

Per-operative Evaluation of Patient Related Difficulties of Laparoscopic Cholecystectomy

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Received: 21 June 2026
Accepted: 29 June 2026
Published Online: 30 June 2026

Published by:
Gopalganj Medical College, Gopalganj,
Bangladesh

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DOI: 10.5281/zenodo.21073810

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ABSTRACT

Background: Gallstone disease is a common cause of morbidity, with an estimated prevalence of 5-22% in the general population. In settings where delayed presentation is frequent due to limited healthcare access and low patient awareness, laparoscopic cholecystectomy can be technically challenging because of difficulties with abdominal access, pneumoperitoneum creation, dissection of the gallbladder, and specimen retrieval. **Methods & Materials:** This descriptive study was performed in the Chittagong Medical College Hospital General Surgery wards from August 2016 to January 2017. In this study, 100 patients who underwent laparoscopic cholecystectomy during the study period were included by purposive consecutive sampling meeting the inclusion criteria. Data were analyzed using chi-square and Student t-tests as appropriate. **Results:** Among the 100 patients who underwent laparoscopic cholecystectomy, 12 cases were categorized as difficult, primarily due to prolonged operative time exceeding 50 minutes, although all were completed laparoscopically. The average operative duration was 36.53 minutes. Difficulties were more frequent among females (66.7%) and patients aged 40–60 years. Significant predictors of operative difficulty included intra-abdominal adhesion of the gallbladder to the gut ($p < 0.001$, $OR = 29.40$), short and wide cystic duct ($p = 0.008$, $OR = 5.79$), and adhesion at Calot's triangle ($p = 0.041$, $OR = 3.90$). Two cases required conversion to open surgery due to unclear anatomy and risk of common bile duct injury. **Conclusion:** Laparoscopic cholecystectomy is a common operation, but sometimes it becomes difficult due to several factors. Adhesion of GB with gut, short, wide cystic duct, and adhesion at Calot's triangle are challenging to operate upon and increase the operating time.

Keywords: Gall bladder, laparoscopy, cholecystectomy, Difficulty, Calot's triangle.

(The Insight 2026; 9(2): 499-505)

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INTRODUCTION

Laparoscopic cholecystectomy (LC) has revolutionized the surgical management of gallstone disease, emerging as the gold standard for symptomatic cholelithiasis worldwide. Historically, open cholecystectomy was the traditional approach for gallbladder removal, often involving significant morbidity, prolonged recovery, and larger surgical scars. However, the surgical paradigm began to shift dramatically in 1985 when Prof. Dr. Erich Mühe of Germany performed the first laparoscopic cholecystectomy, marking a milestone in minimally invasive surgery [1]. This innovation, further refined by Reddick and Olsen through the introduction of the classical four-port technique, rapidly gained popularity in the late 1980s and 1990s due to its numerous advantages over the open technique [2,3]. LC is now widely preferred for its minimally invasive nature, offering reduced postoperative pain, shorter hospital stays, faster recovery, and better cosmetic outcomes [4]. These benefits have improved patient satisfaction, reduced healthcare costs, and facilitated faster return to daily activities. As surgical expertise and technological advancements in laparoscopy have progressed, the indications for LC have expanded beyond simple gallstone disease to include more complex conditions such as acute and chronic cholecystitis, empyema, and gallbladder polyps [5]. Despite its widespread adoption and favorable outcomes, LC can present considerable technical challenges, especially in patients with complex anatomy, inflammation, adhesions, or

obesity. The term "difficult laparoscopic cholecystectomy" encompasses a wide range of intraoperative challenges that may arise due to patient-related factors, anatomical variations, and pathological changes. Common intraoperative difficulties include gaining safe access to the peritoneal cavity, establishing pneumoperitoneum, dissecting the Calot's triangle, and safely removing the gallbladder [6]. Factors such as male gender, obesity, previous upper abdominal surgery, acute inflammation, thickened gallbladder wall, and impacted stones are all associated with increased difficulty during LC [7]. These patient-specific predictors can significantly influence the surgical approach and outcomes, often necessitating conversion to open surgery when safety is compromised. Moreover, the surgeon's experience, training, and familiarity with difficult anatomical and pathological scenarios are crucial in managing intraoperative challenges. A lack of preparation or misjudgment in difficult cases can lead to serious complications such as bile duct injury, hemorrhage, or biliary leaks, which are associated with increased morbidity and healthcare burden [8]. Hence, the accurate preoperative identification of predictors of difficult LC is imperative for informed patient counseling, appropriate surgical planning, and minimizing risks. The increasing recognition of patient-related factors influencing the technical difficulty of LC has prompted a growing body of literature seeking to classify and predict these challenges. However, there remains a need for comprehensive perioperative evaluation models that

integrate clinical, radiological, and intraoperative findings. This study aims to evaluate patient-related perioperative difficulties during laparoscopic cholecystectomy, thereby contributing to improved surgical preparedness, risk stratification, and safer surgical outcomes in gallbladder disease management.

