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Intraoperative Gallbladder Perforation During Laparoscopic Cholecystectomy: Incidence, Risk Factors, and Postoperative Outcomes in a Tertiary Care Hospital

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Abstract: ***Introduction:*** Laparoscopic cholecystectomy (LC) is the gold standard for symptomatic cholelithiasis. Intraoperative gallbladder perforation (IGP) is a frequent but often under-reported complication, with reported incidences ranging from 10% to 40% in international series [1,2]. The clinical implications of IGP, particularly regarding surgical site infection (SSI) and length of hospital stay (LOS), remain a subject of debate. This study aimed to determine the incidence, identify risk factors, and evaluate the postoperative outcomes of IGP during LC in a tertiary care setting in Bangladesh.

Methods: This prospective observational study was conducted in the Department of Surgery at Kurmitola General Hospital, Dhaka, Bangladesh, from November 2020 to March 2021. A total of 100 patients with symptomatic cholelithiasis undergoing elective LC were enrolled. Patients were categorized into two groups based on the occurrence of IGP: the perforation group and the no-perforation group. Preoperative demographic data, ultrasonographic findings, intraoperative details, and postoperative outcomes (pain, pyrexia, SSI, and LOS) were recorded and analyzed.

Results: The incidence of IGP was 19.0% (19/100). Female patients constituted the majority in both groups (73.7% in the perforation group vs. 69.1% in the no-perforation group). The most common site of perforation was during dissection of the gallbladder from the liver bed (52.6%), followed by grasper traction (36.9%). Patients in the perforation group experienced a significantly longer mean hospital stay (5.9 ± 1.3 days vs. 4.2 ± 1.1 days; $p<0.05$) and a higher incidence of persistent postoperative pain (>6 days) (26.3% vs. 9.9%). The overall rate of surgical site infection (SSI) was low and comparable between groups (10.5% vs. 6.2%).

Conclusion: IGP during LC is a common intraoperative event with an incidence of 19.0% in our setting. While it does not appear to significantly increase the risk of major infectious complications, it is associated with increased postoperative pain and a longer hospital stay. These findings underscore the need for meticulous surgical technique and awareness of this complication to optimize patient recovery.

Keywords: Gallbladder perforation, Laparoscopic cholecystectomy, Cholelithiasis, Surgical site infection, Length of stay.

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INTRODUCTION

Laparoscopic cholecystectomy (LC) has been the standard of care for symptomatic gallstone disease since its introduction in the late 1980s, offering patients reduced postoperative pain, shorter hospital stays, and a faster return to normal activities compared to open cholecystectomy [1,2]. As the volume of LC procedures has increased globally, so too has the recognition of its associated intraoperative complications. One of the most frequent technical challenges encountered during LC is iatrogenic gallbladder perforation (IGP), which can lead to the spillage of bile and gallstones into the peritoneal cavity [3,4].

The reported incidence of IGP varies widely in the literature, ranging from 10% to over 40% in different series [5-8]. This variability is often attributed to differences in surgical experience, patient selection, and the acuity of gallbladder inflammation [9]. Risk factors that have been identified include male sex, advanced age, obesity, the presence of dense pericholecystic adhesions, and a history of acute cholecystitis [10,11]. The clinical consequences of IGP are a matter of ongoing debate. While some studies have linked bile and stone spillage to an increased risk of surgical site infection (SSI) and intra-abdominal abscess formation, others have found no significant association, particularly when spillage is adequately managed with irrigation and retrieval of stones [12-14].

In Bangladesh, LC is widely practiced in tertiary care hospitals, yet there is a paucity of local data on the incidence and outcomes of IGP. Understanding the local epidemiology of this complication is crucial for developing targeted prevention strategies and improving surgical training. Therefore, this prospective observational study was designed to

determine the incidence of IGP during LC, identify associated risk factors, and evaluate its impact on postoperative outcomes at Kurmitola General Hospital, Dhaka.

METHODOLOGY

Study Design and Setting

This prospective observational study was conducted in the Department of Surgery at Kurmitola General Hospital, Dhaka, Bangladesh, over a period of five months, from November 2020 to March 2021. The study protocol was approved by the Institutional Review Board (IRB) of Kurmitola General Hospital. Written informed consent was obtained from all participants prior to enrollment.

Study Population

A total of 100 consecutive patients with symptomatic cholelithiasis scheduled for elective LC were included in the study.

