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Study among Patients undergoing Laparoscopic Cholecystectomy: Intraoperative and Postoperative Complications

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Abstract

Background: *Laparoscopic cholecystectomy is the gold standard for treating symptomatic gallbladder diseases due to its minimally invasive nature and quicker recovery. However, intraoperative and postoperative complications remain a concern, especially in patients with comorbidities or complex presentations.*

Aim of the study: *To evaluate the intraoperative and postoperative complications and identify the factors associated with these complications in patients undergoing laparoscopic cholecystectomy.*

Methods: *This prospective observational study included 135 patients undergoing laparoscopic cholecystectomy at a tertiary care hospital. Data on demographics, comorbidities, surgical details, and complications were collected and analyzed. Multivariate logistic regression was used to determine significant predictors of complications.*

Result: *The mean age of patients was 48.7 ± 13.2 years, with females comprising 62.96%. Symptomatic gallstones were the most common indication (57.78%). Intraoperative complications included bleeding (8.15%), spilled gallstones (5.93%), and gallbladder perforation (4.44%). Postoperative complications included wound infection (5.19%), subhepatic collection (4.44%), and bile leaks (2.96%). Age ≥ 60 years, presence of comorbidities, and prolonged surgery duration (>90 minutes) were significantly associated with increased complications.*

Conclusion: *Laparoscopic cholecystectomy is generally safe, but certain patient and procedural factors increase the risk of complications. Preoperative assessment and perioperative vigilance are crucial in minimizing adverse outcomes.*

Keywords: *Laparoscopic cholecystectomy, intraoperative complications, postoperative complications, gallbladder, bile duct injury*

I. INTRODUCTION

Laparoscopic cholecystectomy is a minimally invasive surgical procedure involving the removal of the gallbladder through small abdominal incisions, typically performed for the treatment of symptomatic cholelithiasis or gallstone-related complications [1]. Gallstone disease affects approximately 10–15% of the adult population worldwide, making cholecystectomy one of the most frequently performed abdominal surgeries globally [2]. Since its introduction in the late 20th century, laparoscopic cholecystectomy has become the standard approach, replacing the traditional open method due to its favorable outcomes—such as reduced postoperative pain, shorter hospitalization, quicker recovery, and improved cosmetic results [3]. However, despite these advantages, the procedure is not without risk, and both intraoperative and postoperative complications remain a critical concern for surgeons. Intraoperative complications can include hemorrhage, bile duct injury, gallbladder perforation with spillage of bile or stones, injury to surrounding structures such as the bowel or major vessels, and technical issues related to access or dissection [4]. Postoperative complications, on the other hand, may involve bile leakage, surgical site infections, retained stones in the common bile duct, intra-abdominal abscesses, paralytic ileus, and in rare cases, deep vein thrombosis or cardiopulmonary issues [5]. The incidence and severity of these complications are influenced by multiple factors, including patient-specific variables such as age, obesity, comorbid conditions (especially diabetes or cardiovascular disease), previous abdominal surgeries, and the

presence of acute or chronic cholecystitis [6]. Surgeon-related variables, including level of experience, duration of surgery, and intraoperative decision-making, also play a vital role [7]. One of the most feared intraoperative events is bile duct injury, which, although uncommon, can lead to serious morbidity and may require complex reconstructive procedures [8]. Similarly, bleeding from the cystic artery or liver bed, if not promptly controlled, can necessitate conversion to open surgery or cause hemodynamic instability [9]. The method of initial abdominal access—whether through the open (Hasson) technique or the closed (Veress needle) technique—also contributes to potential complications such as visceral or vascular injury [10]. In the postoperative period, early complications may be masked or delayed, requiring a high index of suspicion for timely diagnosis and intervention [11]. Advances in surgical techniques, particularly the adoption of the "critical view of safety" approach, have significantly reduced bile duct injuries by promoting better anatomical identification during dissection [12]. Additionally, the use of intraoperative cholangiography in selected cases helps in visualizing the biliary tree, particularly in complex or unclear situations [13]. Despite the improvements in surgical safety and outcomes, complication rates vary across different healthcare settings due to disparities in resources, training, patient demographics, and intraoperative practices [14]. In low-resource settings, limited access to advanced imaging or specialized equipment may influence the detection and management of complications. Furthermore, patient reluctance or delayed presentation—common in certain regions—may lead to more advanced gallbladder disease at the time of surgery, thereby increasing technical difficulty and risk [15]. This study aimed to evaluate the intraoperative and postoperative complications among patients undergoing laparoscopic cholecystectomy.