METHODS & MATERIALS

This descriptive cross-sectional study was conducted in the General Surgery wards of Chittagong Medical College Hospital (CMCH), Chittagong, Bangladesh. The study period spanned six months, from August 2016 to January 2017. One hundred patients who met the predefined inclusion and exclusion criteria were enrolled using a purposive consecutive sampling technique. All patients of any age and sex with ultrasonography-confirmed gallstone disease were eligible for inclusion. Patients were excluded if they had concomitant common bile duct stones, a known diagnosis of gallbladder carcinoma, or presented with cholangitis or acute pancreatitis. Before being included in the study, each participant provided informed written consent. The Institutional Review Board (IRB) of Chittagong Medical College Hospital approved ethical clearance.

In this study, Difficult Laparoscopic Cholecystectomy (LC) was defined as a procedure with an operative duration between 50 and 110 minutes (measured from port insertion to port closure) or any case necessitating conversion to open surgery due to intraoperative challenges such as dense adhesions at Calot's triangle, dense adhesions between the gallbladder and surrounding viscera (colon and omentum), or common bile duct (CBD) injury. Intra-abdominal adhesion referred specifically to the presence of fibrous connections between the gallbladder and adjacent structures such as the gut or omentum. Obesity was defined according to World Health Organization (WHO) criteria as a body mass index (BMI) of ≥ 30 kg/m², calculated using the formula: weight (kg) divided by the square of height (m²). An Anomaly of Calot's Triangle encompassed anatomical variations such as a short and wide cystic duct, the presence of anomalous vessels, or any abnormal configuration within the Calot's triangle. Lastly, a Sonographically Difficult Gallbladder was identified by ultrasonographic findings suggestive of surgical difficulty, including a thick-walled or fibrosed gallbladder, stone impacted at the gallbladder neck, or sonographic evidence of acute cholecystitis.

The primary outcome variables assessed in this study were selected to evaluate the factors influencing the difficulty and outcomes of laparoscopic cholecystectomy. These included the total duration of the procedure, measured from port insertion to port closure, and the presence of obesity, defined as a body mass index (BMI) of 30 or higher. A history of previous upper abdominal surgery was recorded to assess the potential impact of postoperative adhesions. Clinical findings such as acute cholecystitis, intra-abdominal adhesions, and adhesions specifically at Calot's triangle were documented. Anatomical variations, including anomalies within Calot's triangle, were noted due to their known influence on surgical complexity. Sonographic features such as a thick-walled or fibrotic gallbladder and the presence of a stone impacted at the neck of the gallbladder were also evaluated. Finally, the necessity for conversion from laparoscopic to open cholecystectomy was recorded as a significant outcome reflecting procedural difficulty and surgical decision-making. All relevant data were systematically recorded in a structured case record form and compiled into a master chart for analysis. Patient demographics, clinical findings, sonographic results, and other necessary information were documented.

Data analysis was performed using Statistical Package for Social Sciences (SPSS) software, version 20.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were summarized as mean \pm standard deviation (SD) and compared using the student's t-test. Categorical variables were presented as frequencies and percentages and analyzed using the chi-square (χ^2) test. A 95% confidence interval (CI) was calculated where appropriate. The results were displayed through tables, figures, and diagrams for clarity and better interpretation.

RESULT

In the table presents the distribution of study participants according to age groups. The majority of participants were aged 40–60 years, comprising 45% (n=45) of the total sample. This was closely followed by those younger than 40 years, who accounted for 42% (n=42). Participants aged over 60 years represented the smallest proportion, at 13% (n=13). The overall mean age of the participants was 44.65 years with a standard deviation of 14.12 years, indicating a moderately wide variation in age among the study population (*Table 1*).

Table 1: Age distribution of the study population (n=100).

