgesic requirement was also significantly higher than in the control group (59% versus 34%). Individuals with bile spillage had a longer hospital stay, but postoperative fever and surgical-site infection did not differ significantly between the two groups, as shown in Table 3.

Table 1. Demographic and operative features of the study population

Variable	Bile spillage (n=60)	No spillage (n=60)	p-value
Mean age in years	41.3 ± 10.7	40.2 ± 9.8	0.55
Male	24 (40.0%)	22 (36.7%)	0.71
Female	36 (60.0%)	38 (63.3%)	
Mean Weight in kg	76.8 ± 10.9	77.6 ± 10.2	0.68
Mean Operative time in minutes	97.3 ± 15.1	90.6 ± 13.8	0.01
Acute cholecystitis	18 (30.0%)	12 (20.0%)	0.20
Chronic cholecystitis	42 (70.0%)	48 (80.0%)	
Conversion to open surgery	2 (3.3%)	1 (1.7%)	0.56

Continuous variables are presented as mean ± standard deviation, and categorical variables as frequency (n) and percentage (%).

Table 2. Pain score after surgery based on NRS

Postoperative time	Bile spillage (n=60) Mean ± SD	No spillage (n=60) Mean ± SD	p-value
0 hour	0.8 ± 0.8	0.7 ± 0.7	0.48
2 hours	1.8 ± 1.3	1.4 ± 1.1	0.07
6 hours	3.6 ± 1.7	2.7 ± 1.4	0.004
12 hours	3.1 ± 1.6	2.3 ± 1.3	0.006
18 hours	2.1 ± 1.3	1.7 ± 1.2	0.08
24 hours	1.4 ± 1.1	1.3 ± 1.0	0.29

We assessed pain intensity using the Numerical Rating Scale (NRS). Values are presented as mean ± standard deviation (SD).

Table 3. Rescue analgesia and early postoperative recovery

Outcome	Bile spillage (n=60)	No spillage (n=60)	p-value
Patients requiring rescue analgesia	35 (59.0%)	20 (34.0%)	0.007
Mean rescue diclofenac requirement, mg	3.13 ± 1.47	2.32 ± 1.29	0.003
Mean Postoperative hospital stay in days	2.4 ± 0.7	1.10 ± 0.5	0.004
Time to ambulation in hours	8.5 ± 2.2	6.8 ± 1.9	<0.001
Fever after surgical procedure	4 (7.0%)	2 (4.0%)	0.41
Surgical-site infection	3 (5.00%)	1 (1.70%)	0.32

Continuous variables are presented as mean ± standard deviation (SD), and categorical variables as frequency (n) and percentage (%). We considered p <0.05 statistically significant.

Discussion

Laparoscopic cholecystectomy (LC) is the primary surgical therapy for symptomatic cholelithiasis as well as other benign gallbladder disorders[11]. Surgical site infection (SSI) is still a major postoperative consequence linked to increased morbidity, longer hospital stays, and greater healthcare expenditures despite its least invasive technique[12].

Bile spillage is a common intraoperative occurrence; however, its clinical importance is still debatable. An intraoperative rupture of the gallbladder wall is called a gallbladder perforation, and it usually happens after dissection from the liver bed or severe traction[14]. Bile spillage refers to bile that leaks into the peritoneal cavity due to such a rupture[13]. Despite their close relationship, the two terms are not interchangeable: bile leakage is the biological result of the mechanical event, whereas perforation denotes the mechanical event. Depending on whether calculi migrate into the peritoneal cavity, perforation may result in bile-only spillage or mixed bile and gallstone spillage[15]. This research identified bile leakage as the main exposure of relevance. When data were available, studies were further classified by spillage type (bile alone versus bile with gallstones), as accumulating evidence shows that gallstone spillage may confer a higher risk than bile alone[16]. This study assessed the effect of bile spillage during laparoscopic cholecystectomy on postoperative infection. A total of 120 individuals were randomly assigned to two equal groups: Group A (60 individuals) had bile spillage, and Group B (control group) had no bile spillage[17]. The mean age of the bile-spillage group was 41.3 years, whereas the non-spillage group was 40.2 years, with no statistically significant difference. The most significant finding was the duration of the operation. Patients who experienced bile spillage had a considerably longer mean operative time. A similar pattern of demographic features was reported in the study by Ranjan et al., which supports our findings [16]. After surgery, the mean pain score was similar between the two groups; however, during the intermediate postoperative period, the bile-spillage group had more pronounced pain. This aligns with the type of complication, since perforation may require additional suction, drainage, retrieval of spilled stones, and careful evaluation of the operating field. A comprehensive study and meta-analysis found that iatrogenic gallbladder perforation was associated with about a 10-minute increase in operation time [17]. Bile spillage may therefore indicate a more challenging procedure. Postoperative pain from laparoscopic cholecystectomy is complex. Pneumoperitoneum, diaphragmatic discomfort, surgical manipulation, and local inflammation might all contribute. Studies have shown that changes in pneumoperitoneum pressure may affect postoperative shoulder-tip pain[18].In the spillage group, analgesic requirement was also significantly higher than in the control group (59% versus 34%), and a lengthy hospital stay was reported in individuals with bile spillage in our study. These findings are comparable to the previous study[18].In contrast, a subsequent meta-analysis and systematic review of 11 trials comprising 51,642 patients

found a slight but significant link between intraoperative bile spillage and SSI, as well as increased overall postoperative morbidity[19]. This variation may reflect changes in how bile leakage, gallstone spillage, bacterial contamination, surgical difficulties, antibiotic use, and postoperative monitoring are defined. Our study highlights the need to handle the gallbladder carefully during dissection. If a perforation develops, bile should be aspirated immediately. Spilled gallstones should be removed wherever possible. The operating field should be thoroughly irrigated and examined. The presence of gallbladder perforation must be documented in the operating notes. The occurrence should be communicated to the patient if clinically appropriate.

Conclusion

Our study concluded that intraoperative bile spillage after laparoscopic cholecystectomy may lead to higher rescue analgesic doses, a longer hospital stay, delayed ambulation, and increased early postoperative pain. Therefore, careful surgical technique, prompt suction of spilled bile, stone removal, and adequate irrigation can all help prevent postoperative morbidity.

Ethical Approval

The Ethical Committee of Aziz Bhatti Shaheed Teaching Hospital, Gujrat, approved this study before it began (approval no. 1244/04/2025). We obtained written informed consent from all participants and maintained confidentiality.

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This study received no external funding. The research used available institutional resources.

Conflict of Interest

The authors declare that they have no competing interests or conflicts of interest related to this study.

Authors' Contributions

Muhammad Asjad: Conceptualization, study design, supervision, data interpretation, manuscript drafting, critical revision, final approval, and accountability for all aspects of the work.

Muhammad Rehman Gulzar: Methodology, study supervision, data interpretation, critical review of the manuscript, final approval, and accountability for all aspects of the work.

Nouman Ali: Data collection, data curation, literature review, manuscript drafting and revision, final approval, and accountability for all aspects of the work.

Muhammad Usman Badar: Methodology, data collection, data analysis, interpretation of findings, manuscript revision, final approval, and accountability for all aspects of the work.

Mamoon Ali: Data collection, literature review, data curation, manuscript revision, final approval, and accountability for all aspects of the work.

Haider Sattar: Data analysis, interpretation of findings, critical review of the manuscript, final approval, and accountability for all aspects of the work.

All authors: Reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work in accordance with ICMJE authorship criteria.

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