II. METHODOLOGY & MATERIALS

This was a prospective observational study conducted at Department of General Surgery, Enam Medical College & Hospital, Dhaka, Bangladesh, over a period from January 2024 to December 2024. The study was approved by the Institutional Review Board (IRB) of [Hospital Name], and written informed consent was obtained from all patients included in the study. The study adhered to the Declaration of Helsinki, and all ethical standards were followed.

Patient Population

A total of 135 patients who underwent laparoscopic cholecystectomy during the study period were included. The inclusion criteria were:

- Patients aged 18 years and older.
- Patients undergoing laparoscopic cholecystectomy for any indication.
- Patients who provided written informed consent.

Exclusion criteria included:

- Patients with incomplete medical records.
- Patients who underwent cholecystectomy using open surgical methods.
- Patients with previous laparoscopic cholecystectomy.

Data Collection and Surgical Procedure

Data for this study were collected prospectively from patients undergoing laparoscopic cholecystectomy. A structured data collection form was used to gather information from medical records, operative notes, and postoperative follow-up charts. Preoperative data included patient demographics, clinical history, comorbidities (e.g., diabetes, hypertension), and indications for surgery. Imaging reports and laboratory findings were also recorded. Intraoperative and postoperative complications were documented systematically by the surgical team and validated through follow-up assessments conducted up to 30 days post-surgery. All procedures were performed using a standard laparoscopic four-port technique. After establishing pneumoperitoneum, the gallbladder was accessed and dissected from surrounding structures. Identification and clipping of the cystic duct and cystic artery were performed carefully before gallbladder removal from the liver bed. Dissection was performed using either electrocautery or harmonic scalpel, based on surgeon preference and intraoperative conditions. Intraoperative complications, such as bleeding from the cystic artery or adjacent structures, gallbladder perforation, injury to the bile duct, spilled gallstones, and bleeding from the abdominal wall or liver ligaments, were recorded in real time. Any unexpected anatomical variations or difficulties were noted. Postoperative monitoring included routine assessment for signs of complications such as bleeding (>100 mL/24h), bile leaks (>50 mL/24h), subhepatic collections, wound infections, incisional hernia, and retained stones. Patients were evaluated clinically and, when necessary, radiologically. Follow-up continued for 30 days postoperatively, either through outpatient visits or telephonic interviews. All data were entered into a secured database for statistical analysis. All relevant intraoperative and postoperative data were prospectively collected from surgical notes, operative reports, and daily clinical progress records for analysis.

Statistical Analysis

Data were analyzed using SPSS version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as means ± standard deviation (SD) for continuous variables and frequencies with percentages for categorical variables. Categorical variables were compared using the Chi-square. Univariate analysis was followed by multivariate logistic regression to identify independent predictors of intraoperative or postoperative complications. A p-value < 0.05 was considered statistically significant.

III. RESULT

The study included patients undergoing laparoscopic cholecystectomy, with a mean age of 48.7 ± 13.2 years. The largest age group was 51–60 years (28.89%), and females comprised the majority of patients (62.96%). The mean BMI was 26.3 ± 3.9 kg/m². Common comorbidities included hypertension (29.63%), diabetes mellitus (23.7%), and cardiovascular disease (7.41%). The average duration of surgery was 72.4 ± 21.5 minutes (Table 1). Symptomatic gallstones were the most common indication for laparoscopic cholecystectomy (57.78%), after acute cholecystitis (23.70%). Less frequent indications included suspected common bile duct stones (8.15%), biliary pancreatitis (5.19%), chronic scleroatrophic cholecystitis (3.70%), and other (1.48%) (Table 2). The most common intraoperative complication was bleeding near the gallbladder (8.15%), followed by spilled gallstones (5.93%), gallbladder perforation (4.44%), and other less frequent issues (Table 3). Postoperative complications following laparoscopic cholecystectomy included surgical wound infection (5.19%) and subhepatic collection (4.44%) as the most common. Other complications observed were bile leaks (2.96%), abscess from lost gallstones (2.22%), and bleeding, hematoma, and choleperitoneum (each 1.48%). Rare findings included incidental gallbladder carcinoma, retained stone, ileus, incisional hernia, and one case of mortality (each 0.74%) (Table 4). Multivariate logistic regression analysis revealed that age ≥ 60 years (aOR = 2.52, p = 0.018), presence of comorbidities (aOR = 2.76, p = 0.007), and surgery duration > 90 minutes (aOR = 3.48, p = 0.003) were significantly associated with a higher risk of complications. BMI ≥ 30 kg/m² and acute cholecystitis as an indication showed increased odds but were not statistically significant (p = 0.439 and 0.072, respectively) (Table 5).