Age groups (in years)	Frequency (n)	Percentage (%)
<40	42	42.00
40-60	45	45.00
>60	13	13.00
Mean \pm SD	44.65 \pm 14.12	

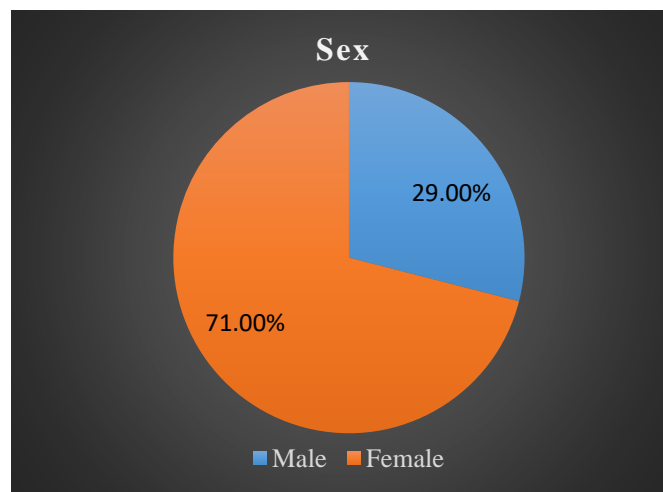


Figure 1: Sex distribution of the study population (n=100).

The study's results reveal several important insights into patient related factors and intraoperative challenges associated with laparoscopic cholecystectomy (LC). Most patients (45%) were between 40–60 years, with a mean age of 44.65 ± 14.12 years and a slightly higher representation of 71% of females (Figure 1).

Most participants (97%) had a body mass index (BMI) below 30 kg/m^2 , indicating a predominantly non-obese cohort with a mean BMI of 24.73 ± 1.95 (Table II).

Table II: Body Mass Index (BMI) Classification of the Study Population.

BMI	Frequency (n)	Percentage (%)
Non Obese (< 30 Kg/m ²)	97	97.00
Obese ($\geq 30 \text{ Kg/m}^2$)	3	3.00
Mean \pm SD		24.73 \pm 1.95

Regarding comorbidities, 76% of patients had no associated medical illness, while 11% had hypertension, and smaller proportions had diabetes or combined conditions (Table III).

Table III: Distribution of Comorbid Medical Illnesses.

Medical Illness	Frequency (n)	Percentage (%)
Hypertension	11	11.00
Diabetes	3	3.00
Hypertension + Diabetes	8	8.00
COPD	2	2.00
None	76	76.00

The most common diagnosis was cholelithiasis (74%),

followed by acute and chronic cholecystitis (Table IV).

Table IV: Primary Diagnosis at Admission.

Diagnosis	Frequency (n)	Percentage (%)
Cholelithiasis	74	74.00
Acute Cholecystitis	14	14.00
Chronic Cholecystitis	12	12.00

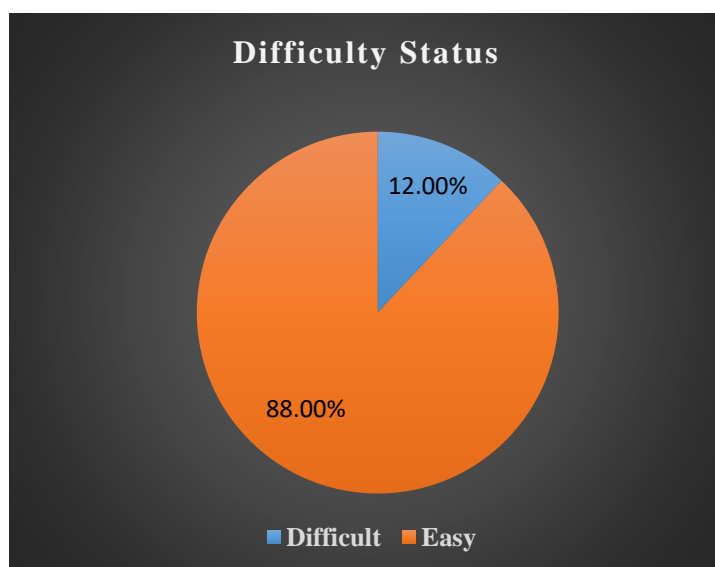


Figure 2: Distribution of operative difficulties among the study subjects (n=100).

Most of the 88 patients had an operative duration of <50 minutes, while 12% of cases required ≥50 minutes (Figure 2).

The table shows the distribution of participants according to duration (in minutes). The majority of participants had a duration of less than 50 minutes, accounting for 88% (n=88)

of the total sample, while only 12% (n=12) had a duration of 50 minutes or more. The mean duration was 36.53 ± 9.16 minutes, indicating that most participants had a duration well below 50 minutes, with moderate variability among the observations (Table V).

Table V: Duration of Operative Procedure.