- **Inclusion Criteria:** Patients aged 18 years or older with ultrasonographically confirmed cholelithiasis who were fit for surgery.
- **Exclusion Criteria:** Patients with suspected gallbladder carcinoma, concurrent common bile duct stones requiring endoscopic intervention, severe comorbid conditions (e.g., uncontrolled diabetes, immunosuppression, coagulopathy), or a history of previous upper abdominal surgery were excluded.

Surgical Procedure and Data Collection

All patients underwent a standard four-port LC. The gallbladder was retrieved through the epigastric port. The surgical team documented any intraoperative events, specifically noting the occurrence and mechanism of gallbladder perforation (e.g., during dissection, grasper traction, or adhesiolysis). In cases of perforation, spilled stones were retrieved as completely as possible, and the peritoneal cavity was irrigated with normal saline.

Preoperative data, including demographic characteristics (age, sex, BMI) and ultrasonographic findings (gallbladder wall thickness, presence of adhesions or a distended gallbladder), were recorded. Postoperative outcomes assessed included the duration of hospital stay (LOS), the presence and duration of postoperative pain, the occurrence of pyrexia (temperature >38°C), and the development of a surgical site infection (SSI) within a 14-day follow-up period.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0. Continuous variables were expressed as mean ± standard deviation (SD) and compared using the Student's t-test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

Incidence of Iatrogenic Gallbladder Perforation

Of the 100 patients who underwent LC, iatrogenic gallbladder perforation occurred in 19 patients, yielding an incidence rate of 19.0% (Table 1).

Table 1: Incidence of Iatrogenic Gallbladder Perforation (IGP)

Variable	Number of Patients
Total patients	100
Patients with IGP	19
Incidence rate	19.0%

Demographic and Preoperative Characteristics

The mean age of patients in the perforation group was 50.3 ± 10.6 years (range: 31–70 years), compared to 47.9 ± 12.3 years (range: 25–62 years) in the no-perforation group. Female patients predominated in both groups (73.7% in the perforation group and 69.1% in the no-perforation group). The majority of patients in both groups had a normal body mass index (BMI 18.5–24.9 kg/m²) (Table 2). Preoperative ultrasonography revealed that a thickened gallbladder

wall (>4 mm) was more common in the perforation group (42.1%) than in the no-perforation group (33.3%), although the difference was not statistically significant (Table 3).

Table 2: Demographic Characteristics of the Study Patients (n=100)

Characteristic	Perforation (n=19)	No Perforation (n=81)
Sex		
Male	5 (26.3%)	25 (30.9%)
Female	14 (73.7%)	56 (69.1%)
Age (years)		
Mean ± SD	50.3 ± 10.6	47.9 ± 12.3
Range	31–70	25–62
BMI (kg/m²)		
Normal (18.5–24.9)	16 (84.2%)	70 (86.4%)
Overweight (25.0–29.9)	2 (10.5%)	8 (9.9%)
Obese (≥30)	1 (5.3%)	3 (3.7%)

Table 3: Preoperative Sonological Findings (n=100)

Finding	Perforation (n=19)	No Perforation (n=81)
Normal	11 (57.9%)	54 (66.7%)
Wall thickness >4 mm	8 (42.1%)	27 (33.3%)
Distended gallbladder	1 (5.3%)	4 (4.9%)
Fibrosed gallbladder	3 (15.8%)	10 (12.3%)

Mechanism of Perforation

The most common mechanism of IGP was injury during dissection of the gallbladder from the liver bed (52.6%), followed by grasper traction (36.9%) and adhesiolysis near Calot's triangle (10.5%) (Figure 1).

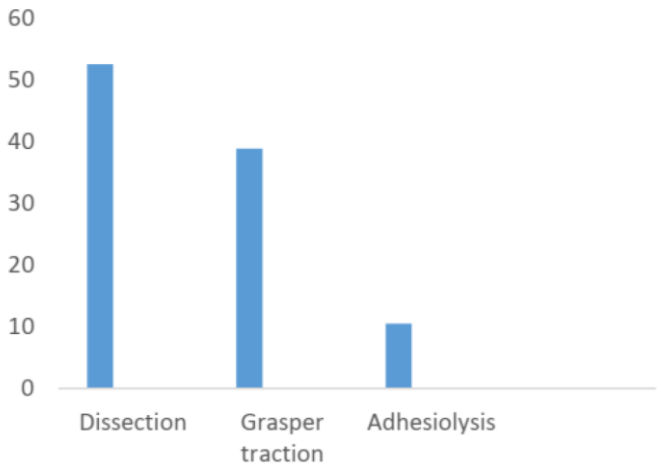


Figure 1: Mechanism of Iatrogenic Gallbladder Perforation (n=19)

Postoperative Outcomes

The mean duration of hospital stay was significantly longer in the perforation group (5.9 ± 1.3 days) compared to the no-perforation group (4.2 ± 1.1 days; $p<0.05$) (Table 4). Postoperative pain persisting for more than 6 days was reported by 26.3% of patients in the perforation group versus 9.9% in the no-perforation group. The incidence of wound infection was 10.5% in the perforation group and 6.2% in the no-perforation group. Pyrexia occurred in 15.8% and 3.7% of patients in the perforation and no-perforation groups, respectively.