Table 1: Demographic and clinical characteristics of the study population (n=135).

Variable	Frequency (n)	Percentage (%)
Age (in years)		
≤30	19	14.07
31-40	28	20.74
41-50	32	23.70
51-60	39	28.89
61-70	12	8.89
>70	5	3.70
Mean ± SD	48.7 ± 13.2	
Gender		
Male	50	37.04
Female	85	62.96
BMI (kg/m²)		
Mean± SD	26.3 ± 3.9	
Comorbidities		
Hypertension	40	29.63
Diabetes Mellitus	32	23.7
Cardiovascular disease	10	7.41
Duration of surgery		
Mean ± SD	72.4 ± 21.5	

Table 2: Indications for Laparoscopic Cholecystectomy (n=135).

Indication	Frequency (n)	Percentage (%)
Symptomatic gallstones	78	57.78
Acute cholecystitis	32	23.70
Suspected common bile duct stones	11	8.15
Biliary pancreatitis	7	5.19
Chronic scleroatrophic cholecystitis	5	3.70
Others	2	1.48

Table 3: Intraoperative Complications among patients (n=135).

Complication	Frequency (n)	Percentage (%)
Bleeding from tissues adjacent to gallbladder	11	8.15
Bleeding from cystic artery	5	3.70
Bleeding from abdominal wall (port site)	2	1.48
Bleeding from liver ligaments	2	1.48

Iatrogenic perforation of gallbladder	6	4.44
Injury to the common bile duct (CBD)	2	1.48
Spilled gallstones	8	5.93
Omental injury	1	0.74
Conversion to open cholecystectomy	5	3.70

Table 4: Postoperative Complications of the study population (n=135).

Complication	Frequency (n)	Percentage (%)
Bleeding from abdominal cavity (>100ml/24h)	2	1.48
Bile leaks (>50–100 ml/24h)	4	2.96
Subhepatic collection	6	4.44
Surgical wound infection	7	5.19
Incisional hernia	1	0.74
Hematoma of the abdominal wall	2	1.48
Gallbladder carcinoma (incidental finding)	1	0.74
Retained stone in the choledochal duct	1	0.74
Abscess from lost gallstone	3	2.22
Choleperitoneum	2	1.48
Ileus	1	0.74
Mortality	1	0.74

Table 5: Multivariate Logistic Regression Analysis of Factors Associated with Complications

Predictor Variable	Adjusted Odds Ratio (aOR)	95% CI	p-value
Age ≥ 60 years	2.52	1.17 – 5.45	0.018
BMI ≥ 30 kg/m²	1.41	0.59 – 3.36	0.439
Presence of comorbidities	2.76	1.32 – 5.76	0.007
Acute cholecystitis as indication	2.03	0.94 – 4.38	0.072
Surgery duration > 90 min	3.48	1.53 – 7.93	0.003