Duration (in minutes)	Frequency (n)	Percentage (%)
≥50	12	12.00
<50	88	88.00
Mean±SD		36.53±9.16

Operative difficulties were observed in 12% of the cases, with most surgeries completed within 50 minutes (mean operative time: 36.53 ± 9.16 minutes). The most frequent intraoperative challenge was adhesions of the gallbladder to the omentum (33%), followed by Calot's triangle adhesions (14%) and

anatomical anomalies like a short and wide cystic duct (11%). Only 2% of the cases required conversion to open surgery (Table VI).

Table VI: Types and Frequencies of Operative Difficulties Encountered.

Operative Difficulties	Frequency (n)	Percentage (%)
Difficulty in Port Placement		
Obesity	3	3.00
Difficulty in Approach		
Intra-abdominal Adhesion of GB with Gut	11	11.00
Intra-abdominal Adhesion of GB with Omentum	33	33.00
Difficulty in Dissection		
Adhesion at Calot's Triangle	14	14.00
Anomaly of Calot's Triangle: Short & Wide Cystic Duct	11	11.00
Anomalous Vessel	4	4.00
Abnormal Anatomy	1	1.00
Fibrosed GB	10	10.00
Stone Impacted at the Neck of GB	4	4.00
Conversion to Open Procedure Needed	2	2.00

When comparing difficult vs. easy LC cases, older age (≥40 years), male sex, obesity, and presence of comorbidities showed higher odds of difficulty, but none reached statistical significance except for prolonged operative time (≥50

minutes), which was significantly associated with difficulty ($p < 0.001$) (Table VII).

Table VII: Comparison of Patient Characteristics with Difficulty Level.

Variables	Difficult (n=12)		Easy (n=88)		P-value	OR (95% CI)
	n	%	n	%		
Age groups (in years)						
≥40	8	66.67	50	56.82	0.517	1.52 (0.4-6.6)
<40	4	33.33	38	43.18		
Sex						
Male	4	33.33	25	28.41	0.724	1.26 (0.3-5.2)
Female	8	66.67	63	71.59		
BMI (Kg/m ²)						
<30	1	8.33	2	2.27	0.248	3.91 (0.1-63.3)
≥30	11	91.67	86	97.73		
Medical Illness						
Present	4	33.33	20	22.73	0.42	1.7 (0.4-7.2)
Absent	8	66.67	68	77.27		
Duration of Operative Procedure (Minutes)						
≥50	10	83.33	0	0.00	<0.001	∞
<50	2	16.67	88	100.00		

In *Table VIII*, specific operative factors significantly associated with difficult LC included intra-abdominal adhesion of the gallbladder with the gut (p<0.001, OR=29.4), Calot's triangle

adhesions (p=0.041), and the presence of a short and wide cystic duct (p=0.008).

Table VIII: Association of Specific Operative Factors with Difficulty.

Variables	Difficult (n=12)		Easy (n=88)		P-value	OR (95% CI)
	n	%	n	%		
Obesity						
Present	1	8.33	2	2.27	0.598	3.58
Absent	11	91.67	86	97.73		
Intra-abdominal Adhesion of GB with Gut						
Present	7	58.33	4	4.55	<0.001	29.40 (5.3-187.1)
Absent	5	41.67	84	95.45		
Intra-abdominal Adhesion of GB with Omentum						
Present	6	50.00	27	30.68	0.182	2.26 (0.6-8.9)
Absent	6	50.00	61	69.32		
Adhesion at Calot's Triangle						
Present	4	33.33	10	11.36	0.041	3.9 (0.7-14.4)
Absent	8	66.67	78	88.64		
Anomaly of Calot's Triangle: Short & Wide Cystic Duct						
Present	4	33.33	7	7.95	0.008	5.76 (1.1-29.7)
Absent	8	66.67	81	92.05		
Anomaly of Calot's Triangle: Anomalous Vessel						
Present	1	8.33	3	3.41	0.414	2.58 (0.1-32.7)
Absent	11	91.67	83	94.32		
Anomaly of Calot's Triangle: Abnormal Anatomy						
Present	0	0.00	1	1.14	0.138	0
Absent	12	100.00	87	98.86		
Fibrosed GB						
Present	2	16.67	8	9.09	0.412	2.00 (0.2-12.7)
Absent	10	83.33	80	90.91		
Stone Impacted at the Neck of GB						
Present	1	8.33	3	3.41	0.414	2.58 (0.1-32.7)
Absent	11	91.67	85	96.59		