Table 4: Duration of Hospital Stay

Group	Mean LOS ± SD (days)	Range (days)
Perforation (n=19)	5.9 ± 1.3	5–9

Group	Mean LOS ± SD (days)	Range (days)
No Perforation (n=81)	4.2 ± 1.1	3–6

DISCUSSION

This prospective study provides contemporary data on the incidence and outcomes of IGP during LC in a Bangladeshi tertiary care hospital. The observed incidence of 19.0% is consistent with several international reports, which cite rates between 10% and 40% [5-7]. For instance, a large retrospective study by Altuntas et al. reported a perforation rate of 36.1% [8], while other series have documented rates closer to 20% [15,16]. The variation likely reflects differences in surgical expertise and the proportion of patients with acute or difficult gallbladder pathology.

Our finding that perforation most commonly occurs during dissection of the gallbladder from the liver bed (52.6%) aligns with the existing literature. Altuntas et al. similarly identified gallbladder bed dissection as the most frequent point of injury (82.1% of cases) [8]. This highlights a critical phase of the operation where traction and counter-traction, along with thermal energy from electrocautery, can inadvertently breach the gallbladder wall, particularly in a thin-walled or inflamed organ.

Regarding risk factors, our study did not identify a statistically significant association between IGP and age, sex, or BMI. This is in contrast to some studies that have linked male sex and obesity to a higher risk of perforation [10,17]. However, a trend toward a higher incidence of a thickened gallbladder wall (>4 mm) was noted in the perforation group, which is a recognized surrogate marker for chronic inflammation and technical difficulty [18]. The absence of a significant association in our cohort may be due to the relatively small sample size.

The clinical impact of IGP remains a key area of investigation. In our study, IGP was associated with a significantly longer hospital stay (5.9 vs. 4.2 days). This is a consistent finding across the literature and is likely multifactorial, reflecting a more difficult dissection, the need for additional irrigation and stone retrieval, and a lower threshold for postoperative observation [8,12]. Interestingly, while the rates of wound infection and pyrexia were numerically higher in the perforation group, the differences were not statistically significant. This supports the growing body of evidence suggesting that when spillage is adequately managed with irrigation and stone retrieval, IGP does not independently increase the risk of major SSI [13,14,19]. The higher rate of persistent pain (>6 days) in the perforation group, however, is a notable finding that warrants further attention, as it may impact patient satisfaction and recovery.

The strengths of this study include its prospective design and the systematic collection of intraoperative and postoperative data. However, several limitations must be acknowledged. The small sample size (n=100) limits the statistical power to detect significant associations for risk factors. The study was conducted at a single center, which may affect the generalizability of the findings. Furthermore, the follow-up period was limited to 14 days, which may not capture late complications such as intra-abdominal abscesses that can present weeks or months after surgery [20].

CONCLUSION AND RECOMMENDATIONS

Iatrogenic gallbladder perforation is a frequent intraoperative complication of LC, occurring in approximately one in five patients in our setting. While it does not appear to be associated with a significantly increased risk of surgical site infection when managed appropriately, it is a marker of surgical difficulty and is associated with increased postoperative pain and a longer hospital stay. These findings have important implications for clinical practice and surgical training.

Recommendations:

1. **Meticulous Surgical Technique:** Surgeons should exercise particular caution during gallbladder dissection and retraction, especially in patients with a thickened, inflamed gallbladder wall, to minimize the risk of perforation.
2. **Adequate Management of Spillage:** When perforation occurs, prompt and thorough retrieval of spilled stones and copious peritoneal irrigation are essential to mitigate the risk of infectious complications.
3. **Accurate Documentation:** IGP should be accurately documented in operative notes, as this information is crucial for postoperative management and for tracking surgical outcomes.
4. **Further Research:** Larger, multicenter prospective studies with longer follow-up are needed to better define the risk factors and long-term consequences of IGP in the Bangladeshi population.

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