IV. DISCUSSION

Laparoscopic cholecystectomy is the standard treatment for gallbladder diseases due to its minimally invasive nature and faster recovery. Despite its widespread use and safety, the procedure may still be associated with various intraoperative and postoperative complications. Identifying the frequency and risk factors of these complications is essential to improve surgical outcomes and patient safety. This study was conducted to evaluate such complications and associated predictors in patients undergoing laparoscopic cholecystectomy. Majority of the study people (28.89%) in our study were in the age group of 51-60 years. Mean age of the study people was 48.7 ± 13.2 years. Most of the study people (62.96%) ware female. Which indicates that women are more prone to gallbladder diseases. In the study of Giger et al, patients mean±SD age was 54.5±16.1 years and most of the study people were female (68.6%) which is similar to our study [16]. Mean BMI of the study people was 26.3 ± 3.9 kg/m2 in our study. Yang et al observed the mean±SD BMI of 22.83±2.15 kg/m2 in their research group and 22.36±2.23 kg/m2 in their control group [17]. In this study, 29.63% had hypertension, 23.7% had diabetes, and 7.41% had cardiovascular disease. Other study found that 17.11% had diabetes and 27.63% had hypertension in study group [17]. According to our study, mean operation time was 72.4 ± 21.5 minutes. Yang et al reported mean ±SD operation time in research group was 48.32±3.84 minutes and mean ±SD operation time in control group was 49.07±3.42 minutes [17]. In our study, the most frequent indication for laparoscopic cholecystectomy was symptomatic gallstones, accounting for 57.78% of cases. Similarly, Z'graggen et al. reported symptomatic gallstones as the leading indication in their study, observed in 87.9% of patients [18]. Our findings indicate that the most common intraoperative complication was bleeding from tissues adjacent to the gallbladder (8.15%), followed by spilled gallstones (5.93%) and iatrogenic perforation of the gallbladder (4.44%). Familiar results were found in the study of Amer et al where the most frequent intraoperative complication was gallstone spillage (35.5%), followed by biliary tract injuries (16.6%) [19]. In our cohort, surgical wound infection was the most frequent postoperative complication, occurring in 5.19% of patients, followed by subhepatic collection (4.44%), bile leaks (2.96%), and abscess formation due to lost gallstones (2.22%). Less common complications included bleeding from the abdominal cavity (1.48%), choleperitoneum (1.48%), and hematoma of the abdominal wall (1.48%). Rare events such as incisional hernia, retained choledochal duct stones, ileus, incidental gallbladder carcinoma, and mortality were each observed in 0.74% of cases. These findings are consistent with those reported

by Maitra et al., who documented postoperative wound infections in 5.2% of cases and post-cholecystectomy syndrome in 4.7% of patients in a Bangladeshi tertiary care hospital [20]. Similarly, Haque et al. reported port site infections in 1.05% and port site hernias in 0.56% of 1,425 laparoscopic cholecystectomy cases, with no mortality observed [21]. Internationally, Amreek et al. found surgical site infections in 2.7% of patients and a mortality rate of 0.1% in a Pakistani cohort [22]. The multivariate logistic regression analysis in our study identified age ≥60 years (aOR: 2.52; p=0.018), presence of comorbidities (aOR: 2.76; p=0.007), and surgery duration >90 minutes (aOR: 3.48; p=0.003) as significant predictors of complications following laparoscopic cholecystectomy. Conversely, BMI ≥30 kg/m² (aOR: 1.41; p=0.439) and acute cholecystitis as the surgical indication (aOR: 2.03; p=0.072) were not statistically significant in our cohort. These findings align with existing literature. A systematic review and meta-analysis by Halabi et al. found that increasing age is significantly associated with higher rates of overall complications (OR: 2.37; 95% CI: 2.00–2.78) and postoperative mortality (OR: 7.20; 95% CI: 4.41–11.73) in patients undergoing laparoscopic cholecystectomy [23].

Limitations of the study: *This study has several limitations. The sample size (n=135) was relatively small compared to larger multi-center studies, which may reduce the statistical power to detect less common complications. Additionally, the study period was relatively short, and the follow-up was limited to 30 days, restricting the ability to assess long-term outcomes such as incisional hernias or chronic complications.*

V. CONCLUSION

Laparoscopic cholecystectomy remains a safe and effective surgical procedure for gallbladder diseases. However, intraoperative and postoperative complications, though relatively uncommon, are influenced by factors such as advanced age, presence of comorbidities, and prolonged operative time. Careful preoperative evaluation, surgical planning, and adherence to established operative protocols are essential to minimize risks. Future studies with larger cohorts and extended follow-up are recommended to better understand the long-term complications and improve patient outcomes.

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