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Original Research Article

Complications of Laparoscopic Cholecystectomy: A Prospective Observational Study

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Abstract:

Introduction: Laparoscopic cholecystectomy (LC) has become the gold standard for the management of symptomatic cholelithiasis due to its minimal invasiveness and faster recovery. However, it carries a risk of intraoperative and postoperative complications that can impact patient outcomes. Understanding these complications in a local institutional setting is essential for improving surgical safety and patient care.

Objectives: To evaluate the incidence, nature, and outcomes of complications associated with laparoscopic cholecystectomy performed at our tertiary care center, and to identify factors associated with increased risk of complications.

Methods: This retrospective observational study was conducted over a one-year period at Institute of Post-Graduate Medical Education and Research and Seth SukhlalKarnani Memorial Hospital, Kolkata and Nil Ratan Sircar Medical College and Hospital, Kolkata. and included 100 patients undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis. Data were collected from medical records and analyzed for intraoperative and postoperative complications, causes of conversion to open surgery, and bleeding events. Patient demographics and clinical variables, including age, gender, presence of acute cholecystitis, gallbladder wall thickness >4 mm, presence of adhesions, and operative time exceeding 90 minutes, were also recorded to assess their association with complications.

Results: Among 100 patients undergoing laparoscopic cholecystectomy, 18% had complications. Intraoperative bile duct injury occurred in 1%, bleeding in 2%, gallbladder perforation in 4%, and bile leak in 6%. Conversion to open surgery was required in 5%. Postoperative complications included bile leak (6%), surgical site infection (3%), fever (5%), intra-abdominal collection (2%), pulmonary complications (1%), and reoperation (1%). No mortality was reported, and no patient or operative factor showed a significant association with complications.

Conclusion: Laparoscopic cholecystectomy remains a safe and effective procedure for the management of gallstone disease. Most complications are minor and manageable; however, careful patient selection, meticulous surgical technique, and prompt recognition of complications are essential to minimize morbidity. Institutional audit of complications can help refine surgical protocols and enhance patient safety.

Keywords: Laparoscopic cholecystectomy, intraoperative complications, postoperative complications, bile leak, conversion to open surgery, retrospective analysis.

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Introduction

Laparoscopic cholecystectomy (LC) has emerged as the gold standard for the management of symptomatic gallstone disease due to its minimally invasive nature, reduced postoperative pain, shorter hospital stay, and faster recovery compared to conventional open cholecystectomy [1,2]. Since its introduction in the late 1980s, LC has been widely adopted worldwide and is now the preferred surgical approach for both elective and emergency cases of cholelithiasis [3]. Despite these advantages, LC is associated with a spectrum of intraoperative and postoperative complications, which, although relatively uncommon, can result in significant morbidity and, in rare cases, mortality [4]. Intraoperative complications commonly reported include bile duct injuries, gallbladder

perforation, hemorrhage, and injury to surrounding structures such as the liver, intestines, or major blood vessels [5]. Bile duct injury, in particular, remains the most feared complication due to its potential for long-term morbidity, including biliary strictures and secondary biliary cirrhosis, if not identified and managed promptly [6]. Postoperative complications include bile leakage, wound infections, retained stones, port-site hernia, and rare but serious events such as deep vein thrombosis or sepsis [7]. The risk of such complications is influenced by multiple factors, including the patient's age, body mass index, comorbidities, acute versus chronic cholecystitis, and the presence of dense adhesions from previous surgeries or inflammation [8]. Conversion to open cholecystectomy remains an important consideration in cases with difficult anatomy, uncontrolled bleeding, or severe inflammation, and although it reduces the risk of certain complications, it is associated with longer operative time, increased postoperative pain, and extended hospital stay [9]. Surgical experience and adherence to standardized operative protocols play a pivotal role in minimizing complications, highlighting the importance of adequate training and institutional audit of outcomes [10]. Understanding the incidence, nature, and predictors of complications in LC is crucial for improving surgical safety, patient counseling, and perioperative management. Retrospective analyses of institutional experience can provide valuable insights into common patterns of complications, facilitate early recognition, and help develop strategies to mitigate risks. Such evidence is particularly relevant in tertiary care centers where both elective and emergency cases are managed, and surgical trainees are actively involved.

Materials and Methods

Study Design: Prospective observational study.

Place of study: Institute of Post-Graduate Medical Education and Research and Seth SukhlalKarnani Memorial Hospital, Kolkata and Nil Ratan Sircar Medical College and Hospital, Kolkata.

Period of study: January 2024-Dec 2024

Study Variables:

- Complication
- Cause of Conversion
- Bleeding
- Age
- Male Gender
- Acute Cholecystitis
- Gallbladder wall thickness >4 mm
- Presence of adhesions
- Operative time >90 min

Sample Size: 100 Patients undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis.