DISCUSSION

Laparoscopic cholecystectomy (LC) has become the gold standard for the surgical management of symptomatic gallbladder disease due to its clear advantages over open cholecystectomy, such as reduced postoperative pain, shorter hospital stays, quicker recovery, and improved cosmetic outcomes [9,10]. However, despite its widespread acceptance, the procedure is not without challenges. Intraoperative difficulties may arise due to a range of patient-related and disease-related factors, which are crucial to recognize preoperatively to reduce complications and improve outcomes. This study classified 12% of the procedures as difficult laparoscopic cholecystectomies. This rate aligns with

previous literature, suggesting that 10–30% of LCs may present technical challenges [11,12]. The patient demographic was consistent with the epidemiology of gallstone disease, showing a predominance of females and a mean age in the mid-40s, supporting existing data that gallstones are more common in middle-aged females [13]. Interestingly, although older age (≥40 years), male gender, obesity, and medical comorbidities such as hypertension and diabetes showed increased odds of operative difficulty, these factors were not statistically significant predictors in this study. However, other studies have identified these variables, especially male gender, and obesity, as risk factors for difficult LC due to thicker abdominal walls, delayed presentation, or more severe

inflammatory responses [14,15]. Our cohort's lack of statistical significance may be attributed to the small number of difficult cases (n=12) compared to the total sample size. The most significant predictor of operative difficulty in this study was a longer operative time (≥ 50 minutes), which was strongly associated with difficult LC ($p < 0.001$). Prolonged duration often reflects intraoperative technical challenges, such as extensive dissection, unclear anatomy, or bleeding, and is commonly used as a surrogate marker for surgical difficulty [16]. Moreover, the need to convert to open surgery in 2% of cases aligns with international figures, where conversion rates range from 2% to 5% in elective LC [17]. A deeper analysis of intraoperative findings revealed that certain factors were more strongly associated with difficulty. Adhesions between the gallbladder and the gut (OR=29.4, $p < 0.001$), adhesions at Calot's triangle (OR=3.9, $p = 0.041$), and a short and wide cystic duct (OR=5.76, $p = 0.008$) were significantly predictive of difficult LC. These findings are supported by previous studies, which emphasized that distorted anatomy due to chronic inflammation, adhesions, or congenital variations complicates dissection, increases the risk of bile duct injury, and prolongs operative time [18,19]. Adhesions, particularly in Calot's triangle, have long been recognized as one of the most important difficulty determinants. Inflammatory changes, often secondary to repeated episodes of cholecystitis, obliterate the regular anatomical planes and may obscure critical structures like the cystic duct and artery, increasing the risk of injury [20]. In such scenarios, techniques like the "fundus-first" approach or subtotal cholecystectomy may be required [21]. Anomalies of the biliary anatomy, such as a short or wide cystic duct or anomalous vessels, are also known contributors to surgical complexity. If not recognized early, such anomalies can lead to misidentification of structures, increasing the likelihood of complications [22]. Although not statistically significant in this study, the presence of anomalous vessels and fibrosed gallbladders was more frequent in difficult cases, underscoring their clinical relevance. While preoperative imaging, such as ultrasound, is widely used, it has limited sensitivity in detecting some intraoperative findings, like adhesions or anatomical anomalies. Therefore, several scoring systems have been proposed in the literature to predict difficulty based on a combination of clinical, radiological, and intraoperative parameters [23]. Incorporating such tools into routine preoperative assessment could guide surgical planning, patient counseling, and even the choice of surgeon, especially in training settings.

LIMITATIONS

The cross-sectional design restricts the ability to establish causality between patient-related factors and intraoperative difficulties. Additionally, intraoperative difficulty was assessed subjectively, which may introduce observer bias. Some variables, such as the surgeon's experience and intraoperative decision-making strategies, were not standardized or controlled, potentially affecting the outcomes. Future multicenter studies with larger sample sizes and objective difficulty scoring systems are needed to validate these findings and improve predictive accuracy.

CONCLUSION

This study highlights that while laparoscopic cholecystectomy is generally safe and effective, specific intraoperative factors such as adhesions, anatomical anomalies, and prolonged operative time significantly contribute to procedural difficulty. Although patient-related factors like age, sex, BMI, and

comorbidities showed no statistically significant association, their presence may still influence surgical complexity. Identifying potential predictors of difficult LC can aid in better preoperative planning, patient counseling, and improved intraoperative preparedness. Incorporating these findings into surgical practice may enhance operative outcomes, reduce complications, and optimize resource allocation in laparoscopic cholecystectomy, particularly in resource-limited settings or training institutions.

FUNDING

No funding sources

CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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