Inclusion Criteria

- Patients of all ages and genders undergoing laparoscopic cholecystectomy for symptomatic gallstones.
- Patients who provided complete medical records for review.
- Elective and emergency cases of cholecystectomy.

Exclusion Criteria

- Patients undergoing open cholecystectomy primarily.
- Patients with incomplete or missing medical records.
- Patients with concomitant major abdominal surgery.
- Pregnant patients.
- Patients with known malignancy of the gallbladder or biliary tract.

Statistical Analysis: Data were entered and analyzed using SPSS version 25.0. Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range (IQR), while categorical variables were presented as frequencies and percentages. The Chi-square test or Fisher's exact test was used to compare categorical variables, and the independent t-test or Mann–Whitney U test was applied for continuous variables, as appropriate. A p-value <0.05 was considered statistically significant.

Result

Table 1: Intraoperative Complications (IOC) – Laparoscopic Cholecystectomy (n=100)

Complication	Number of Patients	Percentage (%)
Bile duct injury	1	1%
Bleeding requiring transfusion	2	2%
Gallbladder perforation	4	4%
Bile leak intraoperatively (>50–100 ml/24h)	6	6%
Conversion to open surgery	5	5%
Total	18	18%

Table 2: Postoperative Complications (POC) – Laparoscopic Cholecystectomy (n=100)

Complication	Number of Patients	Percentage (%)
Bile leak (>50–100 ml/24h)	6	6%
Surgical site infection (SSI)	3	3%
Fever (>38°C)	5	5%
Intra-abdominal collection	2	2%
Pulmonary complications	1	1%
Reoperation	1	1%
Total	18	18%

Table 3: Causes of Conversion to Open Cholecystectomy (n=5)

Cause of Conversion	Number of Patients	Percentage (%)
Dense adhesions / difficult Calot's triangle	3	60%
Bile duct injury suspicion	1	20%
Bleeding	1	20%
Total	5	100%

Table 4: Correlation between Examined Variables and Incidence of Complications

Variable	Complications Present (n=18)	Complications Absent (n=82)	P-value
Age >50 years	8	20	0.12
Male Gender	10	40	0.45
Acute Cholecystitis	7	18	0.21
Gallbladder wall thickness >4 mm	6	15	0.15
Operative time >90 min	9	22	0.08
Presence of adhesions	5	12	0.27

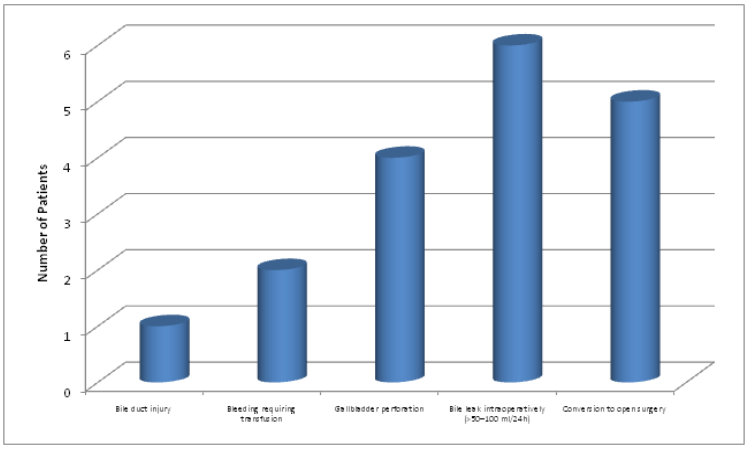

Figure 1: Intraoperative Complications (IOC) – Laparoscopic Cholecystectomy (n=100)

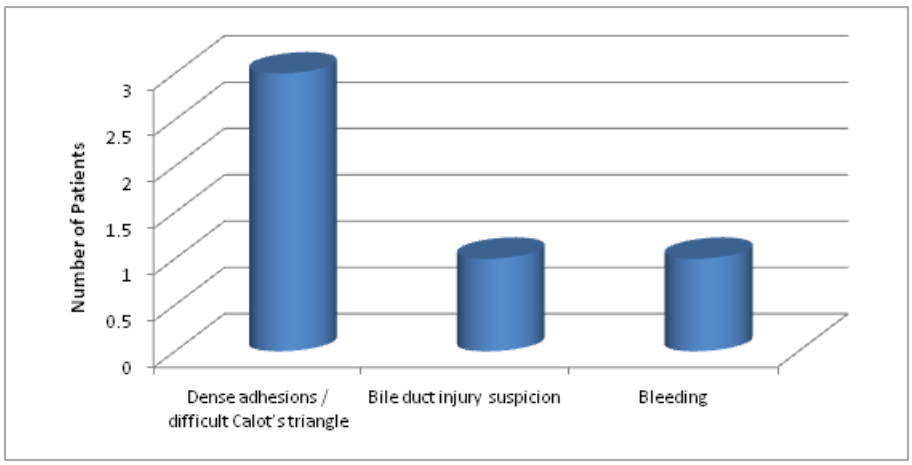

Figure 2: Causes of Conversion to Open Cholecystectomy (n=5)

Out of 100 patients who underwent laparoscopic cholecystectomy, 18 (18%) experienced complications. Intraoperative bile duct injury occurred in 1 patient (1%), while bleeding requiring blood transfusion was observed in 2 patients (2%). Gallbladder perforation was noted in 4 patients (4%). Bile leak of more than 50–100 ml/24 hours was documented in 6 patients (6%). Conversion to open surgery was necessary in 5 patients (5%) due to factors such as dense adhesions or unclear anatomy. No major mortality was reported in the study population.

Among the 100 patients, postoperative complications were observed in 18 patients (18%). Bile leak exceeding 50–100 ml/24 hours occurred in 6 patients (6%), while surgical site infections were noted in 3 patients (3%). Fever above 38°C was recorded in 5 patients (5%). Intra-abdominal collection developed in 2 patients (2%), and pulmonary complications were seen in 1 patient (1%). Reoperation was required in 1 patient (1%) due to persistent bile leak. No mortality was reported in the postoperative period.

Among the 5 patients (5%) who required conversion to open surgery, the most common cause was dense adhesions or a difficult Calot's triangle, accounting for 3 patients (60%). Conversion due to suspected bile duct injury occurred in 1 patient (20%), and intraoperative bleeding necessitated conversion in 1 patient (20%).

The correlation between patient and operative variables with the occurrence of complications was analyzed. Among patients with complications (n=18) compared to those without (n=82), age >50 years was noted in 8 versus 20 patients (p=0.12), and male gender in 10 versus 40 patients (p=0.45). Acute cholecystitis was present in 7 versus 18 patients (p=0.21), and gallbladder wall thickness >4 mm in 6 versus 15 patients (p=0.15). Operative time exceeding 90 minutes was observed in 9 versus 22 patients (p=0.08), while the presence of adhesions was noted in 5 versus 12 patients (p=0.27). None of these variables showed a statistically significant association with complications.

Discussion

In the present study, 18% of patients undergoing laparoscopic cholecystectomy (LC) experienced complications, which aligns with the reported rates in the literature ranging from 10% to 20% [11].

Intraoperative bile duct injury, one of the most serious complications, occurred in 1% of patients in our cohort, comparable to the 0.3–1.5% incidence reported in previous studies [12]. Bleeding requiring transfusion was observed in 2% of patients, consistent with prior reports of 1–3%. Gallbladder perforation occurred in 4% of patients, which is within the reported range of 2–10%.

Bile leak was documented in 6% of cases, slightly higher than the 2–5% reported in other series [13]. This may be attributed to the presence of acute cholecystitis or difficult anatomy in some patients, which increases the risk of cystic duct stump leak or minor biliary injury. Conversion to open surgery was required in 5% of patients, primarily due to dense adhesions or a difficult Calot's triangle, similar to previously reported conversion rates of 4–6% [14]. Conversion due to suspected bile duct injury and bleeding accounted for 20% each in our series, underscoring the importance of intraoperative vigilance and the surgeon's judgment to prevent catastrophic outcomes [15].

Postoperative complications included surgical site infections (3%), fever (5%), intra-abdominal collection (2%), pulmonary complications (1%), and reoperation (1%). These rates are comparable to other studies, which documented postoperative morbidity ranging from 5% to 15% [16]. No mortality was reported in the postoperative period, consistent with most modern LC series where mortality is rare (<0.1%) [17,18].

Analysis of patient and operative variables revealed that advanced age (>50 years), male gender, acute cholecystitis, gallbladder wall thickness >4 mm, operative time >90 minutes, and the presence of adhesions were not significantly associated with complications (p>0.05). While these factors have been cited as predictors of complications in some studies [19,20], meticulous surgical technique and appropriate patient selection, even high-risk patients can undergo LC safely. The lack of statistical significance may also reflect the relatively small sample size of our study. Comparing our outcomes with previous studies highlights that careful patient assessment, surgeon experience, and institutional protocols play critical roles in ensuring favorable outcomes.

Conclusion

Laparoscopic cholecystectomy is a safe and effective procedure for the management of symptomatic gallstone disease, with a relatively low incidence of intraoperative and postoperative complications. Most complications observed, such as bile leak, gallbladder perforation, and minor bleeding, were manageable, and no mortality was reported in the study. Conversion to open surgery, though infrequent, was primarily necessitated by dense adhesions or difficult anatomy.

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